Utilization of HCUP KID & SASD Datasets for Analysis of Cost Associated with Pediatric Leukemia of Lymphoid Origin in the United States

by

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Abstract

The cost associated with healthcare has continually increased over the years especially for oncologic care and treatment of chronic conditions. The diversity of factors affecting cost and outcomes necessitates varied approach to addressing these issues. They necessitate continuous evaluation of cost influencers and development of strategic plans by all stakeholders in addressing this problem. This retrospective study examined various cost influencers, patient and hospital characteristics that impact care for pediatric and adolescent patients diagnosed with leukemia of lymphoid origin.

Leukemia of lymphoid origin presentation in Inpatient dataset (HCUP KID) were 62,338 (2009 & 2012) and outpatient (NJSASD) were 491(2012) at ages 0-21. A comparison group with similar age, sex were selected from the dataset. Treatment-related hospitalization cost in the dataset were selected, patients and hospital characteristics identified, and their relationship was further analyzed. Mean charges of $66,955 (95 CI, $55,076-$89,382) by region could be attributed to several days increased LOS (95 CI, 3-10 days). Moreover, factors such as race, hospital size, ownership, NCHRONIC, and NDX affect these charges. This study shows the highest charges were associated with the West Region of the country, Hispanics, therapeutic procedures and individuals less than one-year-old.

Cost variation shown in this study for therapeutic and diagnostic procedures when performed in an outpatient verse’s inpatient setting could be the key to addressing the most significant factors affecting cost. Moreover, it could decrease readmittance and risk of nosocomial infections. A difference in severity by race can also be associated with

household income as noted in this study. Understanding the factors that affect access to care and coverage is necessary for a broader understanding of this phenomena. Development of specific evidenced-based protocols that guides providers in deciding to transfer a patient to alternate care facilities is essential in the approach towards LOS and cost reduction. These protocols could also aid in directing low-risk procedures to oncologic outpatient settings. Such approaches could most importantly aid in outcome improvement through effective implementation of process and structural measures.

Dedication

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

This study aims to understand the intricate relationship between the cost of care or charge and variables such as demographics, length of inpatient stay at hospitals, outcomes, payers (Insurance Coverages) and race. An understanding of these dynamics will aid health care policy in regard to resources allocation and access. Furthermore, it would support hospitals and healthcare organizations in devising strategic approaches to improving outcomes and cutting cost associated with care. The need for efficient utilization of funds is now even more imperative with changes in healthcare policy especially for the pediatric population in the United States. There is an essential need to improve treatment and therapeutic outcomes for all care approaches, and this is especially true for cancer treatment, and this analysis would aid in gaining a better understanding of how to approach such a task. An understanding of how much individuals are paying for chronic conditions treatment based on demographics, income, healthcare and States Process and structural measures would serve as an essential asset to understanding and addressing the issue of outcome and healthcare cost associated with oncologic care in the United States.

Background of the Study

Cancer is the second leading cause of death in pediatric population between the age of 0-15 in the United States after vehicular and other accidents [1, 2]. An estimated 1% of all recorded new cancers in the United States occurs in the pediatric population. The most common cancer diagnosis in this population includes acute lymphocytic leukemia (ALL) 30%, CNS tumors 26%, and neuroblastoma 7% [2]. An increase in the incidence of pediatric cancer diagnosis has been reported in recent years [1, 2]. Even with some rise in incidence, the survival of these populations has been remarkable, mainly because of improved surveillance as well as new approaches to treatment including targeted therapies [3, 4]. There are some variations in the 5-year survival of the medical conditions mentioned above. Moreover, the improvement of combination, targeted and personalized therapies have played a crucial role in improving survival in this populations [5]. The complexities associated with cancer care includes screening, precise treatments, and cost of care.

As the therapy approaches improved as mentioned above, so has the cost of care for patients with ALL and other forms of pediatric cancers. Healthcare has evolved along with the medical challenge’s humanity faces. As advances in medical technology and drug development continues, people can live longer and manage diverse medical conditions including in ALL care. For example, the number of recorded deaths associated with ALL in 2016 was less than recorded statistics for preceding years. The protocols and standardization of treatment have been increasingly coordinated across countries and international bodies. These have played a role in the effective coordination of clinical trials as well as the development of effective medications and treatment protocols. The cost associated with oncological care has been tremendously increasing the effectiveness of treatment approaches. A tremendous amount of both human and capital investment is necessary for these breakthroughs in development and treatments. An understanding of the different associated financial constraints that come with survival in the patient with ALL is imperative in maintaining this trend and most importantly devising ways of cutting cost associated with ALL care.

Childhood cancer care cost is estimated to be about five times the cost of pediatric-related hospitalizations in the United States [3, 4]. The extensive and diverse nature of the care provided to these populations incrementally adds to the financial burdens that come with these diagnoses. An understanding of the various areas associated with treatment and care provision aspects are essential in developing strategies for cost reduction. Moreover, such an understanding will aid in guiding research and resource allocation in improving effectiveness and prioritization of various aspects of care by all stakeholders. The real cost associated with care for these population is likely more than currently estimated. Furthermore, the financial impact of such medical conditions affects relapse-free organizations [3] and patient's families in diverse ways. As healthcare resources become more difficult to obtain and new criteria are being developed to curb cost, it is imperative now more than ever to gain an in-depth understanding of cost associated with the most common pediatric cancer leukemia. Such studies would aid providers and healthcare organizations to focus resources on more effective treatment approaches at the same time improve care quality and cut the cost of care provision. Families would potentially have fewer cost constraints because of strategies and efficient utilization of resources.

Majority of studies regarding pediatric malignancies and leukemia specifically have mainly concentrated on the rate of hospitalization, complications and other medical aspects of care. An analysis of the relationship between inpatient services and its relationship with cost has not been studied extensively on a national level [5, 6, 7]. Such studies are in the interest of healthcare organizations, providers and patients and their families. Treatment combinations in these populations vary hence a trough understanding of what works for healthcare organizations does not necessarily mean an impact on individual financial expenditure for care. Furthermore, a general overview of these diverse and complicated economic necessities may show diversity in the outcomes or the survival rate in these populations [8, 7, 9]. This study aims to evaluate the relationship between inpatient care for leukemia and the direct and indirect medical cost patients and their families incur when receiving care or treatment.

Problem Statement

There is a problem with the continuous increase in healthcare expenditure in the United States. The cost of care for pediatric cancer populations has increased astronomically over the years [6]. Inpatient healthcare cost as with all another cost rise could be attributed to many factors. Even though many financial cost reduction techniques have been employed over the years, this problem continues to persist for many reasons such as long duration of hospital stay, and cost associated with care for individuals with leukemia. This problem impacts people from all aspects of our society no matter the state of their financial stability. An understanding of the various cost's patients incur during inpatient care is imperative in gaining a broad knowledge of other cost surrounding care. The KID inpatient dataset provides an opportunity for detailed analysis of leukemia and the various charges based on treatment in an inpatient setting. Such an interpretation would aid all stakeholders' especially healthcare organizations, and providers find ways of possibly eliminating some of the cost associated with leukemia care. More specifically ALL which is the most significant subset of the group.

A significant majority of parent's expenditure besides medical care is usually directly related to the process of receiving inpatient care. These then have direct and indirect consequences on entire family finances as well as well-being. The cost for treatment that cannot be afforded by patients goes through national insurance; hence a general increase in public responsibility through Children health insurance programs. The increasing need for effectiveness in healthcare resource allocation and a governmental decrease in healthcare funds, it is imperative to thoroughly analyze all areas of care that utilize a significant portion of healthcare expenditure. How can cost of inpatient care for leukemia and other pediatric malignancies be decreased? Why should all aspects of care during hospitalization be analyzed? How can know expenditures aid in addressing the issue of growing cost? These are some of the questions this study aims to investigate and provide a broader picture of the relationship between inpatient hospitalization and treatments and the high cost of leukemia care.

Purpose of the Study

Medical care cost has been increasing for all types of cancers including leukemia. Research has demonstrated the relationship between the increase in pediatric cancer survival and an increase in cost associated with care. Several factors can be attributed to the financial constraints associated with childhood leukemia care. However, inpatients care stands out because of the various complexities and the need for specialized treatment needed for pediatric leukemia care. An understanding of resource utilization during inpatient hospitalization is essential in devising ways of effective clinical treatment while cutting the cost of care.

The purpose of this quantitative research is to contribute to providing the further understanding of inpatient cost of care for leukemia on a national level. Moreover, it is aimed at evaluating clinical and resource utilization during treatment from the HCUP KID Inpatient dataset. A detailed understanding at this level would aid stakeholders especially patients, healthcare organizations and providers devise protocols that are effective in increasing survival and decreasing cost. The continuous need for strategic funds allocation by healthcare organizations both governmental and private makes an analysis of this nature prudent in today's modern healthcare system. Such an analysis would also prove essential for policymakers in all areas of healthcare and governance on budgeting and funding approaches.

Research Question(s) and Hypotheses

1. What is the relationship between demographics, resource utilization, and age, leukemia of lymphoid origin diagnosis and the cost / total charge for care?
2. What is the effect of inpatient pediatrics leukemia care costs on survival?
3. Is there a relationship between time of diagnosis (age) and outcome in pediatric leukemia of Lymphoid origin in the KID 2009-2012 Databases?
4. What are the relationships between demographics and payer methods and how does this impact survival?
5. Is there an association between duration of hospitalization, payer method, health outcome (severity/ survival), and cost?
6. Is there a relationship between survival of pediatric leukemia and cost/ total charge and severity?
7. What role does genetic screening play in relation to cost, survival, and outcome?

8. What variations exists between treatment outcomes based on income, race and ethnicity?
9. What percent of pediatric lymphoid leukemia population are not insured or underinsured and cannot afford payments?
10. What is the average difference in cost of inpatient care between 2009-2012?
11. What were new modalities of treatment used per HCUP KID inpatient discharge data and how effective are they?
12. What is the impact of LOS on Cost and mortality and is there a difference for any diagnosis subgroup?
13. What proportion of individual received emergency services before admittance? What is their insurance coverage?

    What was the cause of admittance to the emergency room?
14. What is the relationship between these populations and patient disposition after treatment?
15. What is the relationship between disease severity, location and payer?
16. What is the relationship between charge and emergency care
17. Is there a difference between severity, survival and demographics?

1. What is the relationship between demographics, resource utilization (Diagnosis), age and leukemia diagnosis and the cost of leukemia care?

   H_{01}: There is no statistically significant relationship between age and cost of inpatient pediatric leukemia care.

   H_{02}: There is no statistically significant relationship between demographics and cost of inpatient pediatric leukemia care.

H_{03}: There is no statistically significant relationship between age and demographics on the cost of inpatient pediatric leukemia care.

H_1: There is a statistically significant relationship between age, treatment, demographics and cost of inpatient pediatric leukemia care.

2. What is the effect of inpatient pediatrics leukemia care costs on race and survival?

H_{01}: There is no statistically significant effect of cost on the race of pediatric leukemia patients.

H_{02}: There is no statistically significant effect of cost on the survival of pediatric leukemia patients.

H_{03}: There is no statistically significant effect of cost on race and survival of pediatric leukemia patients.

H_1: There is a statistically significant effect of cost on race and survival of pediatric leukemia patients.

3. Is there a relationship between time of diagnosis (age) and outcome in pediatric leukemia in the KID 2006-2012 Databases?

H_0: There is no relationship between time of diagnosis (age) and outcome in pediatric leukemia in the KID 2006-2012 Databases.

H_1: There is a statistically significant relationship between time of diagnosis (age) and outcome in pediatric leukemia in the KID 2006-2012 Databases.

4. What are the relationships between payer methods and survival?

H_0: There are no statistically significant relationships between payer methods and survival in pediatric leukemia.

H_1: There are statistically significant relationships between payer methods and survival in pediatric leukemia.

5. Is there an association between duration of hospitalization and health outcome?

   H_0: There is no statistically significant association between duration of hospitalization and health outcome.

   H_1: There are associations between duration of hospitalization and health outcomes.

6. Is there a relationship between mortality of pediatric leukemia and cost?

   H_0: There is no statistically significant relationship between mortality of pediatric leukemia and cost.

   H_1: There is a statistically significant relationship between mortality of pediatric leukemia and cost.

7. Is there a relationship between race, income and cost of leukemia care?
8. Are there any variations between inpatient and outpatient cost of care?

Theoretical Foundation

There have been studies and postulations that patients are sometimes kept in hospitals or inpatient care for longer than they should. Others even suggest a transfer of the patient to other facilities where they can revive the same standard of care outside the traditional hospital or healthcare facilities. It widely accepted that the length of inpatient stay increases the total cost of care as well as the likelihood of acquiring nosocomial infections. These then increases the potential for further elongation of patients stay, and this is especially true for individuals undergoing cancer treatment [10, 11]. Many areas lack the infrastructure and resources for treatment of these chronic malignancies. Furthermore, the relationship between demographics and health care utilization is imperative in understanding the treatment approaches as well as ways to improve outcomes. Another critical aspect of evaluating such as relationship is to find ways in which quality care could be delivered to all populations regardless to income or which part of the county they live in if such disparity exists [12, 13].

An understanding the treatment provided in different areas across the country and comparing that to the outcomes will be crucial in the adoption of a protocol that improves outcomes at a most useful and minimal cost. The question of health care coverage and access to care are usually directly related hence an understanding of the relationship between these two variables would further aid in addressing the issue of access and also the approach to providing care specifically for these populations. It is also imperative that such a study would aid in finding some benefits to utilizing alternative care approaches such as Home Health and other health facilities other than inpatient care for all duration of illness. Some studies suggest outpatient care for certain aspects of care associated with pediatric cancer treatment is as effective as inpatient care. The variation in the source of payment for cancer-related services has changed over the years, and the association between the private payer and governmental (Medicare, Medicaid) is crucial in studying the charges depending on individual's coverage, residence, race, and income. Such information could be utilized in organizational strategic planning on sources of revenue [14]. Moreover, such an approach would allow us to prioritize resource allocation given the fact that there is an increase in incidence as well as survivorship for cancers in general [15, 16].

The relationship between insurance coverage and demographics is still an essential impediment to many individuals and families across the United States. How does total hospital inpatient cost vary for these individuals and what relationships is there if any to severity and mortality? This observation could them be compared to another income level and demographics to demonstrate if there are any disparities or significant differences in this regard. Inpatient hospital stay for patients with cancer is three times longer and costlier than all other pediatric hospitalizations [4]. An understanding of the reasons why all the above occurs is essential in finding areas that could adjust to decreasing the duration of inpatient care and generally to cost of care. For severe presentation in these populations, was inpatient care related to improvement in general health. The disposition of patient before transfer to inpatient facility has any impact on cost, length of stay and survival. All these factors are crucial to understanding the areas that could be utilized in decreasing total inpatient stay and cost reduction respectively.

Practical Framework

Such a study would aid in providing a better understanding of all areas of the cost associated with lymphoid leukemia. Such an understanding would aid policy directions and resource allocation for both governmental and non-governmental organizations. Healthcare management is an important aspect ensuring continuous resource allocation and management for each organizational department. The availability of revenue is limited to many healthcare organizations especially community-based ones [17]. In recent years much community-based healthcare organization has closed mainly because of revenue or financial solvency. An understanding of all the areas associated with the cost of care will aid in strategic management and allocation of resources. These would aid in ensuring population access as well as the potential for reduction of cost associated with treatment on patients and their families. The variations and unpredictability of hospitalizations affect both parents and health organizations on issues of planning and resource allocation. Moreover, the establishment of outpatient facilities that could manage some of the acute presentations other than inpatients services could significantly decrease the cost of care [18].

Furthermore, such intricate understanding of the relationship between these various variables would aid healthcare policy planner in their approach to resource allocation including research. The utilization of such an approach will aid in the effective use of resources on treatment approaches as well as practical modalities that have shown improved outcomes and cost reduction. Another essential imperative for such a study is the ability to compare different demographics across the country and develop strategic policy on pediatric cancer based on unique demographics.

Nature of the Study

Utilization of the HCUP- KID dataset provides the opportunity to study national estimates and understand the trends in diseases in the United States. The ambulatory data SASD allows for evaluation of statewide outpatient services. Utilization of a retrospective design allows for an adequate evaluation of associated areas that change over the three years period of each data release and what changes in treatment approaches have been adopted and their impact on total cost of care. The total charge reported for all patients in the databases 2009 and 2012 with a diagnosis of leukemia of lymphoid origin is recorded. Other independent variables such as patient sex, the primary source of payment, leukemia of lymphoid origin (ALL, CLL, SLL, other and unspecified lymphoid leukemia), severity, mortality, patient and hospital demographics where analyzed. The data was obtained from HCUP through the online purchasing center. It was then downloaded following instructions provided by HCUP into an SPSS format. IBM-SPSS statistical analysis software V23, R, Microsoft Excel and Tableau were used in data analysis.

Definitions

1. AGE - *Age in years at admission*
2. APRDRG_Risk_Mortality - *All Patient Refined DRG: Risk of Mortality Subclass*
3. APRDRG_Severity - All Patient Refined DRG: *Severity of Illness Subclass*
4. DIED - *Died during hospitalization*
5. DISCWT - *Weight to discharges in the universe*
6. DISPUNIFORM - *Disposition of patient, uniform coding*
7. DQTR - *Discharge quarter*
8. DXCCSn - *Clinical Classifications Software (CCS): ICD-9-CM diagnosis classification*
9. DXn - *ICD-9-CM Diagnosis*
10. ELECTIVE - *Elective versus non-elective admission*
11. FEMALE - *Indicator of sex*
12. HCUP_ED - *HCUP indicator of emergency department record*
13. H_CONTRL - *Control/ownership of hospital*
14. HOSP_BEDSIZE - *Bedside of hospital*
15. HOSP_LOCTEACH - *Location/teaching status of hospital*
16. KID_STRATUM - *Stratum used to post-stratify hospital*
17. HOSP_REGION - *Region of hospital*
18. LOS - *Length of stay, cleaned*
19. NDX - *Number of ICD-9-CM diagnoses on this discharge*
20. NCHRONIC - *ICD-9-CM Number of chronic conditions*
21. NPR - *Number of ICD-9-CM procedures on this discharge*

22. ORPROC - *Major operating room ICD-9-CM procedure indicator*
23. PAY1 - *Expected primary payer, uniform*
24. PL_NCHS2006 - *Patient Location: NCHS Urban-Rural Code, 2006*
25. PRDAYn - *Number of days from admission to procedure n*
26. PRn - *ICD-9-CM Procedure*
27. RACE – *Race*
28. TOTCHG - *Total charges, cleaned*
29. TRAN_IN - *Indicator of a transfer into the hospital*
30. TRAN_OUT - *Transfer out indicator*
31. YEAR - *Calendar year*
32. ZIPINC_QRTL - *Median household income for patient's ZIP Code (based on current year)*
33. SASD- *State Ambulatory Services Database*
34. Process Measure- Steps that leads to positively or negatively affecting an outcome.
35. *Structure Measure- infrastructural capacity, systems and processes to address an issue*

Assumptions

The cost of health care in the U.S has been increasing over the years and continued to do so. This cost directly impacts the general financial resources to pediatric care. The funding of pediatric insurance hence has been an issue of debate on the policy levels. It is likely that the government may on occasion decrease financial support for such programs. Moreover, the development of targeted therapy, personalized medicine, and biotechnology, in general, is likely to increase the general cost of leukemia care. It is then imperative to develop specific protocols that guide all aspects of financial expenditure to ensure more individuals are being taken care of with the limited resources available.

Scope

This research will be limited to looking at associated cost areas in the process of care for individuals with childhood Leukemia of Lymphoid origin within the HCUP KID inpatient dataset (2009-2012) and New Jersey SASD (2012). All primary and secondary diagnosis of leukemia of lymphoid origin including the most frequent secondary diagnosis after initial leukemia diagnosis were studied and their impact on cost were analyzed. The procedures for all primary and secondary diagnosis of lymphoid leukemia were also included in this study.

Limitations

Limited analysis of SASD outpatient data for comparison is likely to mask the variation that may exist by state or region and limit broader understanding of factors affecting the cost of care in these populations. Another limitation is the variation of data availability by state and general compensation systems and varied level of access to cancer and chemotherapy facilities. These variations could potentially impact the financial aspects of cost and access to care. The lack of charge segregation and classification impedes on obtaining an adequate understanding of some aspects of expenditure and protocols for treatment. The lack of detailed information on pharmaceutical utilization during inpatient care limits the scopes of analyzing these costs categorically.

The lack of specific subcategorization of charges by services provided including provider and procedure cost limits an understanding of the specific relationship between charges and these variables. Moreover, the lack of data specifically for genetic testing, its relationship to outcomes and cost impacts prevents further understanding of these factors on cost and charges. Also, an understanding of all cost broken down for procedures, laboratory services, and physician charges could have assisted further in understanding the factors that impact health care cost most.

Significance of the Study

An estimated 10,380 of new cancer diagnosis were expected to occur in 2016 [7, 8]. Incidence and prevalence of cancer among the pediatric population have increased over the years with leukemia being the most prevalent [19, 16] significant research has demonstrated an increase in survival and effectiveness of treatment for childhood leukemia over the years. Many have also demonstrated the continuous increase in the cost of care as the effectiveness of treatment increases hence survival. It is imperative to analyze the areas of cost that is most associated with a significant portion of financial expenditure, and that is inpatient care. Understanding process and structural make up would aid in devising protocols that are effective in achieving strategic clinical goals as well as managing the cost of care.

Many parents have reported financial hardships during the process of care for children with leukemia and other pediatric cancers. Those who cannot afford specific medications use them infrequently and develop more complications [9]. These then lead to the long duration of care in an inpatient setting; moreover, it can be directly related to the high cost of care in the last months of terminally ill patients [20, 7]. This study will provide all aspects of healthcare with intricate knowledge of childhood leukemia of lymphoid origin cost and impact factors. Moreover, it will enable providers and administrators to understand or even evaluate the effectiveness of current protocols. It will serve as a platform for interaction on the effectiveness of protocols, approaches to care, and specific outcomes associated with them. Such a study will aid in shaping the policy of cancer as well as aid in improving effectiveness and efficiency in the allocation of financial resources.

Summary

The utilization of data on health care treatment and cost or charges has the potential to aid in the better utilization of limited resources in an era where there is an increasing number of diagnosis and prevalence of malignant and chronic diseases. Acute Lymphoblastic leukemia is the most common pediatric cancer malignancy in the United States [7]. The cost of care for this medical condition has been shown to continue to rise as survival improves and targeted therapies and the effectiveness of treatment. There is an opposite reaction about resources available for the treatment of such diagnosis and other medical conditions in general. Political climates and policy changes in government and prioritization necessitate the need for a thorough understanding of all areas associated with the most common pediatric malignancy and its subclass. Such a study will aid in addressing the issue of gaps that exist in coverage of care as well as aid policymakers and healthcare administrators with resource allocation and strategic financial management and planning. This study shows there are a variety of factors affecting the cost of care with LOS and specific procedures having more impact than others. It also shows there is a significant difference in charges for same procedures when in an inpatient setting compared to outpatient. An observation of a variation in charges exists by region and location of treatment. Governmental affiliated hospitals tend to charge less when compared to non-profit and for-profit healthcare facilities. The demographics for specific treatments show variations based on hospital region and ownership and primary diagnosis.

Chapter 2: Literature Review

As the availability of resources for health care expenditure decreases, the prevalence of specific chronic conditions has increased because of improved care approaches and targeted therapies [4]. A thorough study of pediatric malignancies have proven very successful in the aspects of treatment and improving health outcomes. The question of financing these treatments is imperative in ensuring affordability for the patient and their families as well as financial stability for organizations that provide these services. Leukemia of lymphoid origin and particular Acute lymphoblastic leukemia (ALL) is the most common pediatric malignancy [2]; an in-depth understanding of the various determinants of cost and charges within the healthcare setting are imperative in developing effective financial planning and strategic resource allocation.

These chronic malignancies tend to be very costly and financial take up a considerable sum of organizational resources. Several kinds of literature have evaluated the effect of cost on some sub-groups of leukemia in local settings [7, 8, 9]. There is a need for a national analysis of this malignancy with a focus on the relationship of cost on demographics, income, survival, and mortality. An understanding through such a study would enable health administrators actively inculcate data finding into organizational business planning to ensure financial solvency. Furthermore, healthcare providers could utilize this information in finding ways of improving outcome and cost by adopting alternative treatment for a patient in outpatient settings instead of the heavy focus on inpatient care.

Literature Search Strategy

Search strategy began with the Rutgers University library which provided access to library databases.

Database	Search Terms
PubMed	*ALL, Lymphoid Leukemia, Cost, Charge*
EMBASE	*Leukemia, ALL, Healthcare Cost, Charges*
Google Scholar	*Cost of pediatric cancer treatment, Leukemia*
PAIS Index	*Healthcare Cost, Management, Pediatric, Cancer*
PLOS One	*Pediatric, Cancer, Cost, Leukemia*

The literature review process was carried out for publications in the last 20 years. The reason for this is to mainly see the difference in research and treatment approaches in treating pediatric cancer in general and advances made in chemotherapy and targeted therapy. Another important reason for such approach was to evaluate the survival and severity or complications, and mortality other publications have found about cost. The focus on pediatric healthcare cost publication for the last 10years (2007-2017). The rationale for this is the drastic changes in approaches to treatment during this time and the impact of new targeted therapy on increasing survival and also evaluate reported increased incidence. The researched focused on peer-reviewed, metanalysis, systematic quantitative literature review. Publications that met the criteria mentioned above were selected and evaluated for association with healthcare cost, healthcare financial management, pediatric cancer, leukemia, acute lymphoblastic leukemia, Subacute lymphoid leukemia.

Theoretical Foundation

It is widely believed and understood in healthcare management that increased the length of stay in an inpatient setting after a week or two dramatically increases the cost of care by more than half of initial cost. Many healthcare managers and administrators have difficulties managing or planning for such patients and including such patient's costs in budgeting and strategic planning. Another factor that is not often evaluated is the correlation between finance and likelihood of survival and severity of patient presentation. An increased inpatient stay is likely to increase disease severity, secondary diagnosis and procedures. Furthermore, household income has a direct relationship to decreased disease severity and improves survival risk.

Another aspect is disparities that is associated with cost and charges and why treatment for same malignancy cost differently even with the same presentation or severity level. There is likely to be a difference in total charges in the same demographics for an individual with the same severity scale. There is also a likelihood of variance in total charges when payer differences are present. An understanding of the population's ability to afford treatment for these medical diagnoses is imperative in formulating strategies of finance. For instance, Medicare, Medicaid reimbursement are much lower and are likely to take longer before healthcare organizations are compensated. There is ample evidence to suggest the cost for pediatric cancer treatment cost about five times that of medical presentation in the same population [4]. It is widely accepted that high-risk patients are likely to receive more intensive treatment compared to low-risk individuals with less severity and mortality risk [21]. The question of how we evaluate the effectiveness of treatment and how to measure this success through cost is crucial for improving the outcomes of health and relapse-free duration. In a study conducted by Kaul et al., they utilized a cost-based approach to evaluate various aspects of treatment based on the cost of inpatient care [21]. This study was conducted with data from the Intermountain healthcare system in Utah. The study's findings support the idea of looking at the impact of cost on care quality from a national perspective to gain a better understanding of both disease demographics impact and cost.

A longitudinal study conducted from the statewide date found some exciting aspects of care that could be utilized in managing cost. For instance, the study found the average of cancer cost was more than fifty thousand dollars in the next ten years following diagnosis compared to individuals without cancer [22]. For an average healthcare organization or a health insurance fund that is a considerable sum for individual patients. Some studies have argued that the impact of total length of inpatient hospitalization not be a significant determinant but rather the frequency of admission [23]. This could mean that the cost is not treatment-related but complications such as secondary infections.

As the study by Kaul et al. demonstrated, it is possible and beneficial for organizational management to conduct projects with the data available. Such approaches will prove vital in the process of long-term organizational planning and goals. The incidence of such conditions have been increasing over the years the resource allocation for such services should be on par with the needs of the population. A study conducted by the national cancer institute on modeling and productivity analysis showed the benefit of mimicking such a model in the pediatric population [24]. Moreover, the model analysis and conclusion indicated the targeting malignancy with high incidence in a particular population could have a positive impact on society and productivity of communities.

Inpatient & Out Patient Cost of Care

In the past years, there has been a continuous increase in the cost associated with medical care in the United States. These increase in healthcare cost has affected all aspects of care especially cancer treatments [23]. Pediatric malignancies or cancers are not as common as those of adults, but the incidence and diagnosis of pediatric cancer have been increased for the past 30 years, and the inverse is true for mortality. The mortality rate for pediatric cancer has decreased tremendously in recent years as a result of improvement in treatment strategies and effectiveness of chemotherapy and targeted therapies [3, 5]. The most common type of pediatric cancer or malignancy is Leukemia with Acute Lymphocytic Leukemia (ALL) being the most common subset.

ALL is estimated to affect about 25% of all pediatric cancer population. Furthermore, there has been an increase in the number of ALL diagnosis over the years [25, 6]. Pediatric cancer hospital stays (LOS) are on average longer than any medical illness in the pediatric population. The average cost of per stay for leukemia patients in the United States from 2000-2009 was about $55000. The mean cost per stay for these populations has also risen by about 35 percent for the same duration per HCUP data [4]. This cost is likely to continue to increase in the publication of the next dataset [24, 6]. A thorough understanding of all aspects and areas, directly and indirectly, affecting the cost of care is imperative to finding ways of improving care provision and also cutting cost associated with leukemia care. Healthcare cost varies in various countries in the developed world; it is also true that the outcome and cost of care varies much when one looks across the United States as a whole. The payment modalities, as well as survival severity, has in some instances be associated with income and demographics. It is then imperative once again to understand the protocols and strategies utilized in other parts of the country if such strategies cost less and have the same or comparative outcome of survival and disease severity.

In a study conducted by Kaul et al., they discovered that higher cost associated with ALL care was significant at high risk ALL patients; furthermore, high cost did not indicate low effectiveness in treatment approaches [21, 24], Many studies have indicated that there is a continuous need for inpatient care from 1-5 years of diagnosis. Also, as the rate or frequency of hospitalization increased with a report of increasing financial burden for both patient's families and the source of payments [18].

The findings of such a study provide a detail description of the complexities that come with treatment as well as time from diagnosis to 5-year treatment period. It could also mean that high-risk individuals have these associated costs because of relapse as well as intensive therapies. Moreover, it imperative to look at the reasons for the spike in cost over the past decade. The question of what and how treatment approaches are utilized need to be evaluated to answer these questions specifically. Why the cost of care was highest in the first six months of treatment [21] also needs to be looked at from the standards or regimen of care, time of diagnosis and age of patients.

Even though there is a concerted effort on the part of many healthcare organization to cut cost associated with cancer care and Leukemia in this case that has not proven successful until now. There is some indication that outpatient, homecare treatment of non-high-risk care can aid in cost reduction [26]. The hospitalization of high-risk events is on many occasions associated with toxicities that increase or prolong hospitalization risk and hence increased overall cost [10, 11]. There is a considerable amount of information of the reasons for frequent hospitalization in patients with ALL. These include neutropenia, fever, infections, and chemotherapy or chemo-radiotherapy related side effects. The acute presentation should be addressed in a hospital setting as indicated by several studies on the complexities of an issue that may arise [27, 28, 29].

A detailed understanding of all these factors about outpatient admission is essential in creating systems that would aid addressing the problem increased cost and its inhibition of effective long-term budgeting for healthcare organizations. For instance, the creation of a decision supports systems that would aid in prompting physicians about fever; neutropenia risk would aid in improving alert systems as well as care approaches [12, 13]. Furthermore, the inclusion of technology that alerts caregivers, patients, and parents of these changes would aid in further alert and most likely seek outpatient care. A similar system could also be utilized in forecasting the potential cost for each of these malignancies in the future. Such models as those created by Bradley et al. could be a valuable tool for health policy, governmental and healthcare management professional in an organization.

Cost of Emergency Care, Geography and Cost

The unpredictability of cost or changes in the process of caring for patients with ALL as with other malignancies necessitates the utilization of emergency care. Emergency care has been historically the top and most expensive care provided to individuals with all kinds of medical presentations. On some occasions, the lack of full records of these patients' health records risks medical approaches that could be detrimental to their health. For instance, the likelihood of certain drug contraindication and changes in treatment approaches could occur during such emergency hospitalizations [14, 15, 16]. These could then lead to worsening of general patient's health, infections, more prolonged hospitalization as well as an increased in cost of care.

The increased cost also comes with extensive inpatient care as well as procedures and therapies. As we gain more understanding of the dynamics and characteristics associated with oncologic care, it is a common understanding that these cares are often associated with acute and symptom management [30, 31, 32]. It is a widely accepted idea that improvement of outpatient or home care services is unlikely to decrease emergency services as well as inpatient services. Some studies have shown a tiny percentage of individual presentations could avoid utilization of ER services [33]. However, the question of how to approach the less severe presentations needs to be addressed as well. The reason for this is to ensure that the cost of care is minimized in these populations.

Another essential aspect associated with emergency care is the issue surrounding the geographical location of individuals diagnosed with cancers [34]. On occasions, individuals and their families have to move closer to areas with specialized care services after diagnosis. In locations where emergency services are not adequately equipped, providers usually have difficulties providing care to the required standards. At times, patients are likely to wait long periods of travel to facilities that specialize in these services. This could increase the likelihood of complications as well as the cost of emergency care [35, 36].

Patients diagnosed with ALL and other leukemia of lymphoid origin or other types of pediatric cancers living in the rural or remote area on occasions have to utilize costly means of receiving emergency care such as air transport [37]. Some cost associated with care especially in the emergency setting comes out of pocket, and the travel expenses put a massive dent in family finances [38]. Some research has estimated the out of pocket cost for individuals ranged between $7500- $25000 [39]. Furthermore, these expenses are likely to be higher for parents because of an increased probability of visits to healthcare centers or clinics as well as general transportation costs. Families of children with pediatric cancers such as ALL have to move to areas closer to cancer care centers; this adds a substantial financial constraint to their financial stability.

Health Insurance Coverage and Gap

Health insurance coverage is an essential part of the total healthcare cost in the United States. The primary health insurance utilized in the U.S health systems include Medicare, Medicaid, State Children Health Insurance Programs (SCHIP) and work or employer-sponsored programs. It is estimated that the average cost of employer-sponsored coverage is about $18,142 in 2016. Employees are estimated to be paying about $5,277 [40]. This cost is more than 3 percent increase compared to a year ago, and it is even more complicated for individuals with children diagnosed with a malignancy. The number of emergency services received by these populations as mentioned above is about 80% more [36, 41]. This then utilizes all funds available for patients and creates intense problems for patients concerning premiums and coverages. Some reports indicate patient and parents often ignore specific presentations such as fever and other signs of potential problems to avoid utilizing all premiums. Coverage has continued to affect more individuals even with the affordable care Act that prohibited disqualification by insurance companies because of preexisting medical conditions [42]. These various problems associated with care affects parents in different ways, and this affects their insurance coverage [43].

Governmental aided insurance coverage such as Children Health Insurance Program (CHIP), Medicaid and employer-based coverage are a significant part of the insurance coverages in the healthcare systems primarily for the pediatric population with malignancies. An estimated two-thirds of all uninsured children are eligible for Medicaid or CHIP programs in the U. S. The process of enrollment and eligibility significantly varies in each state. The complicated process of application, as well as renewal frequency, are some of the reason for lack of enrollment and insurance coverage for many qualified children [44]. These then results in a likelihood of increased premiums for coverage and total cost of care because of late diagnosis and most importantly medical complications. Moreover, as premiums increase, the relative enrollment to some of these programs decreases. These directly affects patients with malignancies or chronic conditions because of the inverse relationship with access to care. Health insurance coverage impacts these populations even after they survive these childhood cancers. It is hence crucial for thorough evaluation of all the characteristics associated with the role of coverage and access to care and services.

The coverage of programs such as CHIP has about 8.5 million children across the United States, and the recent expiration in September 2017 put at risk these populations. Many of the enrollees in this program do not qualify for Medicaid [45]; this means the direct financial cost for parents and hence the likelihood of inability for compensation for medical services rendered. It is likely that when the federal funds provided to states run out sometime March 2017, this will exacerbate the cost of care as well as finances of families and healthcare organizations in diverse ways. A study such as this that specifically looks at one of the significant utilizers of healthcare resources will aid in better policy making and resource allocation for national and regional levels.

Even though the coverages as mentioned above are essential in ensuring continuity of treatment for patients with the cancer diagnosis, there is considerable evidence to suggest the existence of gaps in the coverage for these populations [36, 46]. Furthermore, the changes in political climate and variance in governmental policies directly affect access to care especially for patients undergoing cancer care. The funding for CHIP program has been virtually exhausted by a significant number of the 50 states so far; the question of coverage and uncertainty does not lie with parents to pay out of pocket if Medicaid is not funding for care. This uncertainty does affect not only families but also healthcare administrative processes. Such scenarios are the reason why it is imperative for organizations and policy to make to gain a detailed understanding of the cost of care for these populations. These gaps are directly or indirectly related to the various dynamics associated with the processes of seeking care for leukemia and other pediatric malignancies.

In many instances, parents move closer to areas of services, lose full time working status for employer coverage or merely lose their jobs. Some research indicates individuals utilizing theses insurances were likely to have gaps in care compared to privately insured [47, 48]. The likelihood of complications due to lack of treatment or even primary care in the population of individuals with ALL is increased. Complications in these populations' means hospitalizations with more advanced disease presentations [49]. These are usually associated with high care cost due to complications, emergency services, and inpatient care. It also means an increase in the total cost that would be associated with an individual's care because of the increased emergency visit and the likelihood of severe presentation. Furthermore, the probability of increased mortality in these patient population is higher because of complications that may arise with treatment or secondary infections [50].

There is a strong association between coverage and access to healthcare in both adult and pediatric population. This association has also been established in the care for patients with malignancies including leukemia. The dynamics associated with health insurance coverage in the United States is directly related to care approaches. An understanding of how these coverage policies impact patient access to care would aid in obtaining better insights to care approaches. Furthermore, it would aid stakeholders better understand areas where collaboration is feasible to decrease the gap between coverage and potentially decrease the cost of care for these conditions.

Treatment and Pharmaceutical Cost

Patients are often prescribed medication to aid in alleviating or even eliminating their medical conditions. These medications are an essential part of the treatment plan; these medications are not only essential in cancer treatment they are a must. They are not only self-administered, but some are also utilized intravenously during inpatient care. In the past decade, more targeted medications have been developed, and these have been proven to be very useful in the treatment of cancer for adults and pediatrics alike [17, 18]. There are continuous introduction and approval of new cancer treatment drugs and biologics by the FDA. Furthermore, the development of precision medicine, as well as advancements in immune therapy, serves as hope for individuals diagnosed with these malignancies. The effectiveness of these therapies comes at a significant cost. By some estimates, the cost of pharmaceuticals medications administered during inpatient cancer treatment and oral medications are underestimated.

A significant part of this cost of care is that of medication prices and the continuous rise of deductibles and cost shifting. The rising cost may result in several issues that can affect the overall health of patients [19, 20]. Patients may delay or decrease taking the right dosage for financial reasons or constraints. There are many instances where the patient develops complications or worsening of current medical condition because they cannot afford copayments for their prescriptions. A significant number of individuals are reporting issues with payments and how they directly affect adherence to the regimen. Many of these individuals that cannot afford the medication or treatments tend to refrain from seeking medical care. This then leads to an increase in the likelihood of complications and a further increase in the cost of emergency and inpatient care.

Leukemia and non-Hodgkin's lymphoma are the first and second most expensive to treat pediatric malignancies in the United States. There are several costs associated with pediatric care that is rarely reported and hence not examined [21, 22]. These costs tremendously directly and indirectly increase the burden associated with caring for individuals ALL and other pediatric malignancies [21, 23, 22].

These costs include travel, food, labor, medical help or aid, equipment’s or supplies among many others [51]. In many instances, these financial costs are not covered by insurance coverage and come directly from parents or end up being unpaid. These then take a tremendous toll on families' finances and often leads to constraints. The cost as mentioned above is incurred in the processes of ensuring individuals receive the necessary care as well as make them comfortable. For instance, families have to adjust dietary intake as well as make a supplemental budget for food that is not contraindicated in the treatment being received by children. On occasions, parents have to provide copayment for medication; in many cases, these are costly treatment not covered entirely by insurance. Parents end up using up their saving and become deeply indebted during the process of caring for a child with cancer because increased cost sharing in coverages [30].

Many individuals have to travel extensively during the process of care provided to different cities sometimes states. Parents sometimes have to stay overnight or days if they do not live close to care centers [52]. They have to pay for accommodation at these locations and hence an increase in total financial cost. This takes a significant toll on finances and results in moving close to cancer care centers. Difficulties in obtaining new jobs or even work with schedules that will enable them to care for their wards at the same time is a huge problem. Employment also means an avenue to obtain health insurance, and hence the likelihood of paying out of pocket because of moving to a new location adds to families' costs and expenditures.

Another problem parents encounter is the issue of labor, they have to pay for services if they hire caretakers while they are at work [48, 30]. Other implications associated with care for childhood cancer is the adverse parental health and emotional ramifications.50 It is hence imperative to gain a better understanding of how the stress associated with care forwards will increase the cost of care for parents as well. These could then lead to missed work days or even disruption in the care of the child. Moreover, the complication could arise in treatment approach increases cost of care and further complicate family's financial situation. It is imperative for all stakeholders in the healthcare industry to understand the various impact of all aspects of care in making decisions the tremendously affects all aspects of a family lives.

Summary and Conclusions

It is clear and widely agreed on that cost of care in the field of cancer treatment is rising because of many factors as such as increased treatment effectiveness, increased survival rates, and frequency of healthcare visits by these populations. It is also a widely accepted view that the trend of continuous cost increase is not proportional to the quality of care or survival. The estimation that the number of individuals that needs extensive coverage the medical conditions including malignancies primarily for the pediatric conditions is increasing. The uncertainty around coverage for those who do not qualify for Medicaid calls for a thorough analysis of all aspects of care provision. The development of a strategic financial strategy to ensure these individuals are cared for is imperative in addressing this problem. These leads to the question what could be done to address issues pertinent to direct health care cost and how it could be reduced.

An analysis of the impact cost of survival and also the relationship between income level, access, and quality of care have been non-existent on a national scale. The continuous increase in the cost of care for leukemia is likely to have the dramatic effect of the allocation of resources both for health organizations and policymakers. Outpatient care for cancer treatment has been a topic increasing importance considering the rising cost of care. Several studies that have shown better outcome for outpatient care for several complications associated with leukemia care [17]. Many others have found that there less likelihood of readmission with outpatient treatment compared to inpatient care [18]. There little known specifically about the relationship between cost, demographics income, severity, and mortality. Most studies in this field have not focused on the specific characteristics of individual demographics and have been institution-wide. This study provides a detailed association between the charges, disease severity, mortality, and demographics. The relationship between hospital characteristics and its direct and indirect impact on patient health outcomes as well as charges could be obtained from this study.

Chapter 3: Research Methodology

The goal of this study is to evaluate the relationship between total hospitalization charges with survival, severity, and demographics in a patient with leukemia of lymphoid origin from the dataset 2009 and 2012 and NJ SASD 2012. The patient sample were obtained from the HCUP KID and NJ SASD datasets; these datasets contains all inpatient and outpatient (NJ) hospitalization records and charges. The data for 2009 and 2012 entailed a total of 44 states and had the comprehensive data and data elements, so utilization of this sample will be more indicative of the general population. Since the HCUP-KID dataset is released every three years, it is imperative to study multiple years to gain a better appreciation of the impact of both dependent and independent variables. The hospitals included in this study are all members of American Hospitals Association for both HCUP KID and NJ SASD.

Research Design and Rationale

The variables of focus in this study consist of Charges or cost (dependent) and Leukemia. Independent variables include leukemia (ALL and all subtypes), severity, mortality, race, demographics (Hospital region), ZIPINC_QRTL (household income), PR1-15 (Procedures on record), DISPUNIFORM (Patient discharge disposition). The above variables are further categorized into two specific sections namely 1. Therapeutic (procedures both diagnostic and therapeutic) 2. Demographics (Hospital Region, Income Zip Code) and 3. Other. Utilization of the above variables because of its relationship to care provided in an inpatient setting. Moreover, they allow for a thorough evaluation of the hypothesis and research questions.

Total charges for care are provided for each patient in the database and all those without were eliminated from the study. The cost in the dataset is no delineated and difference in appropriations is not known. The retrospective approach to this research allows for analysis of records of patients with leukemia for six years 2009-2012. The data allows for evaluating the validity of the research questions. Moreover, it aids in exploring the dynamics between the dependent variables and independents variables as well as other covariates. The availability of data and through HCUP-KID allows for such research to continually evaluate to improve health outcomes as well as the policy of health finances.

Research Criteria

Inclusion criteria for this review included original research investigating the cost of care for a patient with leukemia, ALL specifically and general cost of care associated with pediatric malignancies. Articles that have both adult and pediatric and adult cancer statistics and cost evaluation were also included. The literature search was performed on Medline, Google Scholar, and PubMed. The associated included phrases include "pediatric cancer," "cost of care" and "Acute Lymphocytic Leukemia" (ALL), “Outpatient cost of Care”. The outcome of these searches was then evaluated based on the inclusion and exclusionary criteria. The details of the study with regards to originality and aspects of evaluating the financial cost to care as well as the time of publication was considered. Origin of data collection approaches as well as country of origin and a similar standard of cancer care treatment in the country was also examined.

Population

This study will include pediatric leukemia cases from the 2009 and 2012 HCUP KID Inpatient Database and New Jersey SASD 2012. The design for this quantitative approach will include a thorough analysis of inpatient and outpatient lymphoid leukemia presentation for patient’s ages 0-21 years old from HCUP KID database between 2009-2012 and SASD 2012.

These datasets contain inpatient and outpatients clinical and resource utilization discharge information. KID sampling for 2009 and 2012 was obtained from 38, 44, 44 states and 5124, 5128 and 5118 community hospitals respectively. The database also includes information on patient age, sex, payment options (Insurance) and patient's income status by zip code. It also contains 25 discharge diagnosis as well as 15 procedure codes according to ICD-9-CM. Diagnosis at the time of discharge for leukemia will be identified through ICD-9-CM (204 plus all subcategories). All leukemia diagnosis in this population will be considered as primary diagnosis and reason for hospitalization. They will be further categorized as specified leukemia diagnoses such as Acute Lymphocytic Leukemia (ALL), Chronic Lymphocytic Leukemia (CLL), Subacute, Lymphocytic Leukemia (SLL) and other lymphoid leukemia's. This sub-classification will be solely relied on based on ICD-9-CM hence some may be unspecified as mentioned above.

Sampling and Sampling Procedures

A systematic retrospective analysis of cost, emergency service admissions, length of stay (total duration of inpatient service), services provided, diagnosis in the KID database for 2009 and 2012. Such detailed and delineated information is critical in understanding the intricate details that directly affect the cost of care. Russel et al. publication on the cost of pediatric chemotherapy using KID database proved the effectiveness of such an approach [53]. The admission charges in the KID database will be converted to cost to charge ratio. The characterizations of the database include hospital location (Urban vs. Rural and State), designation (Children's / specialized hospital), size (small, medium or large) and teaching status. The number of leukemia discharge data will be used as a description of leukemia treatment. States will be grouped according to geographic regions (Northeast, Midwest, West, and South).

This design was chosen because it allows an in-depth look at the influencers that impact the cost of care for this medical condition in an inpatient setting. Furthermore, it serves as a tool for evaluation of the indirect cost that is often associated with care for pediatric malignancies [54]. Inpatient services offered to leukemia patients will be accessed based on charges and allocation of resource (days of stay) for patients age 0-20 at admission. The associating cost will also be accessed and grouped based on what is services such as chemotherapy, emergency service, or physician compensation. Healthcare providers approach treatment currently will also be accessed through interviews and questionnaire. This will aid in gaining a better understanding of how relevant the data is in focusing areas or services that take up many funds. Moreover, it will aid in understanding new protocols and their relationships with cost directly from providers perspective.

The variables of interest in this study include the cost of inpatient leukemia care, age, demographics, race, diagnosis, and survival (Independents). The cost of care is defined as the discharge cost associated with leukemia care, demographics are associated with the postal code of domicile, diagnosis relates explicitly to the type of leukemia, and the survival rate is the odds of death.

Archival Data

The data was obtained from Online HCUP central distributor after completion of the HCUP Data Use Agreement (DUA) training course. The certification code provided after the training was used for obtaining the data. The data was then downloaded and stored on an external hard drive. The load programs for the data were downloaded in SPSS for utilization through IBM SPSS version 23. The HCUP KID inpatient database is based on administrative data and is the most significant publicly available pediatric all-payer inpatient care database. The partnership of federal, state and industry make the data unique and vital in providing a particular relationship between diverse factors of healthcare delivery for all level of governance and communities.

Data Analysis Plan

IBM SPSS Statistics 23, R, Tableau and Microsoft Excel will be utilized in the process of data analysis. The data will be recorded for all leukemia in a general category and then further subcategorized for detailed analysis. The procedures associated with the total number of lymphoid leukemia diagnosis will be recoded from ICD-9CM to dummy variables to aid is easy data manipulation and analysis. All pediatric leukemia-related diagnostic and therapeutic procedures will be further recoded individuals to aid in comparative analysis. The cost will be recoded to a log link for the cost to aid in regression modeling. Age will also be recoded and grouped into newborns, infants, children, adolescents, and late adults. The most frequent presentations after leukemia as a primary diagnosis will be obtained through descriptive statistics and recoded for further analysis. A descriptive statistics will be run for all new variables for missing values and outliers.

Demographics, diagnosis, procedures and specified cancer-related outcomes were summarized and recoded. Inpatient general charges were examined based on year of data release an average cost per hospitalization since each record provides an individual's hospitalization duration and total charges. The outcomes of each record will be plotted in separately to compare disease severity and mortality for each hospital and then compared to the outcome with a specified region. Longitudinal regression each factor of the presentation was examined for a relationship with cost, the year, number of procedure, number of chronic conditions recorded, and specific cancer-related procedures recorded such as chemotherapy, radiation or bone marrow transplant.

The variables in this regression will be Total Charge and lymphoid leukemia (all subtypes), sex, primary payer, radiation, chemotherapy, race, severity, mortality and all other variables of interest as shown below.

Research Question	Hypothesis	Independent Variable	Dependent .Variable	Covariates	Statistical Analysis
Demographic effects on cost	H1	Lymphoid Leukemia	Total Charges	Age, Gender, Disposition, LOS, NDX, NPR, NCHRONIC, DQTR, ORPROC, RACE, INCOME, LOCATION	ANOVA/ANCOVA, MEAN, Correlations and strength of Association
Severity effects on cost	H2	Lymphoid Leukemia+ Subcategorized	Severity	Age, Gender, Disposition, LOS, NDX, NPR, NCHRONIC, DQTR, ORPROC, RACE, INCOME, LOCATION, PAYER	Logistic Regression, Chi-Square, Mean Correlations and strength of Association

Mortality on Cost	H3	Lymphoid Leukemia+ Subcategorized	Mortality	Age, Gender, Disposition, LOS, NDX, NPR, NCHRONIC, DQTR, ORPROC, RACE, INCOME, LOCATION, PAYER	Logistic Regression, Chi-Square, Mean, Survival Analysis
Hospitalization and outcome	H4	Lymphoid Leukemia+ Subcategorized	LOS	Age, Gender, Disposition, NDX, NPR, NCHRONIC, DQTR, ORPROC, RACE, INCOME, LOCATION, PAYER	Logistic Regression, Chi-Square, Mean

Effects of Hospital Ownership	H5	Lymphoid Leukemia +Subcategorized	Hospital Control, location	Age, Gender, Disposition, LOS, NDX, NPR, NCHRONIC, DQTR, ORPROC, RACE, INCOME, LOCATION, PAYER	Logistic Regression, Chi-Square, Mean
Impact of procedures on cost	H6	Lymphoid Leukemia +Subcategorized	NPR, Procedures (Diagnostic & Therapeutic)	Age, Gender, Disposition, LOS, NDX, NPR, NCHRONIC, DQTR, ORPROC, RACE, INCOME, LOCATION, PAYER	Logistic Regression, Chi-Square, Mean, Correlations and strength of Association

Primary leukemia Dx impact on cost	H7	Lymphoid Leukemia +Subcategorized	Total Charges, LOS	Age, Gender, Disposition, LOS, NDX, NPR, NCHRONIC, DQTR, ORPROC, RACE, INCOME, LOCATION, PAYER	Logistic Regression, Chi-Square, Mean, Correlations and strength of Association

Chapter 4: Results

4.1 Descriptive Statistics, Measures of Central Tendency for total leukemia of lymphoid Origin (2009-2012 Dataset)

Descriptive Statistics & **Case Processing Summary**

Table 1	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Total Charges * Sex * Discharge Year	60642	97.3%	1696	2.7%	62338	100.0%

Gender Distribution

Table 2 **Sex**		Mean	N	Std. Deviation	% of Total N	Sum
Male	2009	$59376.48	17094	123213.838	28.2%	$1014958654
	2012	$74848.77	18130	198128.946	29.9%	$1356996111
	Total	$67340.21	35223	166227.263	58.1%	$2371954765
Female	2009	$59383.63	11699	116577.755	19.3%	$694700315
	2012	$72582.42	13720	173716.748	22.6%	$995830678
	Total	$66507.86	25419	150286.243	41.9%	$1690530993
Total	2009	$59379.39	28792	120559.548	47.5%	$1709658969
	2012	$73872.49	31850	188002.423	52.5%	$2352826789
	Total	$66991.33	60642	159738.495	100.0%	$4062485758

The tables above shows the total number of leukemia of lymphoid origin recorded in the participating hospitals for both 2009 and 2012 are 62,338 with 7677 as primary reason for inpatient hospitalization. All presentation of leukemia were included in the study except ones with missing total charges and other demographics. Moreover, extreme and missing values were excluded from analysis for better prediction of cost. Leukemia of lymphoid origin for both primary and secondary diagnosis were 28, 792 and 31,852 for 2009 and 2012 respectively. The proportion of male to female was 35,223 & 25,419 for both release respectively. Figure 1 below provides an overview of the relationship between charges and gender differentiations.

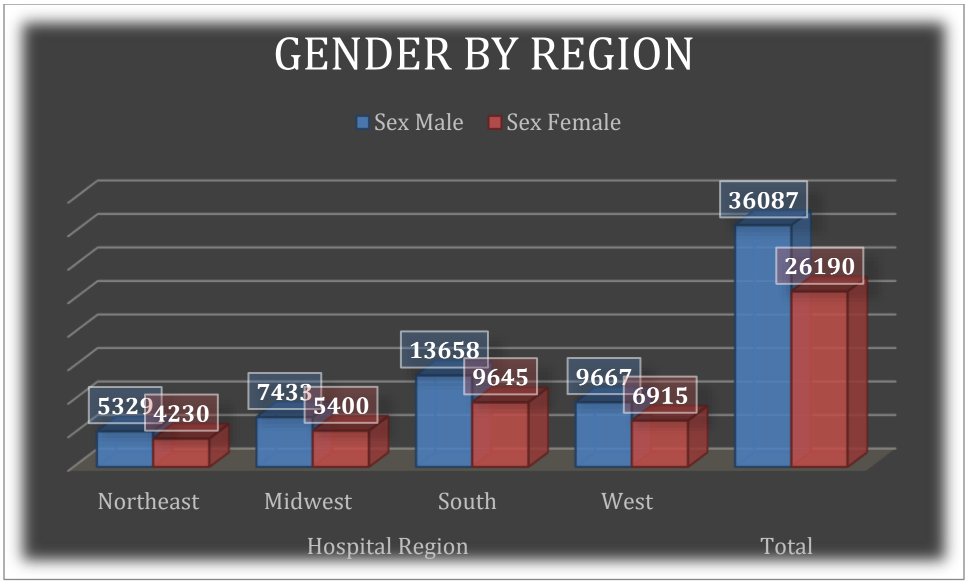
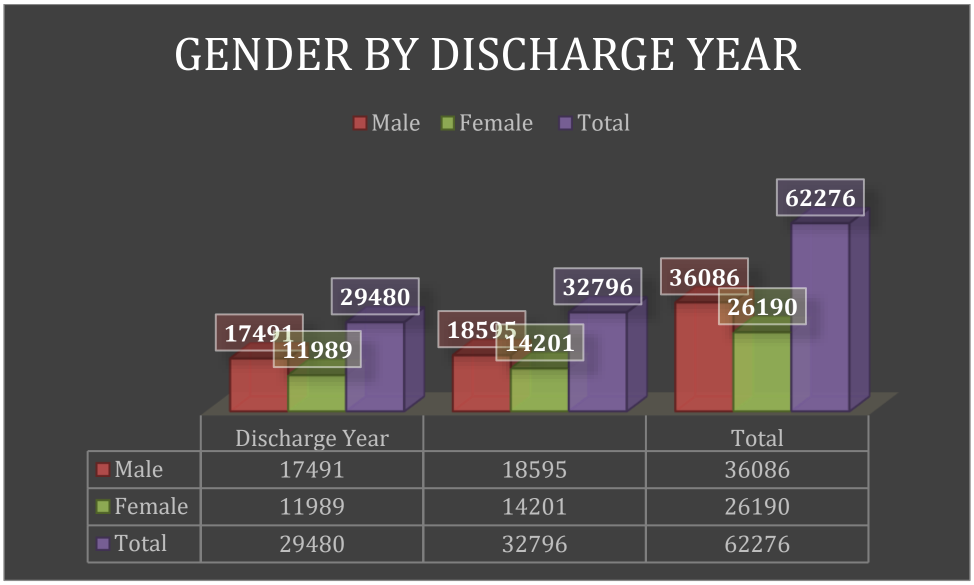


Figure 1. Charges for all years being studied. From the diagram and table 1 above one could see the variance in the cost as well as presence of disease for between males and females. Another evaluation of the data shows the proportion of male diagnosed compared to females is much higher. This also is depicted by the variance in cost or total charges as seen on Figure 1 above. Figure 2 below provides detailed description of male to female percentage in the dataset with diagnosis of lymphoid leukemia.

Figure 2: Gender by Age in years



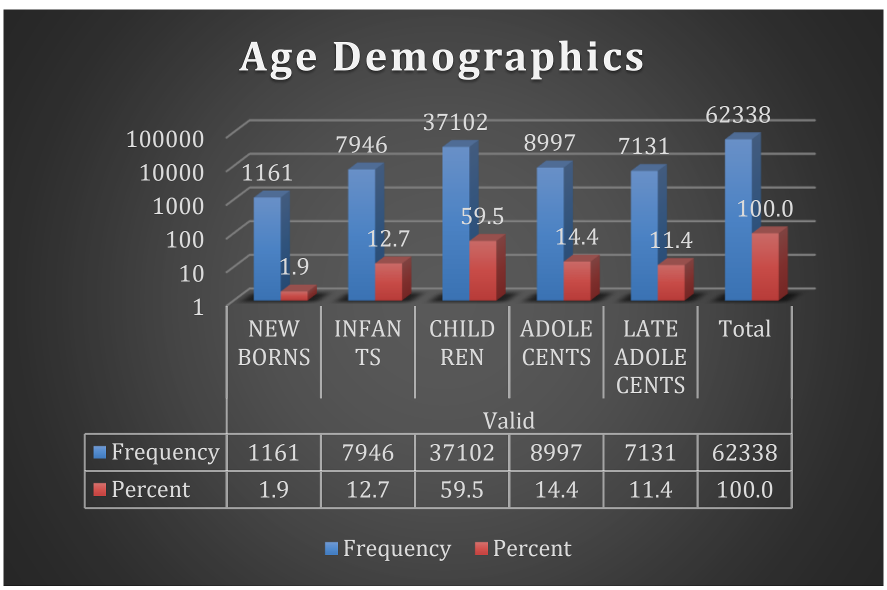


Figure 3:

Age demographics within the population diagnosed with leukemia either diagnosis.

The age demographics depicted above shows that the most affected population of individuals are children aged between 3-12 years old; individuals between the ages of 13-16 were the second highest population with about 14.5 percent. Children less than one year old presented with the lowest rate of leukemia with a total percent of about 2 percent. Another observation that could be made from the data is that the average age of 8 years old. Furthermore, the trends is similar for both years being evaluated. Further evaluation of the data shows that children 2 years old (9%) presented with higher proportion compared to all other age group. The ages with highest presentation were between the ages of 2-7 years old with an average 7 percent for each patient population.

Table 3		*Frequency*	*Percent*
Valid	Routine	55294	88.7
	Transfer to short-term hospital	753	1.2
	Transfer other: includes Skilled Nursing Facility	261	.4
	Home Health Care (HHC)	5352	8.6
	Against medical advice (AMA)	42	.1
	Died in hospital	609	1.0
	Discharged alive, destination unknown, beginning in 2001	19	.0
	Total	62330	100.0
Missing	-9	9	.0
Total		62338	100.0

Table 3: Patient disposition and number of diagnosis and percent from patients diagnosed with leukemia of lymphoid origin.

This table shows the variations or patient's disposition after treatment. One can see that a significant majority of patients were discharged routinely. An observation of the impact of home healthcare after treatment had the second highest disposition post inpatient care. The number of patients transferred from LTAC and short term facilities are very minimal compared to routine transfer out of inpatient healthcare facilities. Furthermore, an observation could be made on the total number of death from patient with a recorded lymphoid leukemia to be about one percent of the total population of diagnosed individuals.

Table 4: Indication of Emergency nature at point of admission

Frequency		**Percent**
Record does not meet any HCUP Emergency Department criteria	44911	72.0
Emergency Department revenue code on record	10996	17.6
Positive Emergency Department charge (when revenue center codes are not available)	2613	4.2
Emergency Department CPT procedure code on record	3	.0
Condition code P7 indication of ED admission, point of origin of ED	3816	6.1
Total	62338	100.0

The above table shows that of the total leukemia cases diagnosed between 2007 to 2012, the number that had emergency presentation were less than 30 percent and non-emergency presentation were 72 percent. These demographics will aid in understanding the relationship between severity and the impact of emergency services in the total cost of care for these populations. As shown in the table above the number of individuals with emergency room as point of origin was 3816 (6 percent) of total diagnosed leukemia.

Table 5: LOS AND DISCHARGE QUARTER

Length of Inpatient stay				
Discharge Quarter		Mean	N	Std. Deviatio
First Quarter (Jan-March)	2009	6.99	7661	10.933
	2012	6.92	8731	11.606
	Total	6.95	16392	11.296
Second Quarter (Apr-June)	2009	7.43	7233	12.925
	2012	6.79	7931	11.707
	Total	7.09	15164	12.307
Third Quarter (Jul-September)	2009	7.15	7105	10.955
	2012	7.40	7895	12.124
	Total	7.28	15000	11.585
Fourth Quarter (October-December)	2009	7.15	7426	11.387
	2012	6.92	8227	11.767
	Total	7.03	15652	11.588
Total	2009	7.17	29425	11.571
	2012	7.00	32783	11.799
	Total	7.08	62208	11.692

This table provides details of the length of inpatient stay for care received by patient with lymphoid leukemia. The table also provides some details of the number of presentations per quarter in the years selected for this study. One can observe that the average length of stay (LOS) of about one week and a fairly dispersed presentation throughout the year. It can also be observed that the average inpatient care decreased with from the 2009 average by about one day.

Frequency	*NCHRONIC*	*Percent*	*Cumulative Percent*
1	8455	13.6	13.6
2	24552	39.4	52.9
3	13918	22.3	75.3
4	7383	11.8	87.1
5	3762	6.0	93.2
6	2071	3.3	96.5
7	1044	1.7	98.2
8	567	.9	99.1
9	330	.5	99.6
10	146	.2	99.8
11	63	.1	99.9
12	28	.0	100.0
13	6	.0	100.0
14	10	.0	100.0
15	1	.0	100.0
18	1	.0	100.0
Total	62338	100.0	

Table 6: This table shows the frequency of the number of chronic conditions in the population.

Table shows details of the number of diagnosis individuals with lymphoid leukemia reported per their records. One can see that more than half of the total leukemia population has 2-3 diagnosis and 1, 4, and 5 were the second most prevalent presentation. Presentation of more than 10 chronic conditions were less than total 0.5 percent of total population. Table 6 below provides a similar description and relationship between individuals diagnosed with lymphoid leukemia and number of diagnosis present on record at the time of discharge. One could see from the table that a significant majority of patients had multiple diagnosis. Many had between 2-15 diagnoses other than leukemia during their inpatient stay.

Numbers of Procedures recorded on discharge

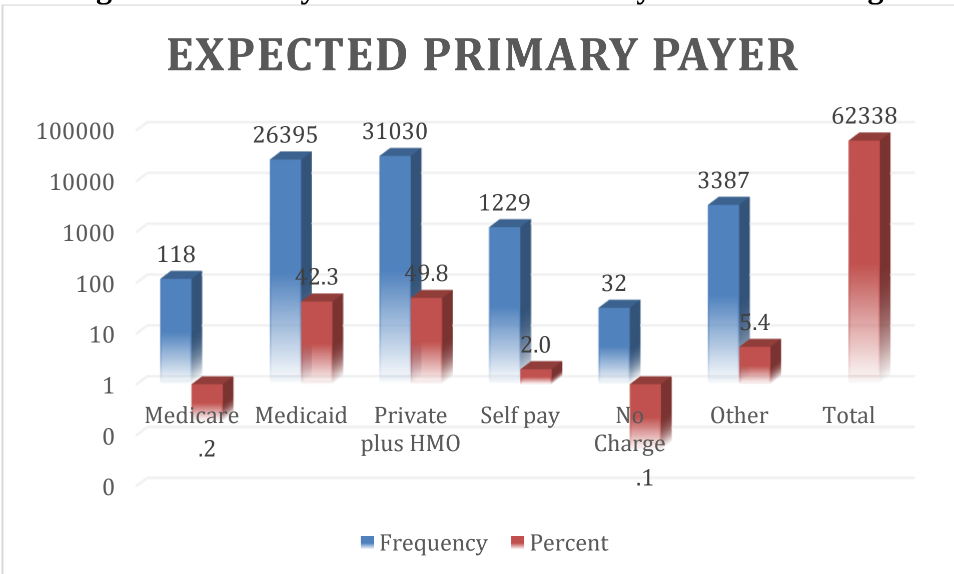
Table 7

Number of procedures coded on original record

Discharge Year	Discharge Quarter	Mean	N	Std. Deviation
2009	First Quarter (Jan-March)	2.33	7661	2.900
	Second Quarter (Apr-June)	2.53	7233	3.095
	Third Quarter (Jul-September)	2.45	7105	2.922
	Fourth Quarter (October-December)	2.45	7427	3.028
	Total	2.44	29427	2.987
2012	First Quarter (Jan-March)	2.38	8732	2.927
	Second Quarter (Apr-June)	2.36	7931	2.839
	Third Quarter (Jul-September)	2.51	7895	3.008
	Fourth Quarter (October-December)	2.39	8227	2.908
	Total	2.41	32784	2.922
Total	First Quarter (Jan-March)	2.36	16393	2.914
	Second Quarter (Apr-June)	2.44	15164	2.965
	Third Quarter (Jul-September)	2.49	15000	2.968
	Fourth Quarter (October-December)	2.42	15654	2.965
	Total	2.42	62211	2.953

Table 7 above shows the number of procedures per quarter and the total number of procedures performed in each year. The number of procedures performed between 2009 and 2012 is significantly different in both numbers and by categorization. The analysis indicates that a significant percentage of the populations did not receive any major Operating Room procedure. Those with some record of major procedure on record were about 4.5 percent (2789 patients).

Figure 4: Primary mode of Healthcare Payment or Coverage



The figure above shows the distribution of the study sample and the expected primary payer. A majority of the patients made payments for inpatient services through a private and HMO; the second highest payer in the distribution was Medicare with about 42 percent with a total of 31,030. Only 2 percent of all inpatient treatment for leukemia was self-pay and Medicare and no payment consist of 0.2 and 0.1 percent respectively. The other (Indian Health Service, Workers compensation, Veterans health service, foreign nationals, CHAMPUS, CHAMPVA, Title V, and other government programs) category depicted above shows about 5.4 percent of the total populations diagnosed with leukemia of lymphoid origin.

The figure 5 below shows the demographics of the population in relation to race or ethnicity. One would observe that more than half of the population were Caucasians followed by Hispanics with 52 and 31 percent respectively. Black or African Americans were the third most prevalent with about 6 percent of the total population. An estimated 10 percent of individuals diagnosed with leukemia did not have a valid race classification and were hence eliminated from in depth data analysis.

Figure 5: Race or Ethnicity and Leukemia of Lymphoid Origin Presentation

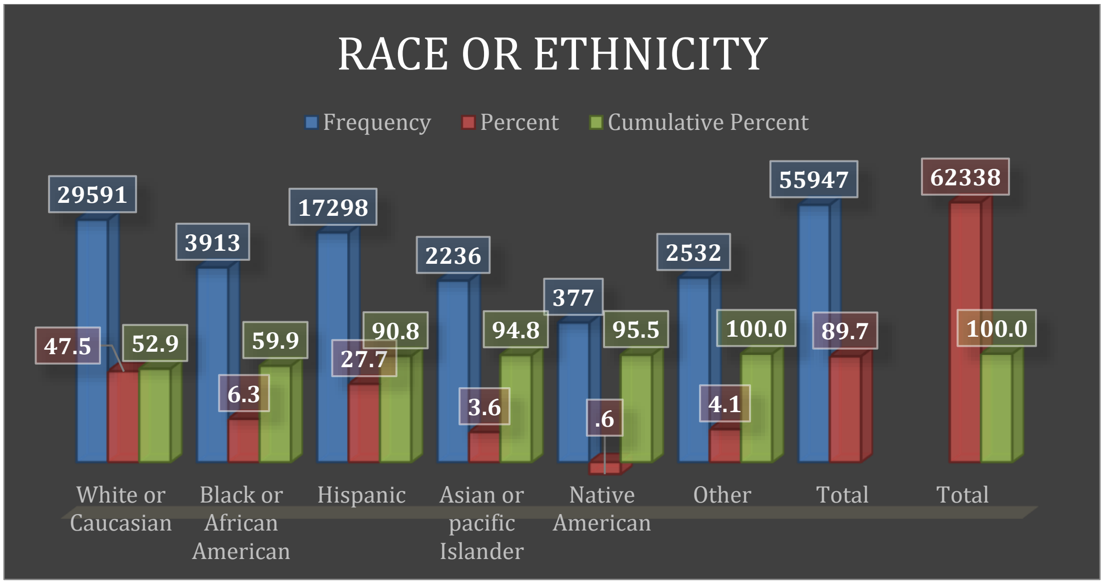


Table 8: Severity of Illness Subclass

	Frequency	Percent	Cumulative Percent
No class specified	73	.1	.1
Minor loss of function (includes cases with no comorbidity or complications)	30672	49.2	51.6
Moderate loss of function	20589	33.0	86.1
Major loss of function	6720	10.8	97.4
Extreme loss of function	1543	2.5	100.0
Total	59597	95.6	
Missing	2741	4.4	

The above table shows the severity within patients diagnosed with leukemia either as primary or secondary diagnosis. It shows about 49 percent of individuals have minor loss of function and 86 percent with minor and moderate loss of function. Major and extreme loss of function makes up about 13 percent of the total patient population. One can also observe that about 4 percent of the total population.

Table 9: Mortality Risk Subclass

	Frequency	Percent	Total Percent
No class specified	73	.1	.1
Minor likelihood of dying	53265	85.4	89.4
Moderate likelihood of dying	4241	6.8	7.1
Major likelihood of dying	1363	2.2	2.3
Extreme likelihood of dying	654	1.0	1.1
Total	59597	95.6	100.0
Missing	2741	4.4	

The table shows mortality risks in the total patient population. The number of individuals accessed to have some (major or extreme) risk of dying are less than 5 percent. Patients with minor to moderate likelihood of dying were the majority with a percentage of over 95 within the total individuals with leukemia. A reminder of about 4 percent of the population mortality risk were not recorded in the dataset and coded as missing in the data.

Table 10: Hospital Region distribution of leukemia presentation

	FREQUENCY	%	CUM %
NORTHEAST	9559	15.3	15.3
MIDWEST	12833	20.6	35.9
SOUTH	23303	37.4	73.3
WEST	16643	26.7	100.0
TOTAL	62338	100.0	

This table shows the distribution of leukemia presentation throughout the United States. The percentage of presentation is more prevalent in the southern part of the United States with an estimated 37 percent followed by Western part with 26 percent. The lowest area for presentation is the Northeast with 15 percent as depicted in the table above. One can also say based on descriptive analytics that the hospital bed size below in Table 11 that large hospitals had more leukemia presentations. About 68 percent of total presentation occurred at large healthcare facilities and 20, 10 for medium and small hospitals respectively. Table 12 also provides some details of the number of leukemia presentation depending on hospital teaching status. Significant majority of individuals received leukemia care from urban teaching hospital.

Table 11: Hospital Bed size and patient presentation

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
VALID	Small	5907	9.5	10.3	10.3
	Medium	12785	20.5	22.3	32.5
	Large	38769	62.2	67.5	100.0
	Total	57460	92.2	100.0	
MISSING	-9	4878	7.8		
TOTAL		62338	100.0		

Table 12: Hospital Teaching Status

		FREQUENCY	PERCENT	VALID PERCENT	CUMULATIVE PERCENT
VALID	Rural	589	.9	1.0	1.0
	Urban nonteaching	4134	6.6	7.2	8.2
	Urban teaching	52737	84.6	91.8	100.0
	Total	57460	92.2	100.0	
MISSING	-9	4878	7.8		
TOTAL		62338	100.0		

Table 13: Hospital Control and Leukemia Presentation

		N	%	VALID%	CUM %
VALID	Governmental Non Federal	7260	11.6	12.6	12.6
	Private Non-Profit	47315	75.9	82.3	95.0
	Private Investment	2886	4.6	5.0	100.0
	Total	57460	92.2	100.0	
MISSING	-9	4878	7.8		
TOTAL		62338	100		

The graph shows the demographics of hospital control in patient with leukemia diagnosis both primary and secondary. More than 75 percent of total presentation occurred at non-profit organizations followed by non-federal governmental associated health care facilities across the United States. an observation could also be made that resource availability in this regard varies. With the South having more private for-profit entities providing care than other areas. More over a significant majority of individuals were cared for in urban centers. This is in stark contrast to ZIPINC_QRTL which indicates low income household. This also means there are other factors such as transportation and travel cost that could be impacting severity, mortality and health outcomes in general.

4.2 Bivariate Analysis

Association between Total Charge and Demographics (Age)

Table 14	Total Charges (TOTCHRG) & Age Relationships						
Total Charges							
Discharge Year	AgeG	Mean	N	Std. Deviation	Minimum	Maximum	% of Total N
2009	Age<1	116222.21	454	197550.787	1496	1448961	0.7%
	Age 1-4	47566.30	8270	87869.292	122	1353607	13.6%
	Age 5-9	48867.79	8806	107988.915	622	1478483	14.5%
	Age 10-14	67231.80	5534	130935.106	426	1475991	9.1%
	Age15-17	80890.03	3311	156600.786	1626	1487383	5.5%
	Age 18-20	77759.75	2422	143202.334	2065	1487958	4.0%
	Total	59196.09	28797	120216.003	122	1487958	47.5%
2012	Age<1	115845.07	582	246341.619	558	2419237	1.0%
	Age 1-4	57344.90	9436	138635.030	198	3946329	15.6%
	Age 5-9	58186.09	9202	127445.567	258	2434762	15.2%
	Age 10-14	84230.97	6500	215537.701	425	4529697	10.7%
	Age15-17	105066.01	3483	281532.633	939	4743651	5.7%
	Age 18-20	106480.95	2623	223008.805	1447	2740007	4.3%
	Total	73422.53	31826	184822.122	198	4743651	52.5%
Total	Age<1	116010.24	1036	226168.883	558	2419237	1.7%
	Age 1-4	52777.38	17706	117778.571	122	3946329	29.2%
	Age 5-9	53629.34	18007	118419.823	258	2434762	29.7%
	Age 10-14	76413.47	12035	181784.612	425	4529697	19.9%
	Age15-17	93284.58	6794	229618.836	939	4743651	11.2%
	Age 18-20	92693.79	5045	189479.634	1447	2740007	8.3%
	Total	66664.74	60624	157632.471	122	4743651	100.0%

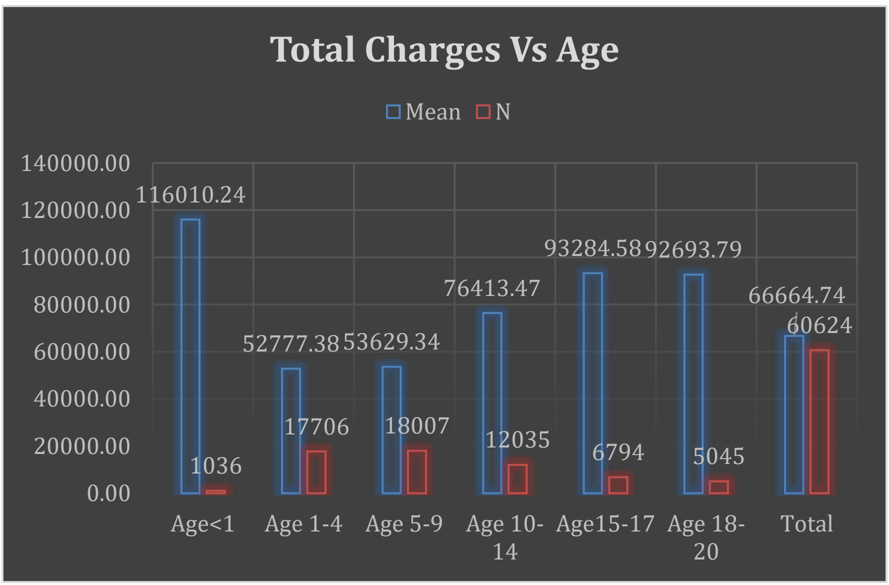
This table provides detailed description of the association between age and cost for the data release years 2009 and 2012. It could be seen that patients ages 5-9years old had the highest number of presentations but those less than one year old (1.7 % total population) had a higher mean charge. This could be associated with severity and treatment protocols or other factors that will be further evaluated. Table 15 below shows that age grouped individuals as in Table 14 are statistically significant with $p<0.005$ as seen below in the Correlation table.

Table 15 **Correlations**

			Total Charges	AgeG
Spearman's rho	Total Charges	Correlation Coefficient	1.000	.131**
		Sig. (2-tailed)	.	.000
		N	54465	54397
	AgeG	Correlation Coefficient	.131**	1.000
		Sig. (2-tailed)	.000	.
		N	54397	55643

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 6: Total Charges Vs Age



The figure provides more detailed description of the relationship of age and charges. It also provides mean association age has with the probability of increased total charges. As shown above patients less than one year old were more likely to have higher cost compared to other populations.

Table 16: Total Charges Relationship with Gender & discharge year

Correlations

		Total	Year	Gender
Total Charges	Pearson Correlation	1	.046**	-.003
	Sig. (2-tailed)		.000	.527
	N	60689	60689	60642
Discharge Year	Pearson Correlation	.046**	1	.027**
	Sig. (2-tailed)	.000		.000
	N	60689	62338	62276

Gender	Pearson Correlation	-.003	.027**	1
	Sig. (2-tailed)	.527	.000	
	N	60642	62276	62276

**. Correlation is significant at the 0.01 level (2-tailed).

The table shows gender in relation to total charges and discharge year. An observation of negative correlation is made between gender and total charges. Moreover, discharge year, gender presented with some statistical significance.

Figure 7 below shows the mean charges for both genders in each year.

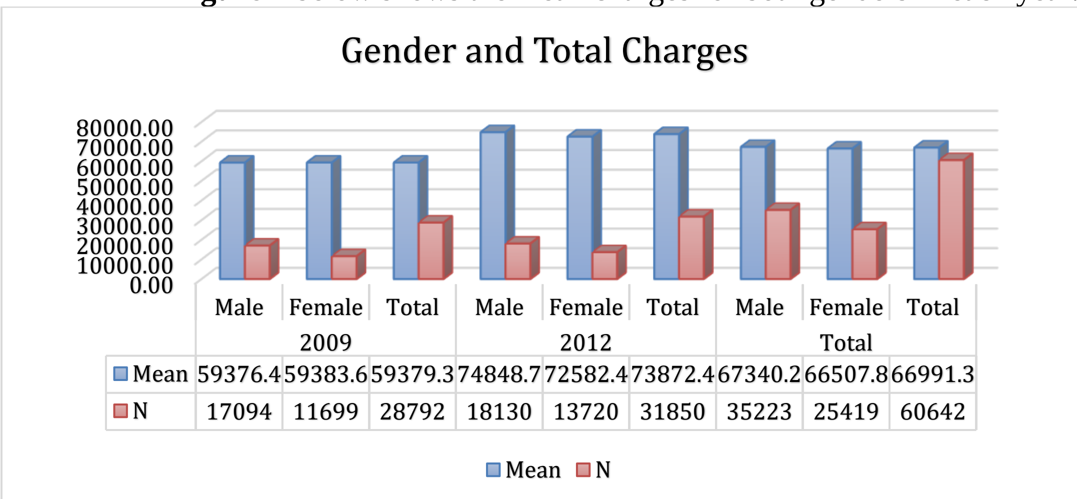


Figure 8: Total Charges Relationship with Patient Disposition & discharge year

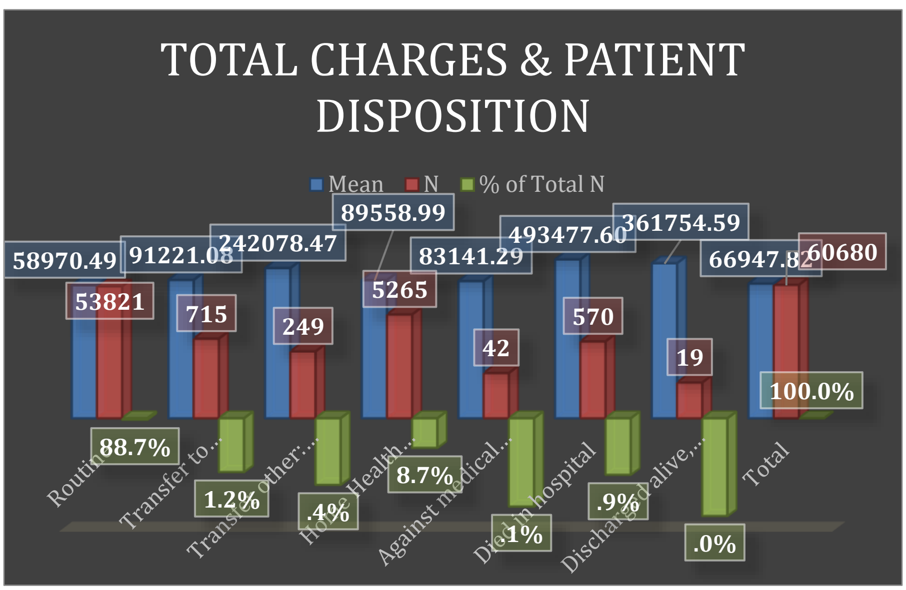


Figure 8 shows almost 90 percent of the population were routine transfer after inpatient care with the other 10 percent representing transfer to other facilities, home health or death during hospitalization.

Table 17 Correlation between Total Charges, Patient Disposition and Discharge Quarter

		Total Charges	D Year	Disposition	Quarter
Total Charges	Pearson Correlation	1	.046**	.215**	.011**
	Sig. (2-tailed)		.000	.000	.008
	N	60689	60689	60680	60562
Discharge Year	Pearson Correlation	.046**	1	-.015**	-.004
	Sig. (2-tailed)	.000		.000	.291
	N	60689	62338	62330	62211
Disposition of Patient	Pearson Correlation	.215**	-.015**	1	.001
	Sig. (2-tailed)	.000	.000		.722
	N	60680	62330	62330	62202
Discharge Quarter	Pearson Correlation	.011**	-.004	.001	1
	Sig. (2-tailed)	.008	.291	.722	
	N	60562	62211	62202	62211

**. Correlation is significant at the 0.01 level (2-tailed).

Table 17 above shows statistically significant correlation between charges or cost and patient disposition. In this case The analysis indicates the correlation is direct but weak since it is < 0.30. The coefficient of determination for this variable will them be $0.215^2 = 0.046$ or 4.6 percent. One can then say **patient disposition variation statistically explains 4.6 percent of the total charges**. Furthermore, there is a negative relationship between discharge year and patient disposition. Discharge quarter as seen above does not show any statistically significant relationship to any of the variables.

Table 18 Correlations between Total Charges and Emergency

		Total Charges	Discharge Year	ED INDIC
Total Charges	Pearson Correlation	1	.046**	.021**
	Sig. (2-tailed)		.000	.000
	N	60689	60689	60689
Discharge Year	Pearson Correlation	.046**	1	-.058**
	Sig. (2-tailed)	.000		.000
	N	60689	62338	62338

HCUP indicator of emergency department record	Pearson Correlation	.021**	-.058**	1
	Sig. (2-tailed)	.000	.000	
	N	60689	62338	62338
**. Correlation is significant at the 0.01 level (2-tailed).				

The table shows statistically weak significance for any indication of emergency service provision for the patient population. There is also a negative or indirect relationship between emergency indication and discharge year. Correlation with discharge year is also weak but statistically significant.

Table 19: Correlations between Total Charges, LOS and Discharge Year

		Total Charges	Discharge Year	Length of Inpatient stay
Total Charges	Pearson Correlation	1	.046**	.828**
	Sig. (2-tailed)		.000	.000
	N	60689	60689	60686
Discharge Year	Pearson Correlation	.046**	1	-.008
	Sig. (2-tailed)	.000		.053
	N	60689	62338	62335
Length of Inpatient stay	Pearson Correlation	.828**	-.008	1
	Sig. (2-tailed)	.000	.053	
	N	60686	62335	62335
**. Correlation is significant at the 0.01 level (2-tailed).				

Measures of Association

Table 20

	R	R Squared	Eta	Eta Squared
Total Charges * Length of Inpatient stay	.828	.686	.870	.757

Strong and direct correlation could be observed between total charges and length of stay because >0.70 with p=0.000. **The coefficient of determination for this variable will them be 0.828^2=0.685 or 68 percent**. The variation of length of inpatient stay statistically explains the 68 percent of total charges. Discharge year also has an inverse significance to length of stay. Table 19 below shows details of individual length of stay, mean charges, minimum, maximum, standard deviation and total percentage. The wide variation of charges and mean shows how dynamics of variation of cost of care.

Table 21 **Correlations between Total Charges and Length of Stay**

Total Charges

Length of Inpatient stay	Mean	N	Std. D	Minimum	Maximu	N of Total
0	8741.18	819	13665.234	258	233849	1.4%
1	10500.16	6319	9970.691	198	136042	10.4%
2	15561.78	10295	12410.192	1158	178265	17.0%
3	21388.44	11120	15805.834	969	385024	18.3%
4	30547.69	7686	29496.464	536	1203516	12.7%
5	40654.30	4812	31501.094	5001	489993	7.9%
6	49278.35	3066	32103.029	477	293720	5.1%
7	59559.53	2486	39963.338	426	345757	4.1%
8	71214.36	1821	45684.106	10619	472433	3.0%
9	79407.53	1559	50004.805	1027	554224	2.6%
10	86626.15	1356	52987.421	9664	496744	2.2%
11	96495.74	1151	57605.382	14590	471636	1.9%
12	109329.24	793	67211.594	10514	706526	1.3%
13	119690.15	679	78995.133	20220	671045	1.1%
14	117174.78	621	64336.858	21907	503104	1.0%
15	130335.07	557	96665.713	20046	1194047	0.9%
16	144974.34	399	91244.044	23468	840761	0.7%
17	152637.32	326	88211.023	558	548470	0.5%
18	174966.43	282	95579.069	26953	572182	0.5%
19	177295.47	266	98564.585	39950	702112	0.4%
20	180618.80	239	103884.702	46475	910576	0.4%
21	208609.15	220	126430.046	64846	697568	0.4%
22	237168.22	230	155086.514	65260	1097376	0.4%
23	221959.25	207	122644.406	45864	693449	0.3%
24	230877.14	214	120916.928	36133	746766	0.4%
25	253475.93	201	194766.104	122	1497268	0.3%
26	235536.67	144	127679.296	70525	816100	0.2%
27	270239.51	155	172382.193	12322	1183770	0.3%
28	291689.31	142	188241.579	50931	1439084	0.2%
29	297348.03	141	153739.584	64131	721611	0.2%

30	307006.81	147	155654.164	12492	801115	0.2%
31	308190.43	134	157668.487	83585	893040	0.2%
32	349585.79	133	291778.156	7442	2289617	0.2%
33	349333.45	88	201329.033	11810	967965	0.1%
34	376325.69	128	160985.158	87116	759896	0.2%
35	446164.51	111	265662.679	76552	1413249	0.2%
36	431538.97	90	202412.107	59408	1030005	0.1%
37	398653.74	98	209223.476	84416	1100196	0.2%
38	429368.34	94	230211.838	122839	1373091	0.2%
39	496301.32	95	218891.861	142532	1262121	0.2%
40	428576.33	43	206199.322	200447	961037	0.1%
41	455050.90	69	231311.152	92208	1003600	0.1%
42	484619.67	74	273290.590	60358	1533486	0.1%
43	446813.97	77	241762.200	18771	1157958	0.1%
44	497855.91	50	236517.807	127476	1110324	0.1%
45	531756.82	53	297430.520	101425	1286504	0.1%
46	497155.44	41	205581.536	69760	900643	0.1%
47	579859.40	28	496008.569	183699	2485548	0.0%
48	630559.66	43	385541.450	246000	1668394	0.1%
49	642347.90	46	405506.219	112779	2211602	0.1%
50	661360.65	38	310151.409	198051	1393180	0.1%
51	687898.30	31	324652.545	136088	1413780	0.1%
52	472547.13	26	208205.869	31736	874500	0.0%
53	632712.87	17	276758.425	310953	1221136	0.0%
54	662345.38	23	286267.235	344302	1359366	0.0%
55	777883.83	22	363168.518	167175	1444238	0.0%
56	681529.95	43	304947.440	199364	1301519	0.1%
57	659337.89	21	377732.409	214526	1402725	0.0%
58	873797.41	24	405268.335	19316	1589898	0.0%
59	777282.43	21	359590.589	277080	1449260	0.0%
60	1008780.24	23	897200.803	219273	3946329	0.0%
61	663285.24	19	338822.784	180317	1294421	0.0%
62	566529.62	9	149772.501	360578	705926	0.0%
63	973461.77	23	693759.332	258127	2917772	0.0%
64	509381.73	12	152531.204	356341	752278	0.0%
65	883776.70	17	287246.084	496086	1603175	0.0%
66	1000786.64	16	486977.816	291456	1674944	0.0%

67	747663.05	21	296631.120	348421	1232256	0.0%
68	1075250.59	9	1112404.006	323173	3498068	0.0%
69	745449.34	19	401512.435	258099	1541653	0.0%
70	977108.68	14	265527.538	566364	1220679	0.0%
71	719814.24	16	267604.603	350447	1219968	0.0%
72	1035689.29	6	274082.673	750411	1441520	0.0%
73	1338017.68	4	916182.334	310569	2332802	0.0%
74	1211385.12	9	702814.475	467077	2498601	0.0%
75	1204460.17	7	972909.449	450032	3041669	0.0%
76	1081086.67	9	524775.591	513090	2058407	0.0%
77	852006.36	6	258578.418	503629	1158986	0.0%
78	1007008.68	11	1017772.879	298943	3476551	0.0%
79	922553.90	10	346672.556	367609	1279906	0.0%
80	1141460.44	7	79894.312	1013740	1245350	0.0%
81	1195062.81	4	939834.430	369176	2311896	0.0%
82	1101041.68	9	243579.380	818229	1455670	0.0%
83	2160956.56	4	435406.697	1610401	2425329	0.0%
84	1966688.84	3	1838162.894	461336	3443791	0.0%
85	985713.66	7	277124.543	699865	1428087	0.0%
86	1175052.27	6	677817.581	492206	2110830	0.0%
87	1998983.77	6	1282220.307	1282808	4073782	0.0%
88	1218379.55	3	219009.969	1048007	1401195	0.0%
89	1307147.23	7	1038570.593	103823	2808158	0.0%
90	1719396.88	9	947556.447	693613	3328131	0.0%
91	1122352.97	9	623113.860	323810	2387585	0.0%
92	871982.95	9	406874.190	467870	1627442	0.0%
93	1520162.54	6	885702.561	583441	2836701	0.0%
94	774327.00	2	.000	774327	774327	0.0%
95	988827.99	7	181302.241	804079	1233003	0.0%
96	927150.80	4	303227.858	640174	1272575	0.0%
97	1153831.26	6	385514.802	660746	1686032	0.0%
98	700620.00	2	.000	700620	700620	0.0%
99	1268077.63	5	377086.056	1022502	1747420	0.0%
102	1651442.18	7	656908.750	1096476	2767368	0.0%
103	1794098.67	5	1153146.625	541308	3007321	0.0%
104	890764.00	1	.000	890764	890764	0.0%
105	1621124.00	1	.000	1621124	1621124	0.0%

106	971637.56	4	431350.671	441102	1243517	0.0%
107	1447208.40	3	658390.885	908023	1976275	0.0%
110	1648930.54	4	324468.135	1363255	2027260	0.0%
111	1139576.00	1	.000	1139576	1139576	0.0%
112	1405109.12	6	715482.200	601968	2416558	0.0%
113	2117476.74	3	943878.116	1353607	2891303	0.0%
114	1456451.28	5	466094.028	1102287	2071520	0.0%
115	1811292.57	4	185377.425	1623980	2011015	0.0%
116	1173006.00	2	.000	1173006	1173006	0.0%
117	2533494.73	3	1396526.982	1414561	3697866	0.0%
118	3030194.48	4	1153027.127	2272325	4529697	0.0%
124	870186.50	3	329893.056	601918	1138455	0.0%
125	1183913.16	3	367911.421	900337	1487383	0.0%
126	839481.00	1	.000	839481	839481	0.0%
127	1464800.00	1	.000	1464800	1464800	0.0%
128	529744.00	1	.000	529744	529744	0.0%
129	2200210.00	1	.000	2200210	2200210	0.0%
132	1373368.78	3	101029.890	1288829	1451635	0.0%
133	616311.00	1	.000	616311	616311	0.0%
135	1487958.00	1	.000	1487958	1487958	0.0%
136	2628607.00	1	.000	2628607	2628607	0.0%
137	2050555.89	3	884757.238	1335377	2740007	0.0%
140	1690824.00	1	.000	1690824	1690824	0.0%
146	672601.00	2	.000	672601	672601	0.0%
149	1700152.00	2	.000	1700152	1700152	0.0%
151	892143.00	1	.000	892143	892143	0.0%
154	4743651.00	1	.000	4743651	4743651	0.0%
155	487337.00	1	.000	487337	487337	0.0%
157	972395.00	2	.000	972395	972395	0.0%
167	748599.00	1	.000	748599	748599	0.0%
183	773840.00	1	.000	773840	773840	0.0%
194	4639221.00	1	.000	4639221	4639221	0.0%
200	1448961.00	1	.000	1448961	1448961	0.0%
231	2539225.00	1	.000	2539225	2539225	0.0%
253	2096066.00	1	.000	2096066	2096066	0.0%
307	4041655.00	1	.000	4041655	4041655	0.0%
Total	66948.84	60686	159678.479	122	4743651	100.0%

Table 22: Correlations between Total Charges and CHRONIC Treatment						
Total Charges						
NCHRONIC	Mean	N	Std. Deviation	Minimum	Maximum	% of Total N
1	34149.19	8190	69283.717	258	2419237	13.5%
2	35902.22	23995	63452.182	389	2628607	39.5%
3	58552.59	13541	110741.354	122	2917772	22.3%
4	91195.50	7173	175131.030	477	4743651	11.8%
5	126581.48	3656	208037.405	1027	2096066	6.0%
6	170026.71	2023	269064.028	939	3328131	3.3%
7	269304.31	1021	431256.063	2804	4529697	1.7%
8	283419.36	540	463604.687	2789	4639221	0.9%
9	429170.63	310	602999.119	4794	3498068	0.5%
10	438607.10	141	674365.774	5246	4041655	0.2%
11	335485.81	57	327697.181	7839	1269384	0.1%
12	583345.52	26	621568.894	46549	2498601	0.0%
13	462630.34	6	434159.098	99085	1120114	0.0%
14	792618.91	9	874306.381	15496	2416558	0.0%
15	1233003.00	1	.000	1233003	1233003	0.0%
18	419068.00	1	.000	419068	419068	0.0%
Total	66955.73	60689	159682.008	122	4743651	100.0%

Table 23	Measures of Association			
	R	R Squared	Eta	Eta Squared
Total Charges * NCHRONIC	.348	.121	.375	.140

The tables above provides an in-depth details of the association of number of chronic conditions and total charges. The relative relationship shows an increase in total charges mean, minimum, maximum as number of chronic conditions increased.

Moderate and direct correlation could be observed between total charges and NCHRONIC because >0.30 with p=0.000. **The coefficient of determination for this variable will them be 0.348^2=0.121 or 12 percent**. The variation of number of chronic conditions statistically explains 12 percent of total charges.

Figure 9: Total Charges and Number of Chronic Conditions

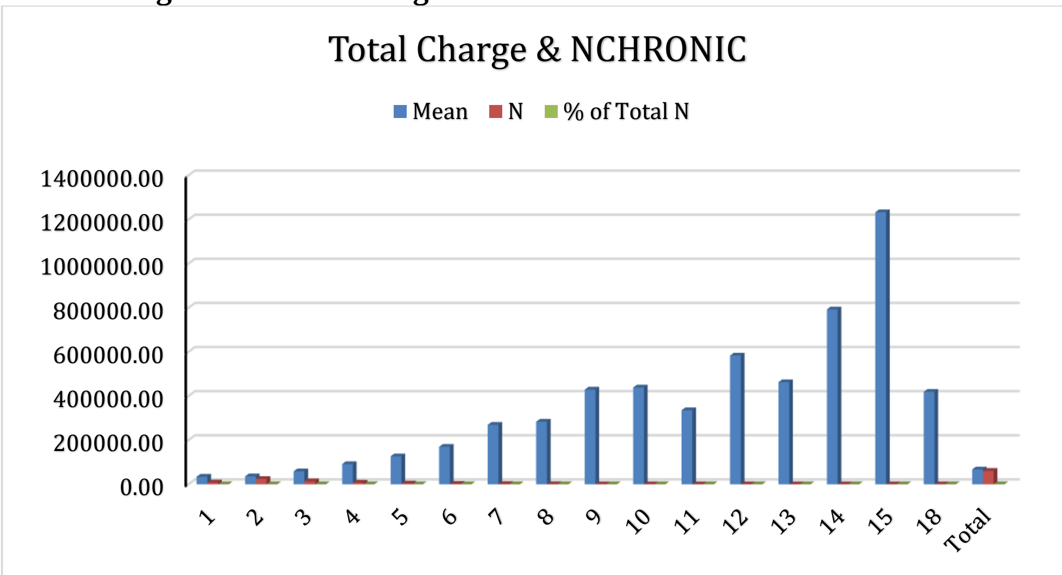


Table 24: Correlations between Total Charges and Number of Diagnosis						
Total Charges						
Number of Diagnosis coded on original record	Mean	N	Std. Deviation	Minimum	Maximum	% of Total Sum
1	52737.11	485	74487.410	425	893899	0.6%
2	25695.86	7466	37106.095	258	1203516	4.7%
3	28244.18	8677	38638.153	761	763172	6.0%
4	32177.11	8703	42974.665	198	754814	6.9%
5	37482.31	7571	53253.419	622	911749	7.0%
6	42607.23	5998	54131.389	1140	634967	6.3%
7	50479.07	4819	80552.929	2048	2419237	6.0%
8	62464.82	3600	98755.650	1233	2434762	5.5%
9	86058.74	3500	137921.871	2065	2539225	7.4%
10	103310.91	1977	167009.155	536	1976275	5.0%
11	101772.44	1421	132932.196	2271	1283000	3.6%
12	119223.43	1146	155070.764	939	1610401	3.4%
13	144346.55	1000	179746.817	426	1405065	3.6%
14	176258.16	947	250693.726	1244	2917772	4.1%
15	218016.22	1167	322650.746	122	4743651	6.3%
16	281739.56	450	332031.461	2104	2740007	3.1%
17	240780.03	296	252423.636	5352	1385854	1.8%

18	391108.89	365	486070.250	7014	4529697	3.5%
19	286035.58	149	279931.922	7041	1541653	1.1%
20	360757.79	121	382374.969	9469	2211602	1.1%
21	458003.22	132	585295.485	5310	4639221	1.5%
22	383512.36	114	425041.515	9147	2808158	1.1%
23	536802.87	100	448402.124	62974	2425329	1.3%
24	480804.60	77	337780.584	28462	1880682	0.9%
25	930481.61	276	828292.395	8817	4073782	6.3%
26	527500.72	25	394402.324	71674	1269384	0.3%
27	522361.40	22	547040.311	46549	2200210	0.3%
28	536710.76	35	437353.381	54945	1621124	0.5%
29	433396.04	7	359573.066	167440	993573	0.1%
30	833784.72	22	990066.784	122778	3946329	0.5%
31	897805.50	3	210756.915	724714	1070897	0.1%
32	725346.50	3	164236.062	591790	858903	0.1%
33	306724.00	1	.000	306724	306724	0.0%
34	574045.00	1	.000	574045	574045	0.0%
35	404451.00	1	.000	404451	404451	0.0%
37	422103.00	1	.000	422103	422103	0.0%
39	1178739.00	1	.000	1178739	1178739	0.0%
44	708658.00	1	.000	708658	708658	0.0%
45	878621.00	1	.000	878621	878621	0.0%
49	419068.00	1	.000	419068	419068	0.0%
50	2416558.00	1	.000	2416558	2416558	0.1%
55	1233003.00	1	.000	1233003	1233003	0.0%
Total	66955.73	60689	159682.008	122	4743651	100.0%

The table above shows that as the number of diagnosis increased so does the cost of care. The majority of individuals had about 5 & 9 diagnosis with about 7.5 percent of total cost each. Moreover, majority of the populations had between 1-15 diagnose with wide varying costs associated with care.

Table 25 **Measures of Association**

	R	R Squared	Eta	Eta Squared
Total Charges * Number of Diagnosis coded	.489	.239	.573	.328

The above table shows that the coefficient of determination is 0.239 or 24%. **The results indicates that variation of number of number of diagnosis statistically explains 24 percent of total charges.**

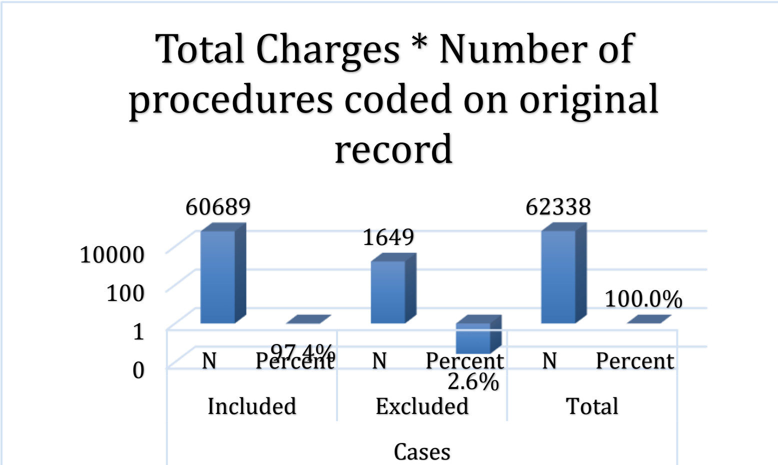


Figure 10: Total Charges and Number of Procedures

The above graph shows the total number of cases included and excluded in analysis of procedures. The table below shows that individuals who received 6 procedures during hospitalization entailed the majority of 13 percent of total expenditure on leukemia care. Patients with one to 6 procedures performed make up a significant population and cost of care from the graph above. Figure 11 below provides further information on the dynamics ORPROC on total charges. Major ORPROC on record statistically explains an estimated 16 percent of charges or cost. **The results indicates that variation of number of number of procedure statistically explains 31 percent of total charges.**

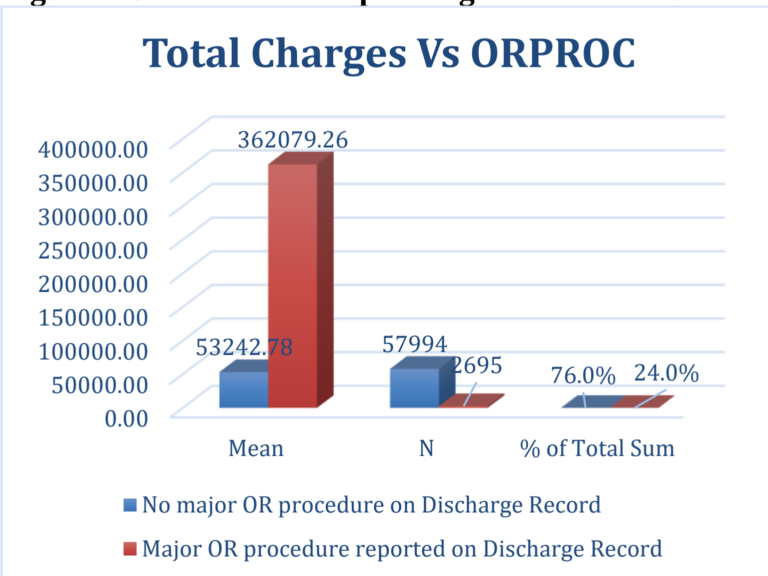
Table 26: Correlations between Total Charges and Number of Procedures

Total Charges

Number of procedures	Mean	N	Std. Deviation	Minimum	Maximum	of Total Sum
0	20402.60	15357	30499.113	425	1050111	7.7%
1	28810.44	15911	39645.628	198	1220679	11.3%
2	40275.46	9420	53211.449	508	1260424	9.3%
3	56718.18	5638	73243.109	1811	965018	7.9%
4	84367.05	3296	100202.168	2541	1283000	6.8%
5	111596.65	2402	149626.237	2559	2434762	6.6%
6	138284.74	4020	204611.334	122	2419237	13.7%
7	197480.38	1300	262230.477	14212	3697866	6.3%
8	218566.14	782	209828.660	6168	1590606	4.2%
9	270249.13	714	306875.162	17585	3443791	4.7%
10	276299.81	511	303728.405	5513	2917772	3.5%

11	285982.67	265	268852.841	40436	2211602	1.9%
12	461925.93	226	488339.538	58369	3328131	2.6%
13	434392.90	177	439867.845	28462	2836701	1.9%
14	506726.82	148	585470.621	17069	4743651	1.8%
15	626127.93	248	673977.790	52806	4639221	3.8%
16	526022.35	35	361562.355	155921	1439084	0.5%
17	574203.69	36	411819.411	111615	1776749	0.5%
18	957950.30	36	812237.683	65449	3946329	0.8%
19	472050.32	33	255001.759	68112	1138455	0.4%
20	1026507.80	17	518998.233	410175	2080573	0.4%
21	1277844.73	57	943468.136	310714	4529697	1.8%
22	886570.50	12	413632.559	231263	1455670	0.3%
23	466387.14	9	318243.808	141409	900337	0.1%
24	1613445.01	5	653393.299	1219968	2539225	0.2%
25	1286343.97	20	992412.710	295228	3498068	0.6%
26	759435.00	3	391457.984	441102	1077768	0.1%
27	619040.00	1	.000	619040	619040	0.0%
28	610950.00	2	.000	610950	610950	0.0%
29	306724.00	1	.000	306724	306724	0.0%
30	1263960.21	6	768445.727	596249	2416558	0.2%
31	1570213.00	1	.000	1570213	1570213	0.1%
39	1021762.00	1	.000	1021762	1021762	0.0%
Total	66955.73	60689	159682.008	122	4743651	100.0%

Figure 11: Indication of Operating Room Procedure



The figure above shows the difference in cost for individuals with record of surgeries and its direct impact on total patient cost or charges. This could be further seen in the table below with details of cost per year. **The results indicates that variation of OR procedure statistically explains 16 percent of total charges.**

Correlations between Total Charges and OR Procedures

Table 27

OR Procedure	Discharge Year	Mean	N	Std. Deviation	% of Total N	% of Total Sum
No major OR procedure on Discharge Record	2009	48552.34	27521	88950.327	45.3%	32.9%
	2012	57478.74	30473	115402.570	50.2%	43.1%
	Total	53242.78	57994	103789.469	95.6%	76.0%
Major OR procedure reported on Discharge Record	2009	284025.35	1318	315393.789	2.2%	9.2%
	2012	436845.60	1376	620975.998	2.3%	14.8%
	Total	362079.26	2695	501367.221	4.4%	24.0%
Total	2009	59316.89	28839	120471.996	47.5%	42.1%
	2012	73872.49	31850	188002.423	52.5%	57.9%
	Total	66955.73	60689	159682.008	100.0%	100.0%

Correlations between Total Charges and Payer

Table 28

Expected primary payer	Discharge Year	Mean	N	Std. Deviation	% of Total N	% of Total Sum
Medicare	2009	53971.45	31	78798.692	0.1%	0.0%
	2012	44006.59	88	62950.960	0.1%	0.1%

	Total	46585.31	118	67196.388	0.2%	0.1%
Medicaid	2009	62073.23	12176	124906.490	20.1%	18.6%
	2012	75151.86	13991	187986.749	23.1%	25.9%
	Total	69066.23	26167	161853.671	43.2%	44.6%
Private plus HMO	2009	55841.63	14599	114435.183	24.1%	20.1%
	2012	69140.13	15136	185320.352	25.0%	25.8%
	Total	62610.93	29735	154773.232	49.1%	45.9%
Self Pay	2009	56757.41	568	107008.955	0.9%	0.8%
	2012	60768.00	651	111548.444	1.1%	1.0%
	Total	58899.39	1220	109430.469	2.0%	1.8%
No Charge	2009	46524.67	17	48212.431	0.0%	0.0%
	2012	90927.26	15	165716.828	0.0%	0.0%
	Total	67414.32	32	118954.873	0.1%	0.1%
Other	2009	73322.18	1379	146393.232	2.3%	2.5%
	2012	107460.47	1890	228436.890	3.1%	5.0%
	Total	93060.27	3269	198708.892	5.4%	7.5%
Total	2009	59327.57	28770	120526.489	47.5%	42.1%
	2012	73836.83	31772	188116.752	52.5%	57.9%
	Total	66941.91	60541	159770.318	100.0%	100.0%

The above table shows the relationship of finance or payment sources in relation to total charges. Moreover one may observe some mild relationship between payer type and total charge. Private payment make up almost 50 percent of patient payers and Medicaid about 43 percent of the total population and others make up the rest of the percentage of about 8 percent. This could be as a result of partial relationship.

Correlations between Total Charges and NCHS Urban-Rural Code

Table 29

Patient Location	Discharge Year	Mean	N	Std. Deviation	% of Total N	% of Total Sum
Central Counties >= 1M population	2009	70261.36	9054	133471.191	15.2%	16.0%
	2012	92760.61	9668	233943.654	16.2%	22.6%
	Total	81879.86	18721	192358.632	31.4%	38.7%
Fringe Counties <=1M population	2009	59200.43	6698	116595.035	11.2%	10.0%
	2012	78005.24	7458	195713.446	12.5%	14.7%
	Total	69107.74	14157	163397.960	23.8%	24.7%
Metro 250K to less 1M	2009	49251.67	5650	106651.412	9.5%	7.0%
	2012	58944.46	6781	142816.652	11.4%	10.1%
	Total	54539.29	12431	127743.090	20.9%	17.1%
Metro 50K to less 250K	2009	52495.55	2475	116356.005	4.2%	3.3%
	2012	65761.61	2835	149782.258	4.8%	4.7%
	Total	59578.04	5310	135383.126	8.9%	8.0%
Micropolitan Counties	2009	46823.50	2394	106750.238	4.0%	2.8%
	2012	59559.44	3040	157084.271	5.1%	4.6%
	Total	53949.23	5434	137340.696	9.1%	7.4%
Not-Metropolitan or Micropolitan counties	2009	49234.96	1657	100566.198	2.8%	2.1%
	2012	45153.70	1864	94687.402	3.1%	2.1%
	Total	47074.24	3521	97505.320	5.9%	4.2%
Total	2009	58527.34	27927	119136.532	46.9%	41.2%
	2012	73624.47	31647	187766.016	53.1%	58.8%
	Total	66547.19	59574	159495.016	100.0%	100.0%

The relationship between total charges and patient locations shows a negative relationship of -0.069 with a correlation coefficient of 0.006. This table shows that resources for cancer treatment are located in urban centers with high populations. It also shows that cost in these areas seem to be higher. This also shows that limited resource availability could be directly impacting cost as well as patient survival.

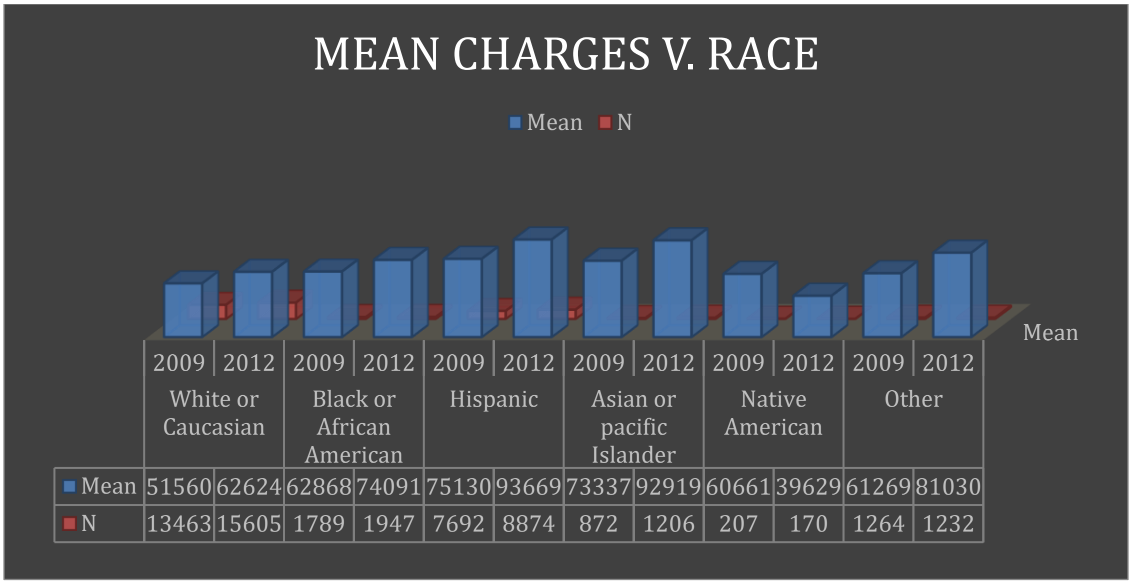
Correlations between Total Charges and Race

Table 30

Race or Ethnicity	Discharge Year	Mean	N	Std. Deviation	% of Total N	% of Total Sum
White or Caucasian	2009	51560.89	13463	109482.997	24.8%	18.7%
	2012	62624.47	15605	162937.364	28.7%	26.3%
	Total	57500.37	29068	140833.074	53.5%	45.1%
Black or African American	2009	62868.75	1789	127960.898	3.3%	3.0%
	2012	74091.13	1947	188093.858	3.6%	3.9%
	Total	68716.55	3736	162178.805	6.9%	6.9%
Hispanic	2009	75130.46	7692	139259.845	14.2%	15.6%
	2012	93669.12	8874	224128.456	16.3%	22.4%
	Total	85060.98	16566	189728.285	30.5%	38.0%
Asian or pacific Islander	2009	73337.12	872	140465.587	1.6%	1.7%
	2012	92919.75	1206	257219.650	2.2%	3.0%
	Total	84704.20	2078	216233.779	3.8%	4.7%
Native American	2009	60661.61	207	168181.243	0.4%	0.3%
	2012	39629.94	170	62090.670	0.3%	0.2%
	Total	51177.58	377	131676.923	0.7%	0.5%
Other	2009	61269.87	1264	114302.369	2.3%	2.1%
	2012	81030.98	1232	189929.759	2.3%	2.7%
	Total	71025.08	2496	156559.799	4.6%	4.8%
Total	2009	60841.30	25287	122939.867	46.6%	41.5%
	2012	74787.02	29034	191054.391	53.4%	58.5%
	Total	68295.19	54321	163075.574	100.0%	100.0%

The above table and figure below provides details of the relationship of race and total charges. An observation could be made that the total charges increased for each of the population subgroup as well as between 2009 and 2012. There was significant increase for the Hispanic population with a mean charge of $75,130.46 to $93,669.12 between 2009 and 2012 respectively. A careful observation reveals a similar relationship for Asian or Pacific Islanders with an increase in the total number of presentations for both populations.

Figure 12: Mean Charges and Race

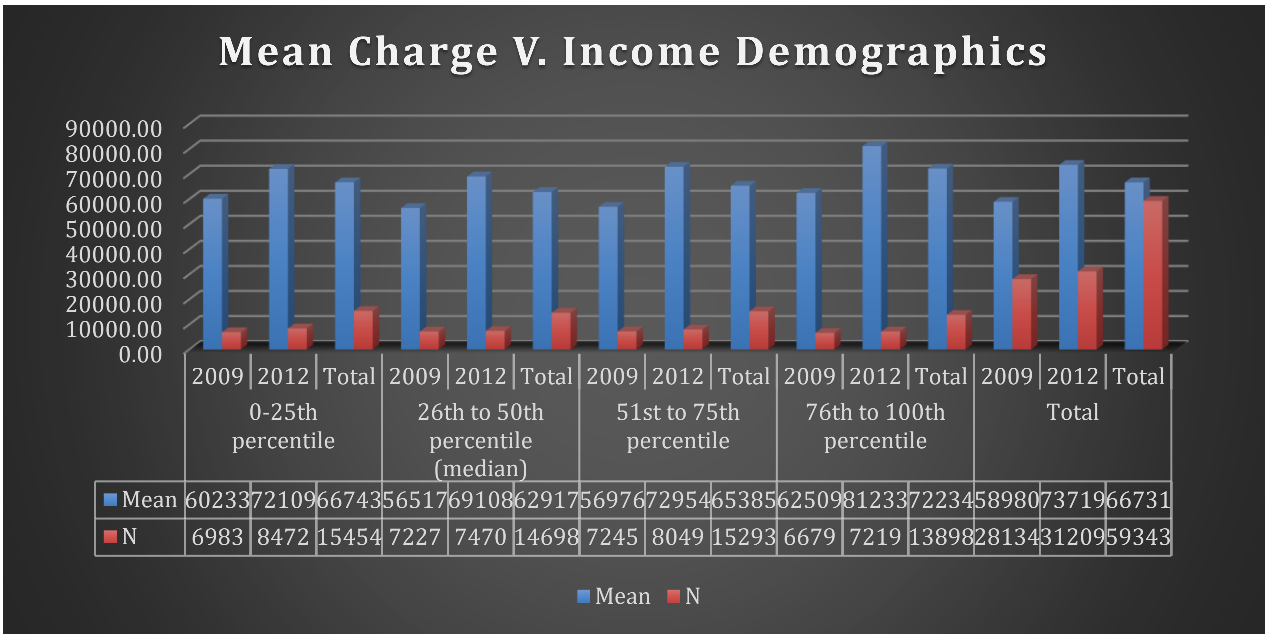


Correlations between Total Charges a ZIP Income Household

Table 31

Median household income for patient's ZIP Code	Discharge Year	Mean	N	Std. Deviation	% of Total N	% of Total Sum
0-25th percentile <$40,000	2009	60233.73	6983	123812.024	11.8%	10.6%
	2012	72109.46	8472	183079.286	14.3%	15.4%
	Total	66743.76	15454	159164.818	26.0%	26.0%
26th to 50th percentile (median) <$50,000	2009	56517.64	7227	120737.835	12.2%	10.3%
	2012	69108.60	7470	166187.328	12.6%	13.0%
	Total	62917.05	14698	145752.415	24.8%	23.4%
51st to 75th percentile <$65,000	2009	56976.18	7245	108119.395	12.2%	10.4%
	2012	72954.62	8049	181129.685	13.6%	14.8%
	Total	65385.54	15293	151216.404	25.8%	25.3%
76th to 100th percentile >$65,000	2009	62509.66	6679	127124.852	11.3%	10.5%
	2012	81233.05	7219	218598.123	12.2%	14.8%
	Total	72234.63	13898	180753.351	23.4%	25.4%
Total	2009	58980.59	28134	120003.488	47.4%	41.9%
	2012	73719.40	31209	187718.593	52.6%	58.1%
	Total	66731.90	59343	159415.290	100.0%	100.0%

Figure 13: Mean Charges and ZIP Income



The table above shows the relationship between income and total charges for the patient population. The population is evenly distributed among all the four categories of income as shown in the above table. The highest increase in charge between 2009 and 201 shows more than $30000 difference for income over $60000 annually. Majority of patient populations were Caucasians and they fit into the 76th-100th percentile of income as shown in figure 16 above.

Correlations between Total Charges and Severity

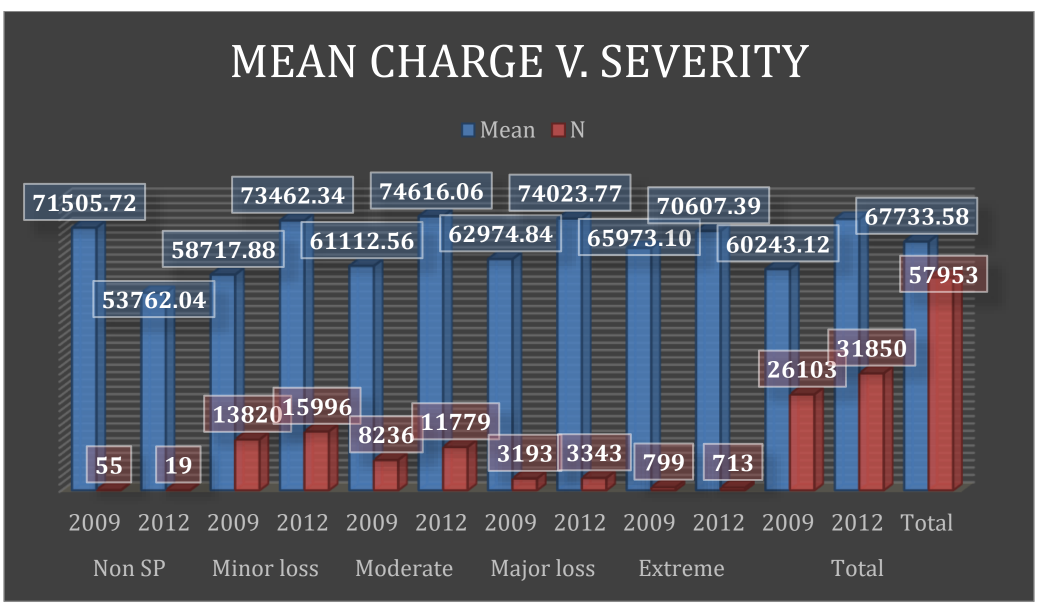
Table 32

All Patient Refined DRG: Severity of Illness Subclass	Discharge Year	Mean	N	Std. Deviation	% of Total N	% of Total Sum
No class specified	2009	71505.72	55	137089.256	0.1%	0.1%
	2012	53762.04	19	76596.058	0.0%	0.0%
	Total	67004.12	73	124290.667	0.1%	0.1%
Minor loss of function (includes cases with no	2009	58717.88	13820	114760.095	23.8%	20.7%
	2012	73462.34	15996	188556.173	27.6%	29.9%
	Total	66628.14	29815	158844.941	51.4%	50.6%

comorbidity or complications)						
Moderate loss of function	2009	61112.56	8236	127633.414	14.2%	12.8%
	2012	74616.06	11779	187247.395	20.3%	22.4%
	Total	69059.32	20015	165469.298	34.5%	35.2%
Major loss of function	2009	62974.84	3193	134359.636	5.5%	5.1%
	2012	74023.77	3343	188777.820	5.8%	6.3%
	Total	68626.08	6537	164538.703	11.3%	11.4%
Extreme loss of function	2009	65973.10	799	125587.581	1.4%	1.3%
	2012	70607.39	713	186736.160	1.2%	1.3%
	Total	68159.21	1512	157383.489	2.6%	2.6%
Total	2009	60243.12	26103	121837.261	45.0%	40.1%
	2012	73872.49	31850	188002.423	55.0%	59.9%
	Total	67733.58	57953	161730.156	100.0%	100.0%

The severity tables show severity of presentation was directly related the increase in total inpatient cost. Moreover, it shows how cost or charges increased with increased severity and extreme loss of function. The figure below further supports the finding that increased in severity was related to increased total cost or charges. The relationship between these variables can be classified as not statistically significant

Figure 14: Mean Charge and Severity



Correlations between Total Charges and Mortality

Table 33

All Patient Refined DRG: Risk of Mortality Subclass	Discharge Year	Mean	N	Std. Deviation	% of Total N	% of Total Sum
No class specified	2009	71505.72	55	137089.256	0.1%	0.1%
	2012	53762.04	19	76596.058	0.0%	0.0%
	Total	67004.12	73	124290.667	0.1%	0.1%
Minor likelihood of dying	2009	59683.78	23554	120339.415	40.6%	35.8%
	2012	73846.99	28257	189062.537	48.8%	53.2%
	Total	67408.21	51812	161639.878	89.4%	89.0%
Moderate likelihood of dying	2009	64728.98	1510	136141.072	2.6%	2.5%
	2012	74009.79	2588	164676.250	4.5%	4.9%
	Total	70589.90	4098	154822.305	7.1%	7.4%
Major likelihood of dying	2009	65803.17	648	136643.976	1.1%	1.1%
	2012	73190.14	680	219428.086	1.2%	1.3%
	Total	69585.65	1329	183722.608	2.3%	2.4%
Extreme likelihood of dying	2009	66739.84	335	125044.488	0.6%	0.6%
	2012	77820.51	305	204246.905	0.5%	0.6%
	Total	72019.28	640	167473.084	1.1%	1.2%
Total	2009	60243.12	26103	121837.261	45.0%	40.1%
	2012	73872.49	31850	188002.423	55.0%	59.9%
	Total	67733.58	57953	161730.156	100.0%	100.0%

The table above shows that patient population with increased liklihood of dying decreased but not signoficantly. It also showed a general increase in cost regardless of mortalityand severity risk. The analysis indicates that there was a signifcant improvement in patient outcomes because of the increase in minor to moderate dying risk. Furthermore, these finding can be directly related to disease severity accesment during patient intake.

Correlations between Group Charges by Hospital Control, Income

Case Processing Summary

Table 34	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*Hospital Control * Median household income for patient's ZIP Code * GROUPCHARGES * Hospital Region*	56179[a]	90.1%	6159.297	9.9%	62338.297	100.0%

a. Number of valid cases is different from the total count in the crosstabulation table because the cell counts have been rounded.

An observation shows statistical significance in the relationship between cost of care and median household income. individual's household income less than $40000 shows considerable likelihood on infections, readmittance and severity and mortality as a result of these. Person Chi-square for this relationship is 0.000 with df-6. These finding is same for multiple presentations and when charges are grouped into various sections in thousands. Another important finding from these analyses is the varied strength of association based on household income and charges.

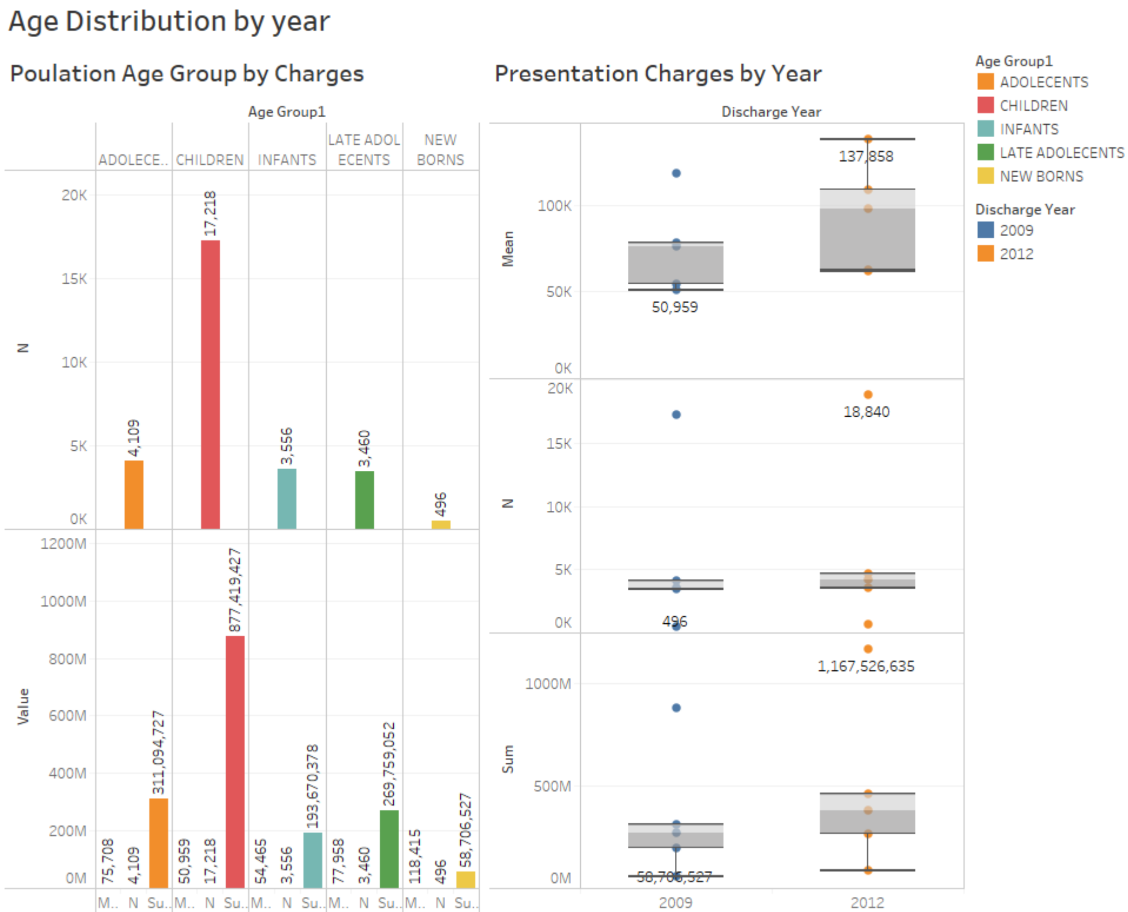
Table 35 **GROUPCHARGES**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<10T	10761	17.3	17.3	17.3
	<20T	14723	23.6	23.6	40.9
	<30T	8926	14.3	14.3	55.2
	<40T	5310	8.5	8.5	63.7
	<50T	3519	5.6	5.6	69.4
	<60T	2652	4.3	4.3	73.6
	<70T	1882	3.0	3.0	76.6
	>80T	1774	2.8	2.8	79.5
	>90T	1354	2.2	2.2	81.7
	<100T	1051	1.7	1.7	83.3
	<110T	854	1.4	1.4	84.7
	<130T	609	1.0	1.0	85.7
	<140T	519	.8	.8	86.5
	<150T	480	.8	.8	87.3
	<160T	351	.6	.6	87.9
	<170T	390	.6	.6	88.5

<180T	346	.6	.6	89.0
<190T	231	.4	.4	89.4
<200T	222	.4	.4	89.8
<300T	1555	2.5	2.5	92.3
<400T	741	1.2	1.2	93.4
<500T	495	.8	.8	94.2
<600T	305	.5	.5	94.7
<700T	213	.3	.3	95.1
<800T	135	.2	.2	95.3
<900T	106	.2	.2	95.5
<1M	73	.1	.1	95.6
<1.5M	241	.4	.4	96.0
<2M	35	.1	.1	96.0
<2.5M	32	.1	.1	96.1
<3M	11	.0	.0	96.1
<3.5M	8	.0	.0	96.1
<4M	3	.0	.0	96.1
<4.5M	3	.0	.0	96.1
<5M	4	.0	.0	96.1
>50M	1649	2.6	2.6	98.8
>120T	774	1.2	1.2	100.0
Total	62338	100.0	100.0	

This table shows the distribution of patients in relation to charges grouped by Categories. It also shows that there is statistical significance between charges and where patients live. The cost difference by location could aid in further understanding of concepts such as other external factors affecting health determinants. Furthermore, it could aid in understanding the need for certain non-medical support services to patents in order to encourage effective communication with providers and keeping healthcare appointments among many other things.

The Figure 15: below shows Patient Distribution by year and Age



This figure shows and increase in cost of care from 2009 to 2012. It also shows a significant majority of patient presentation were between Children (3-12years). one can also observe that there is a considerable difference in the cost or charges between the years. The intervals show significant variation in charges across regions.

Figure 16: Patient Cost Presentation by Region

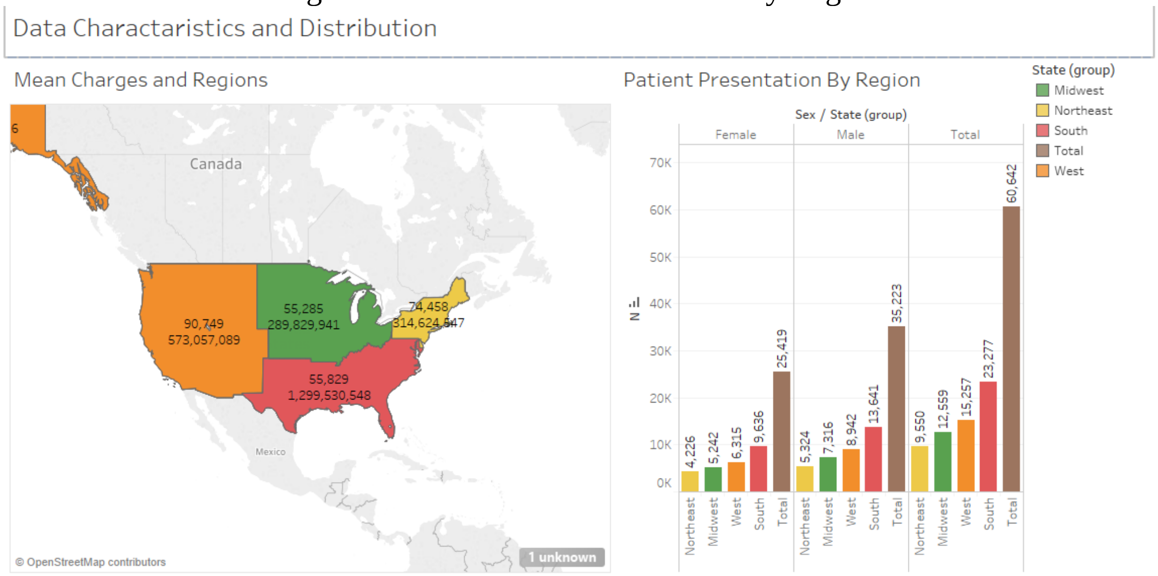
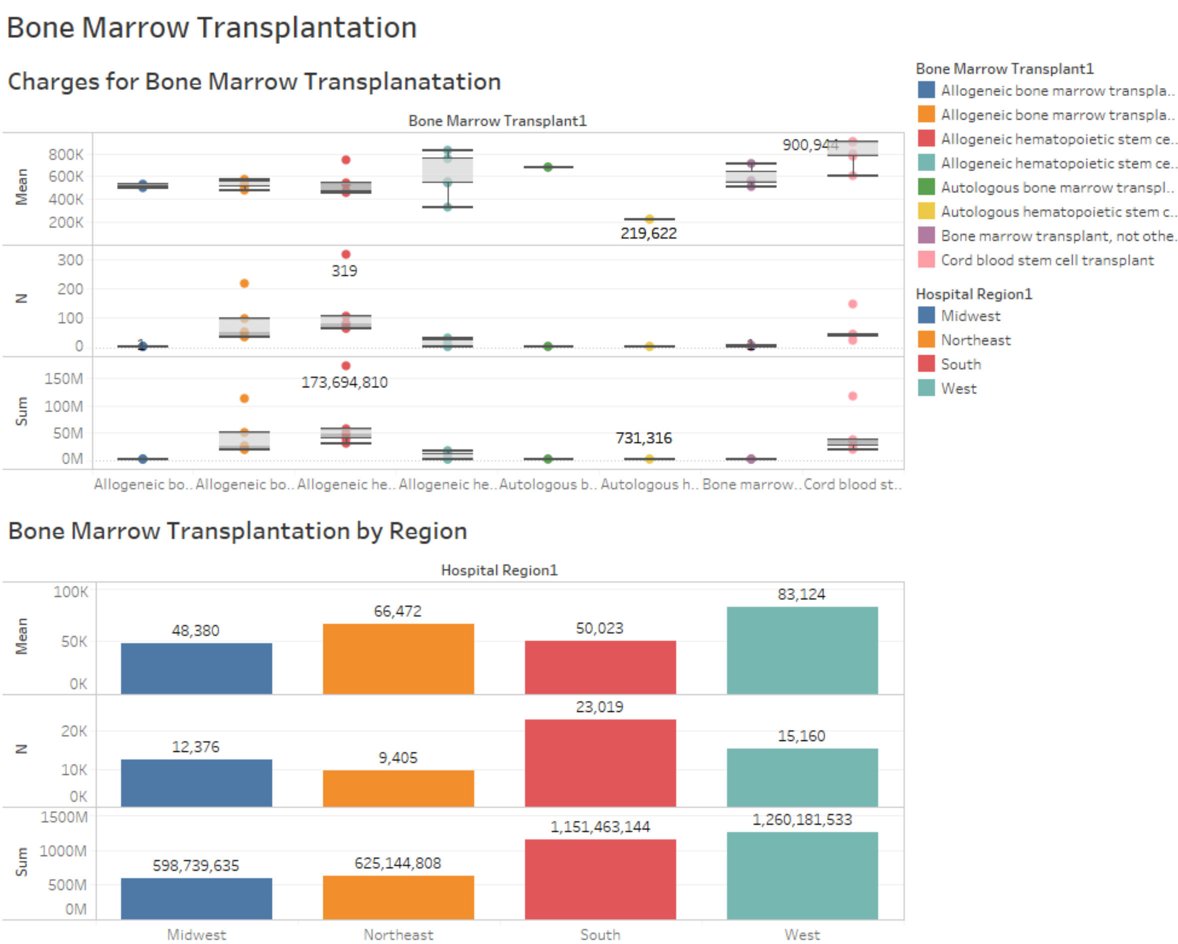
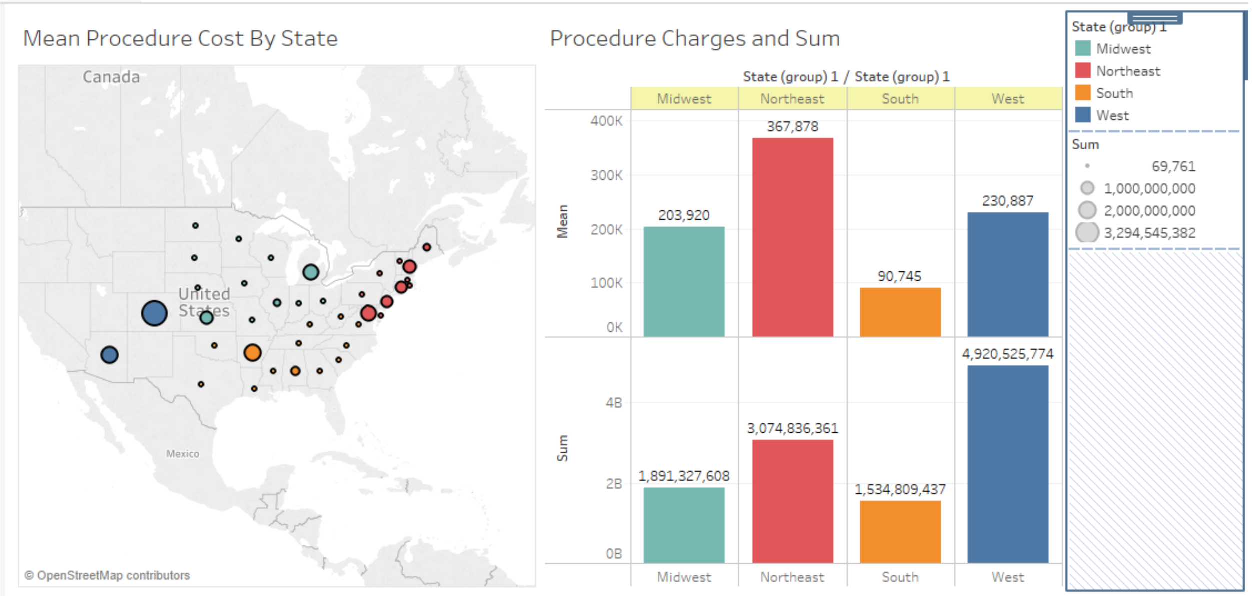


Figure 17: Selected Procedures and Charges by Region



The figures above show the distinct relationship between total charges, hospital control and ownership. It shows there is statistically significant differences in charges from one region to the next. The Figure 20 shows between 20-30-thousand-dollars difference in cost between states. These phenomena could be seen constantly regardless of changes in procedure types and even with diagnostic and therapeutic procedures. For instance, Bone marrow transplantation cost seems to be much higher in the western part of the country with no significant variation in mortality and severity of patients. The figures also show the significant difference in the influence of disease severity in the low-income population and its impact on total charges and mortality risk. In general, an observation could be made that charges have generally increased significantly over the years for all aspects of care. Furthermore, patient presentation can be generally associated with region demographics and provides details on healthcare resources available at these locations. One can observe that procedure cost seems to be higher in the Northeast followed by the West. This finding shows that even though procedure cost impact total charges, it is not the most significant factor given the fact that high means were charged in the West. The figure also shows the variation in cost for therapeutic procedures with cord blood stem cell transplant being the most expensive procedures conducted.



4.1 R: Regression-Linear Modelling

In this analysis a linear regression is conducted for all the variables with total healthcare cost or charge for inpatient stay as the dependent variable. The formula for multiple linear regression as seen below. Y is the dependent variable, x's are the independent variables and b's are the regression coefficients and b0 is the constant (intercept).

$$y_i=\beta_0+\beta_1 x_{i,1}+\beta_2 x_{i,2}+\ldots+\beta_{p-1} x_{i,p-1}+\epsilon_i.$$

Table A ***ANOVA[a]***

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	918813889811336.000	15	61254259320755.700	7496.666	.000[b]
	Residual	408294849856303.000	49970	8170867327.453		
	Total	1327108739667640.000	49985			

a. Dependent Variable: Total Charges

b. Predictors: (Constant), Median household income for patient's ZIP Code, Discharge Quarter, Sex, Disposition of Patient , Discharge Year, Indication of Transfer, AGE in years, Race or Ethnicity, Admission Type, Expected primary payer, Length of Inpatient stay, Patient Location , NCHRONIC, Number of Diagnosis coded on original record, Admission Month

Table B ***Model Summary[c]***

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.832[a]	.692	.692	90392.850	.[b]

a. Predictors: (Constant), Median household income for patient's ZIP Code, Discharge Quarter, Sex, Disposition of Patient , Discharge Year, Indication of Transfer, AGE in years, Race or Ethnicity, Admission Type, Expected primary payer, Length of Inpatient stay, Patient Location , NCHRONIC, Number of Diagnosis coded on original record, Admission Month
b. Not computed because fractional case weights have been found for the variable specified on the WEIGHT command.

c. Dependent Variable: Total Charges

The table above shows that the adjusted coefficient of determination is 0.69 so about 70 percent of variance in total charges is explained by the independent variables shown above. It is also the indicator for the models goodness of fit. One can also observe a p value of 0.000 indicating statistical significance for the relationships or the independent variables provide satisfactory explanation for the response variable.

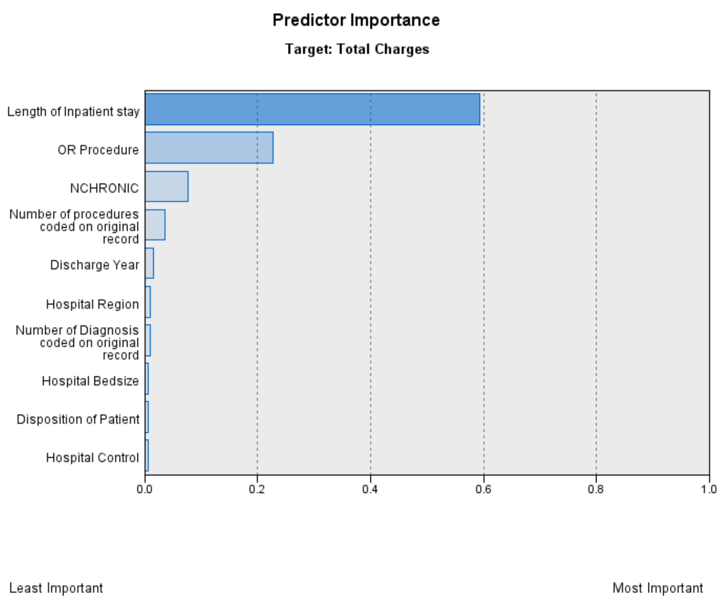
Coefficients[a]

Model		Unstandardized Coefficients		Standa Coeffic	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolera	VIF
1	(Constant)	-9272184.896	552628.863		-16.778	.000	-10355343.458	-8189026.334		
	AGE in years	1181.841	74.883	.040	15.783	.000	1035.070	1328.612	.940	1.064
	Admission Month	-100.334	256.283	-.002	-.391	.695	-602.651	401.984	.204	4.900
	Disposition of Patient	3959.389	161.994	.063	24.442	.000	3641.878	4276.899	.938	1.066
	Discharge Quarte	1263.053	791.517	.009	1.596	.111	-288.329	2814.435	.204	4.901
	Admiss Type	8538.481	892.487	.025	9.567	.000	6789.197	10287.766	.937	1.067
	Sex	-5116.037	820.959	-.016	-6.232	.000	-6725.125	-3506.948	.995	1.005
	LOS	12057.556	45.596	.786	264.443	0.000	11968.188	12146.925	.697	1.435
	NDX	2413.972	154.853	.063	15.589	.000	2110.458	2717.486	.381	2.628
	NCHRONIC	-2439.034	380.998	-.023	-6.402	.000	-3185.794	-1692.274	.459	2.180
	Primary payer	1805.832	433.019	.011	4.170	.000	957.110	2654.555	.966	1.035
	P.Loca	-3075.285	293.407	-.028	-10.481	.000	-3650.366	-2500.204	.842	1.187
	Race	2347.182	316.027	.019	7.427	.000	1727.766	2966.599	.924	1.082

Transfer	-6341.170	1262.863	-.013	-5.021	.000	-8816.395	-3865.945	.972	1.029
D.Year	4586.4	274.878	.042	16.685	.000	4047.642	5125.169	.979	1.022
Median household income for patient's ZIP Code	2197.7	388.824	.015	5.652	.000	1435.604	2959.802	.867	1.154

a. Dependent Variable: Total Charges

Figure 19



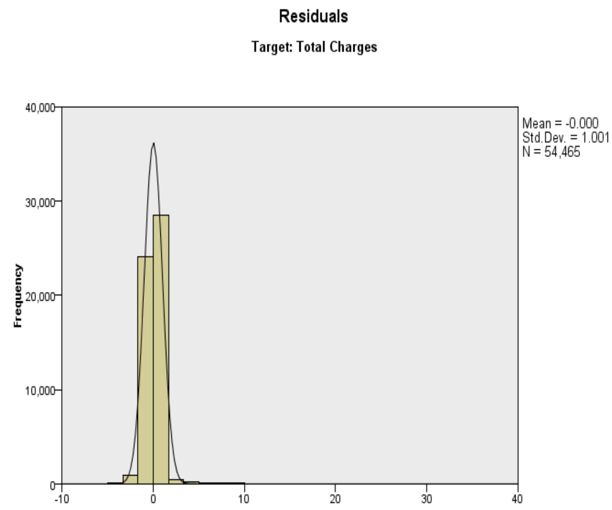
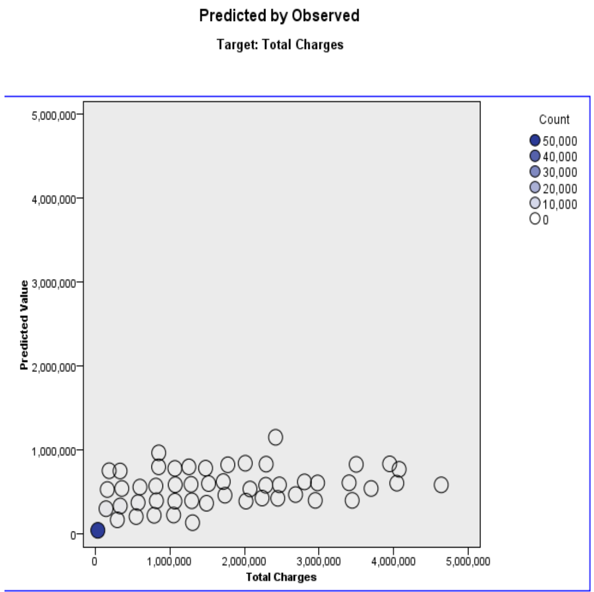


Figure 20



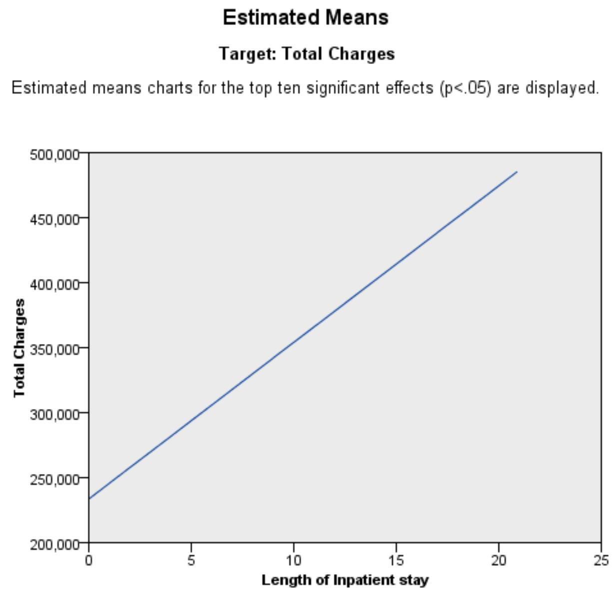
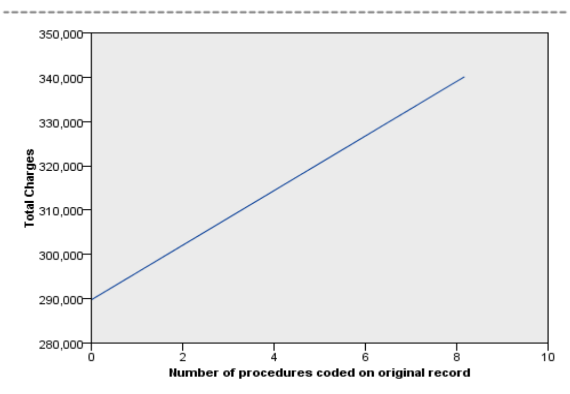


Figure 23:

Figure24



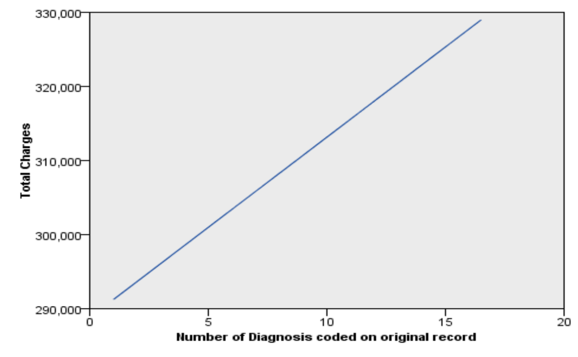
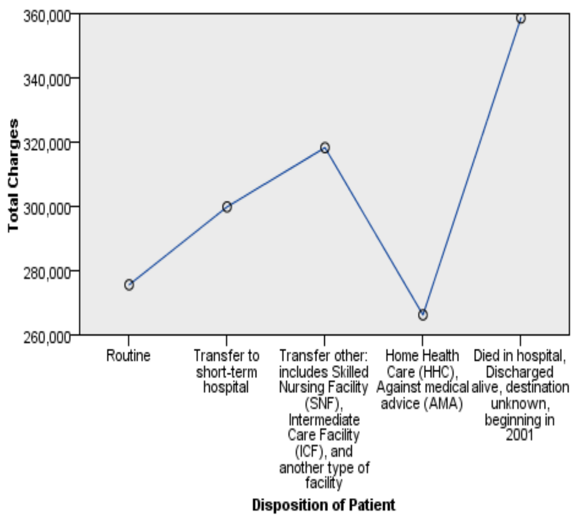


Figure 25 **Figure 26**



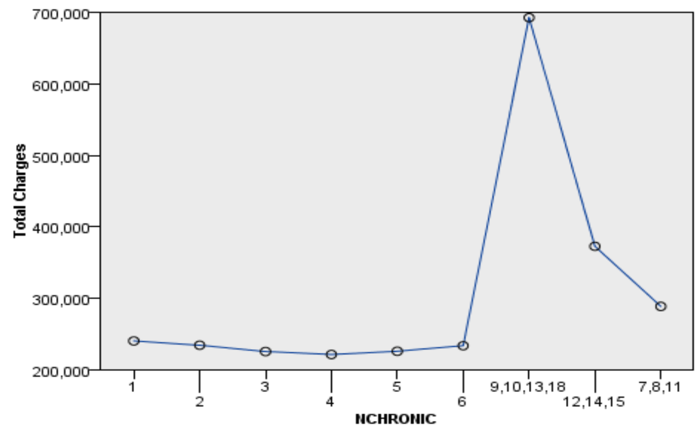
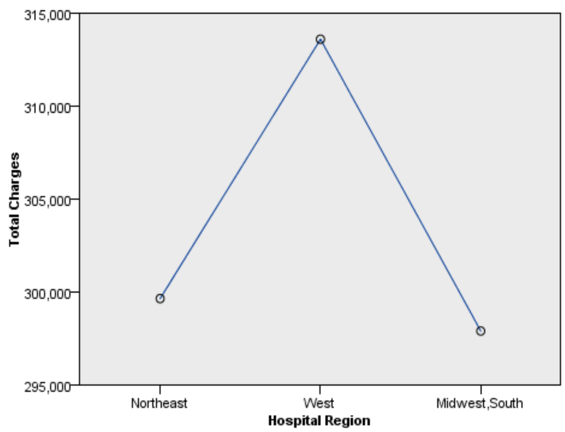
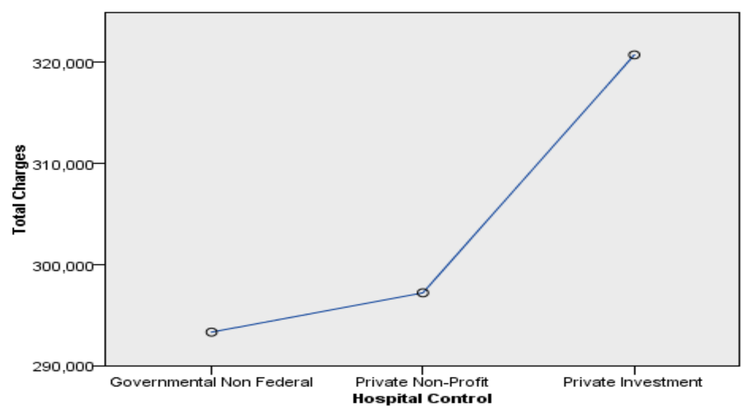
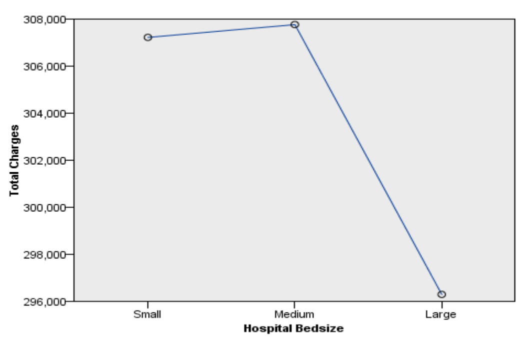


Figure 27 Figure 28,29







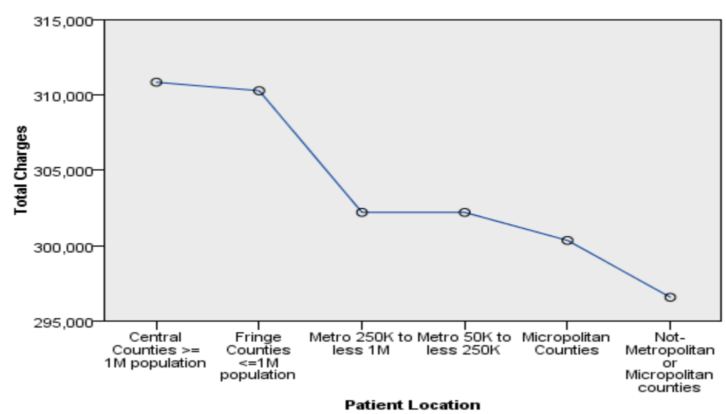
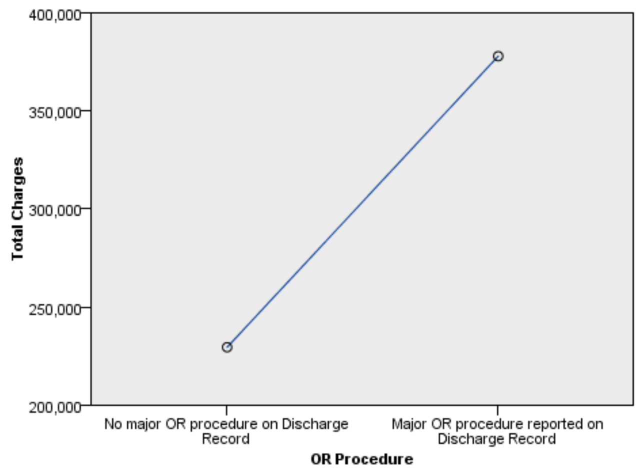


Figure32



The images above show the most significant influencers of cost and their relative impact on other variables of interest. The figure 30 and 31 shows that in areas classified as not metro or micropolitan areas cost seems to be much lower than metropolitan areas. Furthermore, NCHRONIC between 9,10,13 &18 shows a significant increase in cost. Moreover, 7,8 and 11 shows a relative lower charge considering the comorbidities associated with these chronic conditions. The figure 32 show how impactful OR procedure is on charges as well as relative presentation and cost for these procedures based on the size of healthcare facility. Finally, the relative difference in cost between regions could be said the Midwest and South had similar charges, North East had about $10,000 higher charges and West with a significantly disproportionate charge.

4.2: Effects of Leukemia Severity

Table 38: Relationship between Severity and Age

	Value	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	112.373[a]	80	.010
Likelihood Ratio	111.744	80	.011
Linear-by-Linear Association	2.899	1	.089
N of Valid Cases	59533		

The table above shows that there is not statistically significant with a p value of 0.010. We can then say that disease severity is not directly associated with patient age at time of presentation.

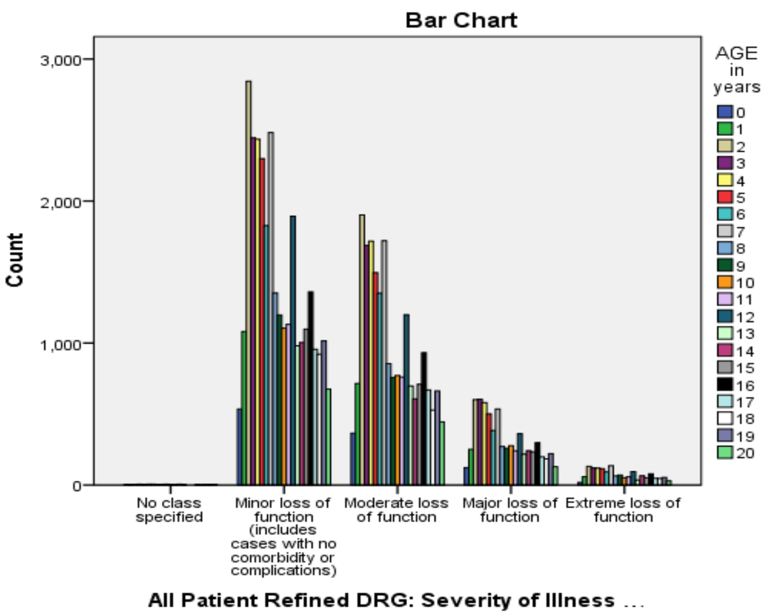


Figure 33: **This figure shows severity variation in years and majority of presentation had less severity disease severity.**

The table and image above show that there is significance in relation to disease severity and patient age. Majority of patients show minor loss of function with varied presentation. Furthermore, extreme loss of function seems to be in the early years of life between 2-10 as depicted above.

Table 39: Relationship between Severity and Gender

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	16.242[a]	4	.003
Likelihood Ratio	16.373	4	.003
Linear-by-Linear Association	1.528	1	.216
N of Valid Cases	59535		

The table shows a statistically significant relationship between disease severity and gender with a p value of 0.003. The association between these variables is weak. The Cramer's V test in this case is 0.017.

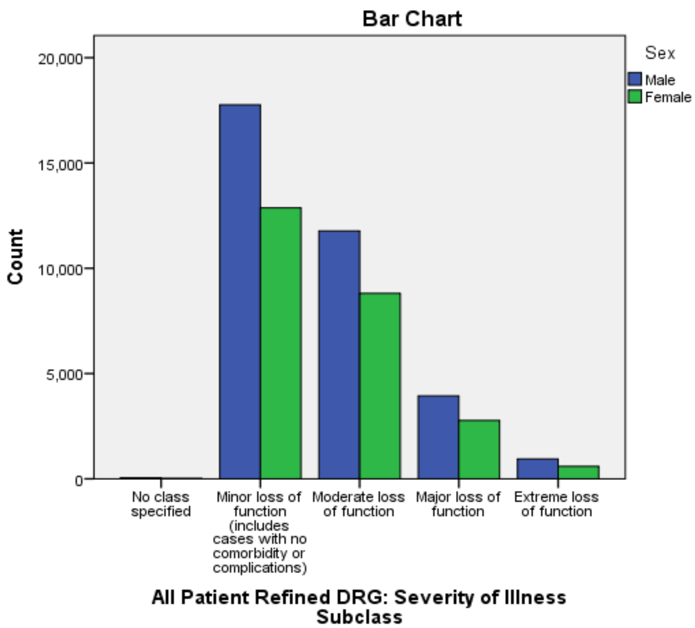


Figure34

In general, an observation could be that severity seem to be higher in male population for all severity subcategories.

Table 40: Relationship between Severity and Patient Disposition

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	31.669[a]	24	.135
Likelihood Ratio	31.651	24	.136
Linear-by-Linear Association	1.012	1	.314
N of Valid Cases	59588		

The table shows there is no statistical significance between severity and disposition of patients including death.

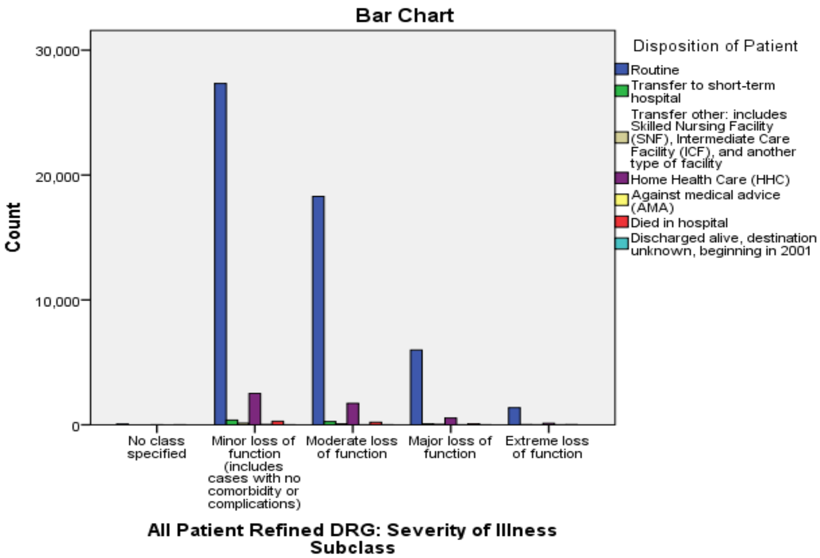


Figure35
The variation in patient disposition shows its impact on severity. It also shows variations presentation.

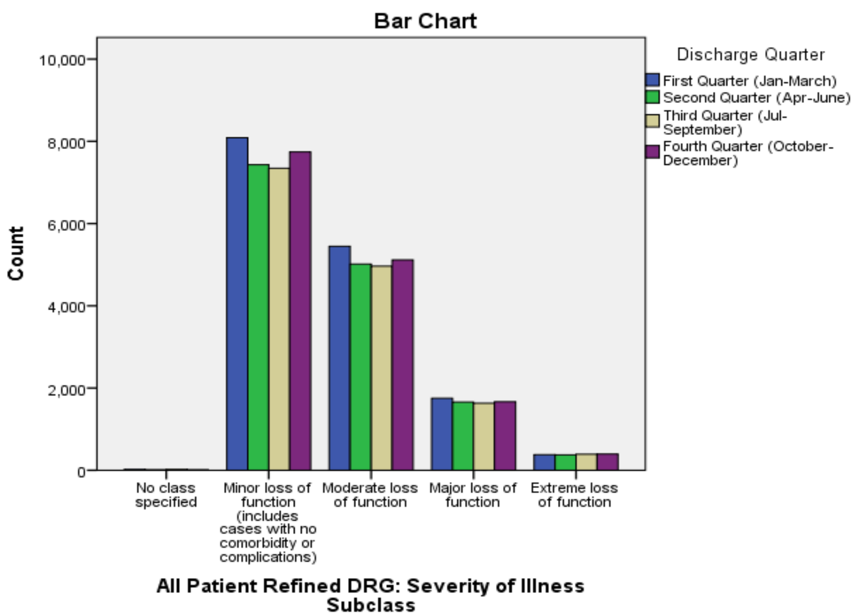


Figure:36
This image shows a varied patient presentation by each quarter and similar presentation for extreme loss of functionality. It also shows that extreme severity seems to be more prevalent in the third and fourth quarters of the year.

Table 44: Relationship between Severity and Elective Admission

	Value	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	21.916[a]	4	.000
Likelihood Ratio	22.230	4	.000
Linear-by-Linear Association	2.571	1	.109
N of Valid Cases	59525		

Elective admission is statistically significant with a p value of 0.000 and Cramer's V of 0.019. The analysis indicates that the sources of patient presentation is an indication or how much patients were going to be charged.

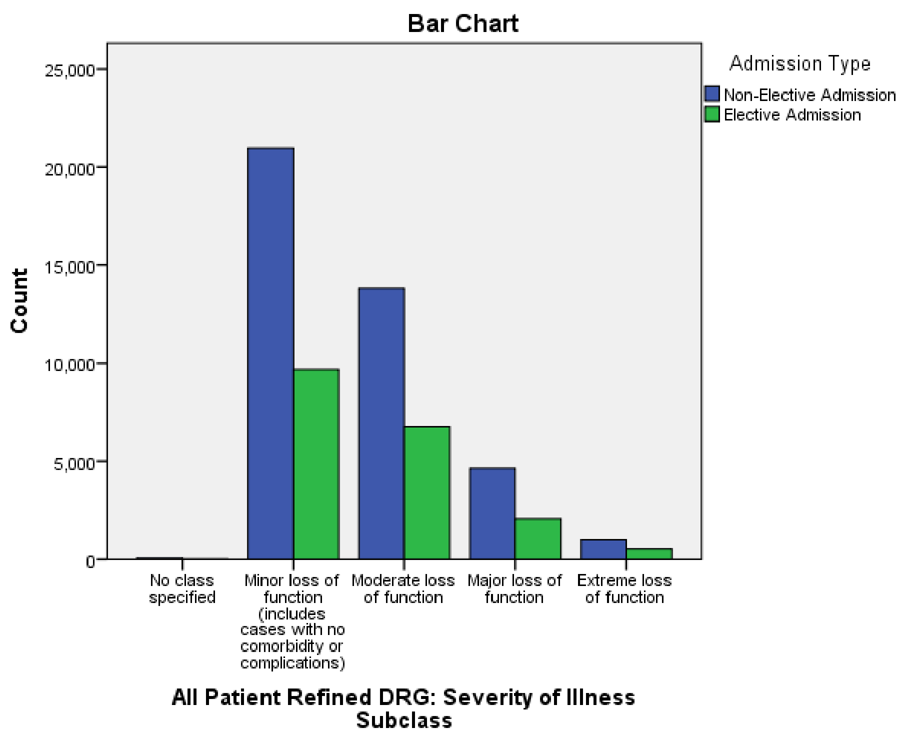


Figure 37

Table 45: Relationship between Severity and NCHRONIC

	Value	*df*	*Asymptotic*
Pearson Chi-Square	98.263[a]	60	.001
Likelihood Ratio	97.265	60	.002
Linear-by-Linear Association	.800	1	.371
N of Valid Cases	59595		
a.			

There is statistical significance between the variables severity and NCHRONIC with a p value of 0.001 and Cramer's V of 0.020.

Table 46: Relationship between Severity and NDX

	Value	df	Asymptotic
Pearson Chi-Square	229.519[a]	164	.001
Likelihood Ratio	198.173	164	.035
Linear-by-Linear Association	.037	1	.847
N of Valid Cases	59597		
a.			

The number of diagnosis on record during discharge statistically significant in explaining the severity with a p value of 0.001 and Cramer's V of 0.031. NDX seems to show a correlation and have a direct impact.

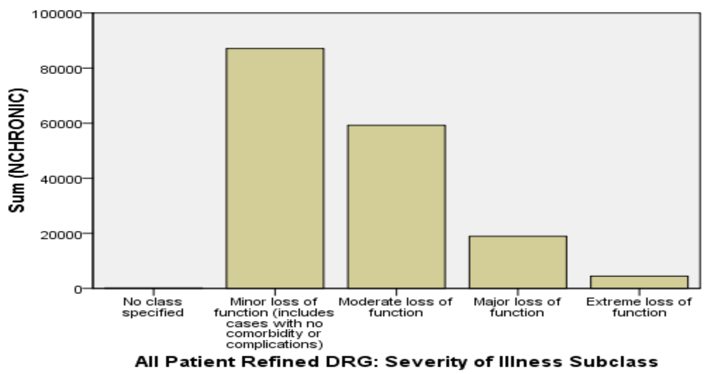


Figure 38

The figures 38 shows that Chronic conditions does not translate into disease severity. high severity shows low number of chronic conditions.

Table 47: Relationship between Severity and Primary Payer

	Value	df	Asymptotic
Pearson Chi-Square	10.448[a]	20	.959
Likelihood Ratio	13.348	20	.862
Linear-by-Linear Association	.281	1	.596
N of Valid Cases	59455		

There is no statistically significant relationship between severity and expected primary payer

Table 48: Relationship between Severity and discharge year

	Value	df	Asymptotic)
Pearson Chi-Square	246.040[a]	4	.000
Likelihood Ratio	246.934	4	.000
Linear-by-Linear Association	.118	1	.732
N of Valid Cases	59599		

The p value of 0.000 shows significant relationship between diseases severity and discharge year for patients with lymphoid leukemia. Cramer's V of 0.064 could be observed for this relationship.

Table 49: Relationship between Severity and Mortality

	Value	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	96765.578[a]	16	0.000
Likelihood Ratio	19099.284	16	0.000
Linear-by-Linear Association	18683.121	1	0.000
N of Valid Cases	59596		

The p value is 0.000 and hence statistically significant relationship between disease severity and mortality. Cramer's V for this relationship is 0.637

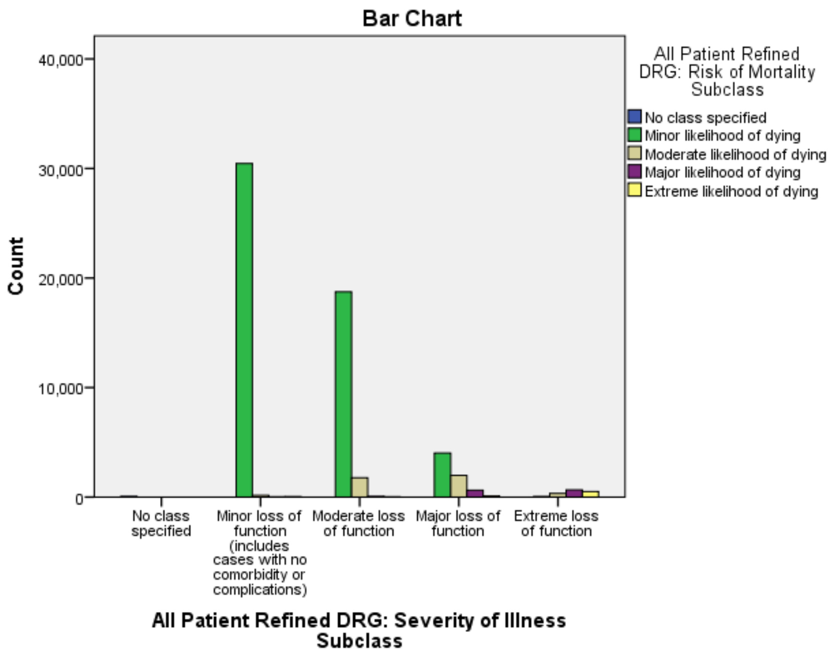


Figure 39

The figure shows that extreme loss of function is directly related to likelihood of dying. So, severity and mortality are directly related, and these are also specifically related to household income.

4.2 R: Logistic Regression

Table 50: logistic Regression Details

		N	*Marginl Percentage*
All Patient Refined DRG: Severity of Illness Subclass	No class specified	53	.1%
	Minor loss of function (includes cases with no comorbidity or complications)	24545	51.6%
	Moderate loss of function	16445	34.6%
	Major loss of function	5303	11.1%
	Extreme loss of function	1239	2.6%
Valid		47584	100.0%
Missing		14755	
Total		62338	
Subpopulation		32687[a]	
.			

The table provides details of the population subset included in the regression model as well as individual groups within each subset of disease severity. Severity shows relationship with median income household, discharge year, NCHRONIC and NDX. These variables show that that LOS is associated with chronic condition and diagnosis. It can also be observed that extreme loss of function has decreased from 2009 to 2012.

Table 51: Model fitting Information

Model	*Model Fitting Criteria*	*Likelihood Ratio Tests*		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	100462.590			
Final	85525.029	14937.562	80	0.000

The table shows a p value of 0.000 and a degree of freedom of 80. The Pearson test also shows statistical significance. The pseudo R squared for this regression is 0.307(Nagelkerke). The variation of disease severity is 30 percent explained by the independent variables.

Table 52: Likelihood Ratio Tests

Effect	*Model Fitting Criteria*	*Likelihood Ratio Tests*		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	85705.372	180.343	4	.000
AGE	85527.314	2.286	4	.683
NDX	85529.418	4.390	4	.356
AWEEKEND	85529.105	4.077	4	.396
DIED	85526.507	1.479	4	.830
DISPUNIFORM	85526.772	1.743	4	.783
DQTR	85529.632	4.603	4	.331
ELECTIVE	85532.288	7.260	4	.123
FEMALE	85532.265	7.236	4	.124
PAY1	85526.160	1.131	4	.889
NCHRONIC	85531.999	6.971	4	.137
PL_NCHS2006	85527.884	2.855	4	.582
RACE	85527.494	2.466	4	.651
TRAN_IN	85527.975	2.947	4	.567
YEAR	85706.703	181.674	4	.000
ZIPINC_QRTL	85528.780	3.751	4	.441
AMONTH	85528.042	3.013	4	.556
HCUP_ED	85536.726	11.698	4	.020
LOS	85529.242	4.214	4	.378
TOTCHG	85528.469	3.441	4	.487
APRDRG_Risk _Mortality	100150.161	14625.133	4	0.000

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

Summary of Findings

Tables above shows a logistic regression parameter estimates for each variable and covariates included in the regression analysis for the datasets 2009 and 2012. The reference category for this regression is extreme loss of function for individuals with leukemia. Discharge year, mortality risk are statistically significant in relation to disease severity as seen on the table above. The likelihood of disease severity increases slightly with higher NDX, location, patient disposition, gender and charges. One can also observe that the likelihood of having a major loss of function is low for NCHRONIC, LOS, and Race as depicted by anti-log (Exp (B)) less than 1.

1. **Table 52 shows a p value of 0.000 and a degree of freedom of 80. The Pearson test also shows statistical significance. The pseudo R squared for this regression is 0.307(Nagelkerke). The variation of disease severity is 30 percent explained by the independent variables**
2. **Table 41 shows a statistically significant relationship between disease severity and gender with a p value of 0.003. The association between these variables is weak. The Cramer's V test in this case is 0.017**
3. **Table 44 Shows Elective admission is statistically significant with a p value of 0.000 and Cramer's V of 0.019**
4. **Table 45 Shows there is statistical significance between the variable's severity and NCHRONIC with a p value of 0.001 and Cramer's V of 0.020.**
5. **Table 46 Shows The number of diagnosis on record during discharge statistically significant in explaining the severity with a p value of 0.001 and Cramer's V of 0.031**

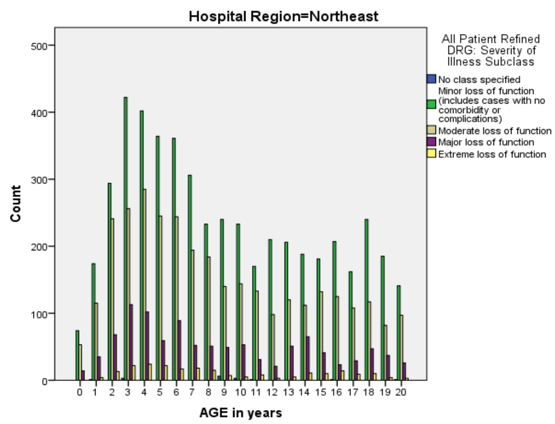
6. **Table 50 Shows the p value of 0.000 shows significant relationship between diseases severity and discharge year for patients with lymphoid leukemia. Cramer's V of 0.064 could be**
7. **Table 52 Shows The p value is 0.000 and hence statistically significant relationship between disease severity and mortality. Cramer's V for this relationship is 0.637.**

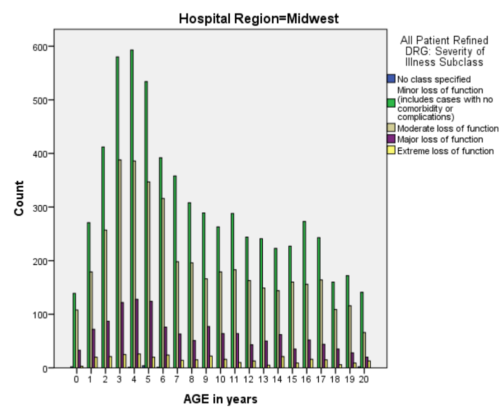
4.3 Relationship between Mortality and Variables of interest

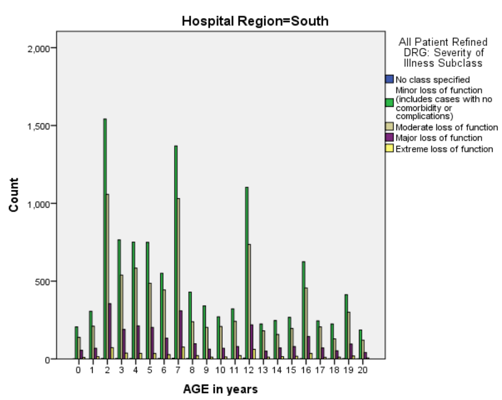
Table 53 ***Age and Mortality***	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	130.845[a]	80	.000
Likelihood Ratio	130.616	80	.000
Linear-by-Linear Association	.145	1	.703
N of Valid Cases	59528		

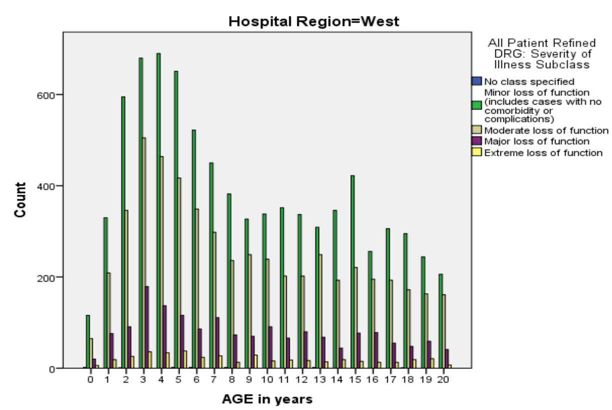
The table shows statistical significance between mortality and age with a p value of 0.000. Moreover, the strength of association between these variables is 0.023(Cramer's V)

Figures 40-43









These images show there is a stark variation in mortality by region and in relation to age differences. These can also be associated with disease severity and mortality. The South region with high patient presentation and shows relative low mortality relative to patient population.

Table 54
Gender and Mortality

			All Patient Refined DRG: Risk of Mortality Subclass					Total
			No class specified	Minor likelihood of dying	Moderate likelihood of dying	Major likelihood of dying	Extreme likelihood of dying	
Sex	Male	Count	49	30677	2538	811	394	34469
		Expected Count	42.3	30803.6	2456.0	788.5	378.6	34469.0
	Female	Count	24	22528	1704	551	260	25067
		Expected Count	30.7	22401.4	1786.0	573.5	275.4	25067.0
Total		Count	73	53205	4242	1362	654	59536
		Expected Count	73.0	53205.0	4242.0	1362.0	654.0	59536.0

Table 55
Gender and Mortality

	Value	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	13.295[a]	4	.010
Likelihood Ratio	13.405	4	.009
Linear-by-Linear Association	7.916	1	.005
N of Valid Cases	59536		

There is statistical significance for the relationship between mortality and gender. As shown in the table above more males died than females.

Table 56
Hospital Region and Mortality

			All Patient Refined DRG: Risk of Mortality Subclass					Total
			No class specified	Minor likelihood of dying	Moderate likelihood of dying	Major likelihood of dying	Extreme likelihood of dying	
Hospital Region	Northeast	Count	17	8609	551	232	107	9516
		Expected Count	11.8	8504.9	677.2	217.8	104.3	9516.0
	Midwest	Count	11	11031	700	264	137	12143
		Expected Count	15.1	10852.8	864.1	277.9	133.1	12143.0
	South	Count	35	19839	1732	494	235	22335
		Expected Count	27.7	19961.9	1589.4	511.2	244.7	22335.0
	West	Count	11	13785	1258	374	174	15602
		Expected Count	19.4	13944.3	1110.3	357.1	171.0	15602.0
Total		Count	74	53264	4241	1364	653	59596

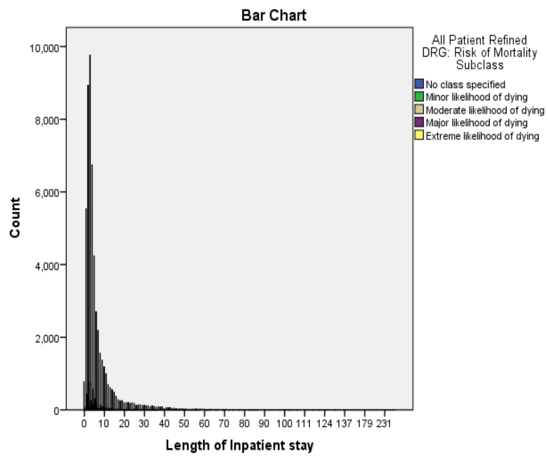
Expected Count	74.0	53264.0	4241.0	1364.0	653.0	59596.0

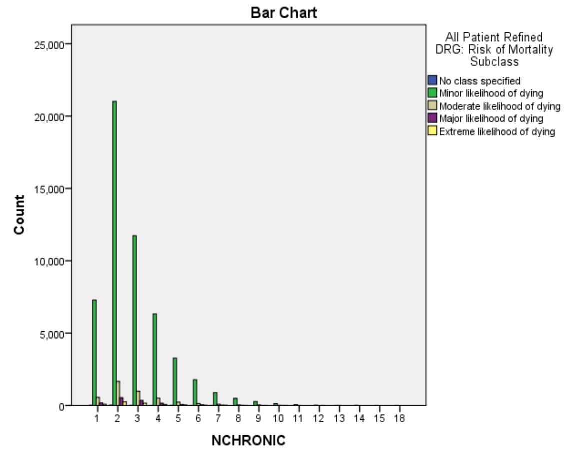
Table 57 Hospital Region and Mortality	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	106.439[a]	12	.000
Likelihood Ratio	109.400	12	.000
Linear-by-Linear Association	21.471	1	.000
N of Valid Cases	59596		

The table 62 & 63 shows p value of 0.000 which indicates statistical significance between hospital region and mortality. The Cramer's V of 0.024 which indicates the strength of association. An observation can be made that LOS, NCHRONIC and the images and tables supports this conclusion. This table shows there is no statistically significant relationship between length of inpatient stay and mortality.

Table 58 NCHRONIC and Mortality	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	93.445[a]	60	.004
Likelihood Ratio	90.718	60	.006
Linear-by-Linear Association	1.255	1	.263
N of Valid Cases	59598		

This table shows statistically significant relationship between NCHRONIC and mortality. The p value of 0.004 and a Cramer's V of 0.020 which informs of the strength of association.





Figures 44-45 above shows the relationship and proportion between mortality and LOS and NCHRONIC in the patient population.

Table 59 NDX and Mortality	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	240.575[a]	164	.000
Likelihood Ratio	165.725	164	.448
Linear-by-Linear Association	1.185	1	.276
N of Valid Cases	59592		

This table show statistically significant relationship between the number of diagnosis (NDX) and mortality. An observation of 0.032 Cramer's V. the association between the variables is estimated to about 3.2

Table 60 NPR and Mortality	***Number of Procedures***					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*Number of procedures coded on original record * All Patient Refined DRG: Risk of Mortality Subclass*	59598	95.6%	2740.297	4.4%	62338.297	100.0%

This table provides descriptive of the inclusion criteria for mortality and number of procedures.

Table 61 NPR and Mortality	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	184.442[a]	128	.001
Likelihood Ratio	151.831	128	.074
Linear-by-Linear Association	.096	1	.756
N of Valid Cases	59598		

This table shows that there is no statistical significance between PAYER and mortality.

Table 56 shows statistical significance between mortality and number of procedure with a p value of 0.001. Cramer's V of 0.028.

Table 69 PAYER and Mortality	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	24.552[a]	20	.219
Likelihood Ratio	26.691	20	.144
Linear-by-Linear Association	3.107	1	.078
N of Valid Cases	59456		

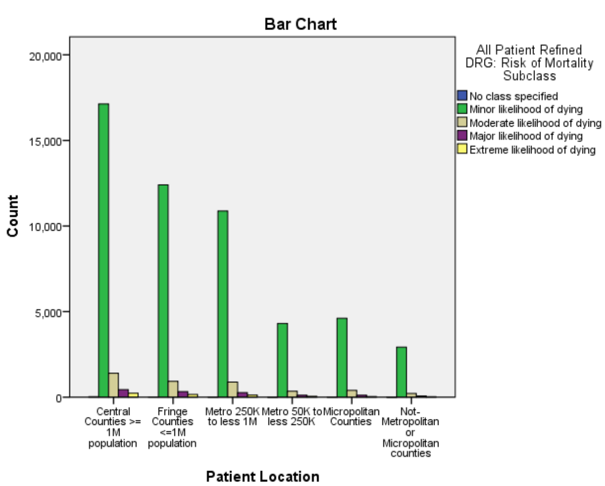


Figure 46: This figure shows the number of presentation and based on location and mortality risk.

Table 62
Race and Mortality

			Race/ Ethnicity: Risk of Mortality Subclass					*Total*
			No class specified	Minor likelihood of dying	Moderate likelihood of dying	Major likelihood of dying	Extreme likelihood of dying	
Race or Ethnicity	White or Caucasian	Count	37	25094	1946	636	277	27990
		Expected Count	35.6	24974.8	2036.0	638.5	305.1	27990.0
	Black or African American	Count	6	3372	261	91	35	3765
		Expected Count	4.8	3359.4	273.9	85.9	41.0	3765.0
	Hispanic	Count	20	14838	1292	388	203	16741
		Expected Count	21.3	14937.6	1217.7	381.9	182.5	16741.0
	Asian or pacific Islander	Count	2	1901	167	37	30	2137
		Expected Count	2.7	1906.8	155.4	48.8	23.3	2137.0
	Native American	Count	0	319	32	14	3	368
		Expected Count	.5	328.4	26.8	8.4	4.0	368.0
	Other	Count	3	2194	192	54	35	2478
		Expected Count	3.2	2211.1	180.2	56.5	27.0	2478.0
Total		Count	68	47718	3890	1220	583	53479
		Expected Count	68.0	47718.0	3890.0	1220.0	583.0	53479.0

Table 63 Race and Mortality	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	31.989[a]	20	.043
Likelihood Ratio	31.672	20	.047
Linear-by-Linear Association	11.371	1	.001
N of Valid Cases	53479		

Table 72 shows there is statistically significant relationship between race and mortality for leukemia patients. Even though not strong there seem to be a high mortality in the Hispanic population relative to patient population size.

Discharge Year * All Patient Refined DRG: Risk of Mortality Subclass Cross tabulation

Table 64 Discharge Year and Mortality			All Patient Refined DRG: Risk of Mortality Subclass					Total
			No class specified	Minor likelihood of dying	Moderate likelihood of dying	Major likelihood of dying	Extreme likelihood of dying	
Discharge Year	2009	Count	55	24182	1564	663	338	26802
		Expected Count	33.3	23953.6	1907.7	613.4	294.1	26802.0
	2012	Count	19	29083	2678	701	316	32797
		Expected Count	40.7	29311.4	2334.3	750.6	359.9	32797.0
Total		Count	74	53265	4242	1364	654	59599
		Expected Count	74.0	53265.0	4242.0	1364.0	654.0	59599.0

Table 65 Discharge Year and Mortality	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	161.414[a]	4	.000
Likelihood Ratio	163.623	4	.000
Linear-by-Linear Association	5.096	1	.024
N of Valid Cases	59599		

This table shows statistical significance between discharge year and mortality with a p value of 0.000. Moreover, Cramer's V for this relationship is 0.052 with a significance of 0.000. There is a difference in mortality presentation and this could be attributed to improved treatment approaches and increased disease prevalence.

Chi-Square Tests (Hospital Size)			
Table 66 Hospital Size and Mortality	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	22.654[a]	8	.004
Likelihood Ratio	22.842	8	.004
Linear-by-Linear Association	.891	1	.345
N of Valid Cases	54722		

This table shows statistically significant relationship between hospital size and mortality with p value of 0.004 and a Cramer's V of 0.014.

Table 67
Hospital Control and Mortality

			All Patient Refined DRG: Risk of Mortality Subclass					*Total*
			No class specified	Minor likelihood of dying	Moderate likelihood of dying	Major likelihood of dying	Extreme likelihood of dying	
Hospital Control	Governmental Non Federal	Count	7	6287	513	153	70	7030
		Expected Count	8.1	6274.4	511.0	159.6	76.9	7030.0
	Private Non-Profit	Count	53	40048	3207	1015	495	44818
		Expected Count	51.6	40000.7	3257.9	1017.2	490.6	44818.0
	Private Investment	Count	3	2507	258	74	34	2876
		Expected Count	3.3	2566.9	209.1	65.3	31.5	2876.0
Total		Count	63	48842	3978	1242	599	54724
		Expected Count	63.0	48842.0	3978.0	1242.0	599.0	54724.0

Table 68 Hospital Control and Mortality	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	16.261[a]	8	.039
Likelihood Ratio	15.452	8	.051
Linear-by-Linear Association	4.789	1	.029
N of Valid Cases	54724		

Table 65 and 66 shows that there is statistically significant relationship between hospital control and mortality. This relationship could be associated with the number in the dataset as well as general hospital demographics in the United States.

4.3 R: Logistic Regression Mortality

Table 69		*N*	*Marginal Percentage*
All Patient Refined DRG: Risk of Mortality Subclass	No class specified	44	.1%
	Minor likelihood of dying	38533	89.0%
	Moderate likelihood of dying	3257	7.5%
	Major likelihood of dying	982	2.3%
	Extreme likelihood of dying	460	1.1%
Valid		43277	100.0%
Missing		19061	
Total		62338	
Subpopulation		29956[a]	

a. The dependent variable has only one value observed in 29956 (100.0%) subpopulations.

This table provides a summary of case processing and the number of valid cases included in the regression analysis.

Table 70	*Model Fitting Criteria*	*Likelihood Ratio Tests*		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	38026.433			

Final	24291.126	13735.307	104	0.000

This table shows the statistical significance of the 0.000. More over the Person goodness of fit test has a p value of 0.000. The pseudo R squared for this regression is 0.465(Nagelkerke). The variation of disease mortality is 46 percent explained by the independent variables.

Table 71

Goodness-of-Fit			
	Chi-Square	df	Sig.
Pearson	4355076.741	119716	.000
Deviance	24291.126	119716	1.000

Summary of Findings

1. **Table shows statistical significance between mortality and age with a p value of 0.000. Moreover, the strength of association between these variables is 0.023(Cramer's V)**
2. **The table 62 & 63 shows p value of 0.000 which indicates statistical significance between hospital region and mortality and LOS and mortality respectively. The Cramer's V of 0.024 which indicates the strength of association.**
3. **Table 75 shows statistically significant relationship between hospital size and mortality with p value of 0.004 and a Cramer's V of 0.014.**
4. **Table 56 shows statistical significance between mortality and number of procedures with a p value of 0.001. Cramer's V of 0.028.**
5. **Table 65 shows statistically significant relationship between NCHRONIC and mortality. The p value of 0.004 and a Cramer's V of 0.020 which informs of the strength of association.**

6. Table 66 show statistically significant relationship between the number of diagnosis (NDX) and mortality. An observation of 0.032 Cramer's V. the association between the variables is estimated to about 3.2.

4.4 Impact of length of Inpatient Hospital Stay on Variables of Interest.

Table 72 Age by LOS	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	6967.965[a]	3140	.000
Likelihood Ratio	4644.551	3140	.000
Linear-by-Linear Association	130.494	1	.000
N of Valid Cases	62191		

Table 72 shows the Chi-Square tests and p values for the relationship between the length of inpatient stay and age. Cramer's V analysis shows statistical significance with a value of 0.075. Shows the relationship between LOS and Age in years. It shows LOS is diverse and younger individuals spent more time inpatient than older individuals.

Table 73A **Report**

Length of Inpatient stay

Expected primary payer	Mean	N	Std. Deviation	Sum	% of Total Sum
Medicare	5.05	118	8.413	597	.1%
Medicaid	7.41	26393	12.010	195523	44.3%
Private plus HMO	6.70	31028	11.038	207855	47.1%
Self pay	6.39	1229	10.250	7854	1.8%
No Charge	6.09	32	5.639	194	.0%
Other	8.53	3387	15.291	28891	6.6%
Total	7.09	62188	11.714	440913	100.0%

Table 73B AMONTH V. LOS	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	2579.134[a]	1716	.000
Likelihood Ratio	2150.964	1716	.000
Linear-by-Linear Association	.105	1	.746
N of Valid Cases	59821		

This table shows a correlation between length of inpatient stay and admission month. Moreover, Cramer's V for this correlation is 0.063.

As the table 82 shows LOS varies for each payer with private payers, and no charge spending more time impatient compared to others. On average 7 days mean could be seen as reported in the table above. The payment demographics could be generalized because it is similar to payment data in the public.

Table 74 LOS V. DISPOSITION	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	11252.469[a]	948	0.000
Likelihood Ratio	3415.331	948	.000
Linear-by-Linear Association	2404.846	1	0.000
N of Valid Cases	62298		

The table show statistically significant relationship between LOS and patient disposition. The Cramer's V in this instance is 0.174 and a Pearson correlation of 0.196.

Table 75 Died V. LOS	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	5523.296[a]	158	0.000
Likelihood Ratio	1430.597	158	.000
Linear-by-Linear Association	2360.603	1	0.000
N of Valid Cases	62316		

The table show statistical significance with a p value of 0.000 for the relationship between LOS and inpatient death. Cramer's V is 0.298 with p value of 0.000. this relationship could also be related to disease severity and admission type. ER presentation seem to have and effect to the charges and mortality risk assessments.

Table 76 LOS V. Elective	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	282.241[a]	158	.000
Likelihood Ratio	320.743	158	.000
Linear-by-Linear Association	14.042	1	.000
N of Valid Cases	62257		

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The table shows statistical significance with a p value of 0.000 for the relationship between LOS and gender. The correlation of Cramer's V of 0.067. this shows the strength of association between the variables.

Table 77 LOS V. HOSP REGION	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	1194.214[a]	474	.000
Likelihood Ratio	1195.208	474	.000
Linear-by-Linear Association	1.724	1	.189
N of Valid Cases	62314		

The table shows statistical significance between LOS and hospital region with a p value of 0.000. The Cramer's V for this correlation is 0.080

Chi-Square Tests

Table 78 LOS V. NCHRONIC	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	42920.892[a]	2370	0.000
Likelihood Ratio	13297.603	2370	0.000
Linear-by-Linear Association	8666.701	1	0.000
N of Valid Cases	62287		

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This table shows a p value of 0.000 indicating statistically significant relationship between LOS and NCHRONIC. The Cramer's V is 0.214 and a Pearson's R correlation of 0.373

Chi-Square Tests

Table 79 LOS V. NDX	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	162165.912[a]	6478	0.000
Likelihood Ratio	23499.339	6478	0.000
Linear-by-Linear Association	17165.198	1	0.000
N of Valid Cases	62233		

This table shows a p value of 0.000 indicating statistically significant relationship between LOS and NDX. The Cramer's V is 0.252 and a Pearson's R correlation of 0.525

There is a correlation between LOS and diagnosis on discharge record.

Chi-Square Tests

Table 80 LOS V. NPR	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	260753.678[a]	5056	0.000
Likelihood Ratio	31620.067	5056	0.000
Linear-by-Linear Association	23004.254	1	0.000
N of Valid Cases	62268		

This table shows a p value of 0.000 indicating statistically significant relationship between LOS and NPR. The Cramer's V is 0.362 and a Pearson's R correlation of 0.608
There is a correlation between LOS and number of procedures on discharge record.

Chi-Square Tests

Table 81 LOS V. OR PROCEDUR	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11888.592[a]	158	0.000
Likelihood Ratio	5130.572	158	0.000
Linear-by-Linear Association	9245.011	1	0.000
N of Valid Cases	62321		

This table shows a p value of 0.000 indicating statistically significant relationship between LOS and Major OR Procedure. The Cramer's V is 0.437 and a Pearson's R correlation of 0.385
There is a correlation between LOS and indication Major OR procedures on discharge record.

Chi-Square Tests

Table 82 LOS V. PAY1	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1099.112[a]	790	.000
Likelihood Ratio	902.191	790	.003
Linear-by-Linear Association	2.863	1	.091
N of Valid Cases	62164		

This table shows a p value of 0.000 indicating statistically significant relationship between LOS and Payer Method. The Cramer's V is 0.059 and a Pearson's R correlation of 0.007
There is a correlation between LOS and Payer Method on discharge record.

Table 83 LOS V. LOC	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	1294.776[a]	780	.000
Likelihood Ratio	1296.237	780	.000
Linear-by-Linear Association	68.749	1	.000
N of Valid Cases	61192		

This table shows a p value of 0.000 indicating statistically significant relationship between LOS and Patient location based on population. The Cramer's V is 0.065
There is a correlation between LOS and indication of patient location on discharge record.

Chi-Square Tests

Table 84 LOS V. RACE	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1752.205[a]	780	.000
Likelihood Ratio	1263.893	780	.000
Linear-by-Linear Association	105.808	1	.000
N of Valid Cases	55919		

This table shows a p value of 0.000 indicating statistically significant relationship between LOS and Race. The Cramer's V is 0.079
There is a weak correlation between LOS and Race of patient on discharge record.

Table 85 LOS V. YEAR	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	440.683[a]	158	.000
Likelihood Ratio	479.708	158	.000
Linear-by-Linear Association	6.675	1	.010
N of Valid Cases	62326		

This table shows a p value of 0.000 indicating statistically significant relationship between LOS and Discharge Year. The Cramer's V is 0.084
There is a weak correlation between LOS and Discharge Year of patient on discharge record.

Table 86 LOS V. ZIP	*Value*	*df*	*Asymptotic Significance (2-sided)*
Pearson Chi-Square	681.390[a]	462	.000
Likelihood Ratio	699.174	462	.000
Linear-by-Linear Association	5.077	1	.024
N of Valid Cases	60963		

This table shows a p value of 0.000 indicating statistically significant relationship between LOS and Median Household Income. The Cramer's V is 0.061
There is a weak correlation between LOS and median household income of patient on discharge record.

Chi-Square Tests

Table 87 LOS V. H.CONTROL/ BEDSIZE	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	539.155[a]	312	.000
Likelihood Ratio	465.409	312	.000
Linear-by-Linear	9.121	1	.003
N of Valid Cases	57443		

This table shows a p value of 0.000 indicating statistically significant relationship between LOS and Hospital control. The Cramer's V is 0.069There is a weak correlation between LOS and hospital control of patient on discharge record

4.4R: Linear Regression for the relationship between LOS and other demographic variables

Table 88 ***Model Summary[c]***

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.842[a]	.710	.710	5.725	.[b]

a. Predictors: (Constant), Median household income for patient's ZIP Code, Discharge Quarter, Sex, Disposition of Patient , Discharge Year, Indication of Transfer, AGE in years, Race or Ethnicity, Admission Type, Expected primary payer, Total Charges , Patient Location , NCHRONIC, Number of Diagnosis coded on original record, Admission Month
b. Not computed because fractional case weights have been found for the variable specified on the WEIGHT command.
c. Dependent Variable: Length of Inpatient stay

Table 89A ***ANOVA[a]***

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4003363.672	15	266890.911	8142.125	.000[b]
	Residual	1637954.312	49970	32.779		
	Total	5641317.983	49985			

a. Dependent Variable: Length of Inpatient stay

b. Predictors: (Constant), Median household income for patient's ZIP Code, Discharge Quarter, Sex, Disposition of Patient , Discharge Year, Indication of Transfer, AGE in years, Race or Ethnicity, Admission Type, Expected primary payer, Total Charges , Patient Location , NCHRONIC, Number of Diagnosis coded on original record, Admission Month

As the table above shows strength of association, it also shows the relationship each selected variable has with LOS. LOS seem to be an important indicator of charges, mortality risk and disease severity risk as well. Factors such as NCHRONIC, NDX all seem to be very important

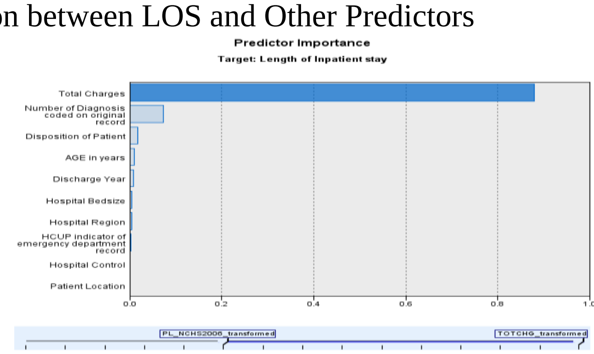
Table 89B ***Coefficients[a]***

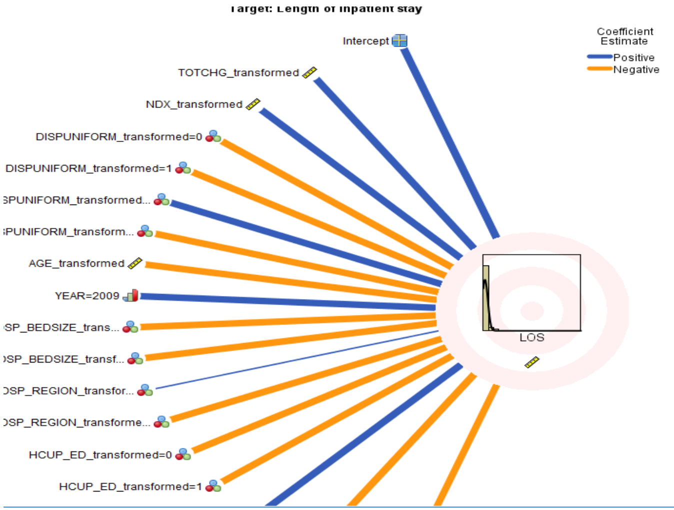
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	726.159	34.950		20.777	.000	657.656	794.662		
	AGE in years	-.103	.005	-.054	-21.816	.000	-.113	-.094	.944	1.060
	Admission Month	-.025	.016	-.008	-1.548	.122	-.057	.007	.204	4.899
	Disposition of Patient	-.075	.010	-.018	-7.255	.000	-.095	-.055	.928	1.077
	Discharge Quarter	-.001	.050	.000	-.013	.990	-.099	.098	.204	4.901
	Admission Type	-.005	.057	.000	-.096	.924	-.116	.105	.935	1.069
	Sex	.307	.052	.014	5.908	.000	.205	.409	.994	1.006
	NCHRONIC	.152	.024	.022	6.280	.000	.104	.199	.459	2.180
	Number of Diagnosis coded on original record	.434	.010	.173	45.021	0.000	.415	.453	.394	2.538
	Expected primary payer	-.044	.027	-.004	-1.612	.107	-.098	.010	.966	1.036
	Patient Location	-.010	.019	-.001	-.533	.594	-.046	.027	.840	1.190
	Race or Ethnicity	-.013	.020	-.002	-.649	.517	-.052	.026	.923	1.083
	Total Charges	4.837E-05	.000	.742	264.443	0.000	.000	.000	.738	1.355
	Indication of Transfer	.938	.080	.029	11.740	.000	.781	1.095	.974	1.026
	Discharge Year	-.360	.017	-.050	-20.717	.000	-.394	-.326	.982	1.019
	Median household income for patient's ZIP Code	-.156	.025	-.016	-6.325	.000	-.204	-.107	.867	1.153

a. Dependent Variable: Length of Inpatient stay

Indicators of how long individuals spent in the healthcare facilities. Another interesting finding in the relationship is the hospital bed size and the indication that small facilities seems to discharge patient much earlier than larger facilities.

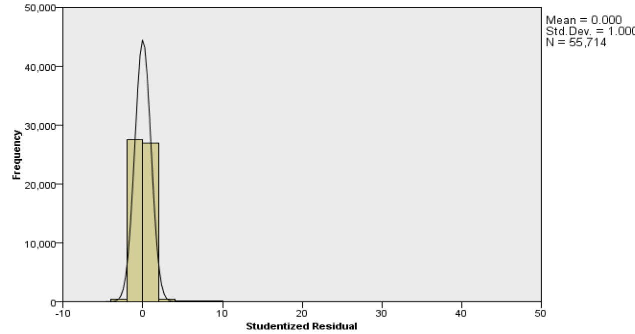
Figure 47-52: Correlation between LOS and Other Predictors





Residuals

Target: Length of Inpatient stay

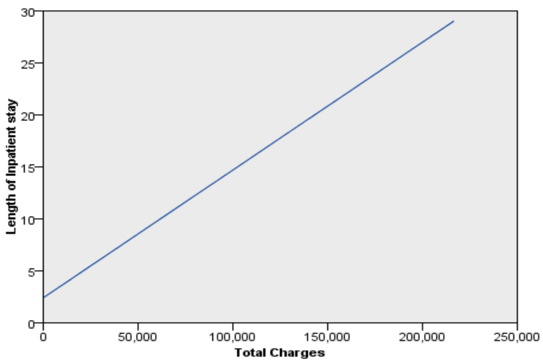


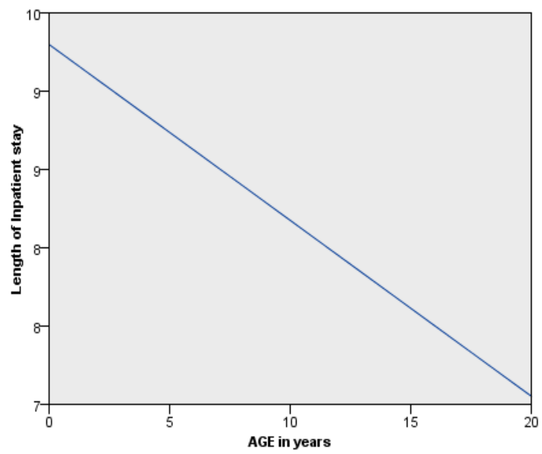
The histogram of Studentized residuals compares the distribution of the residuals to a normal distribution. The smooth line represents the normal distribution. The closer the frequencies of the residuals are to this line, the closer the distribution of the residuals is to the normal distribution.

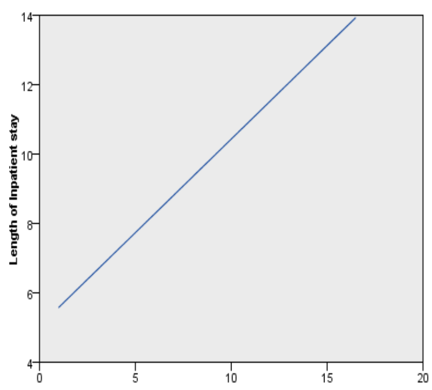
Estimated Means

Target: Length of Inpatient stay

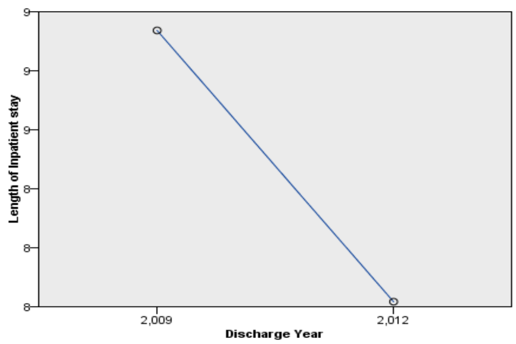
Estimated means charts for the top ten significant effects (p<.05) are displayed.

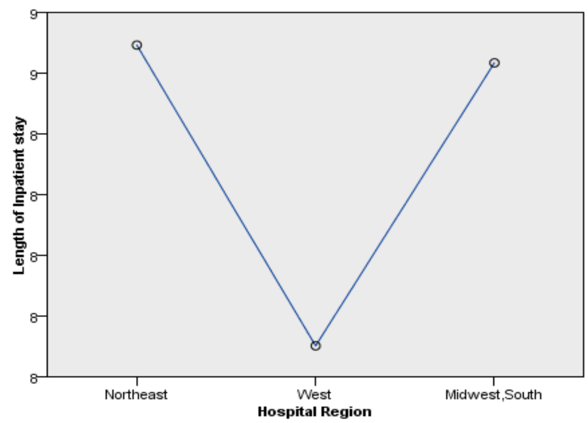


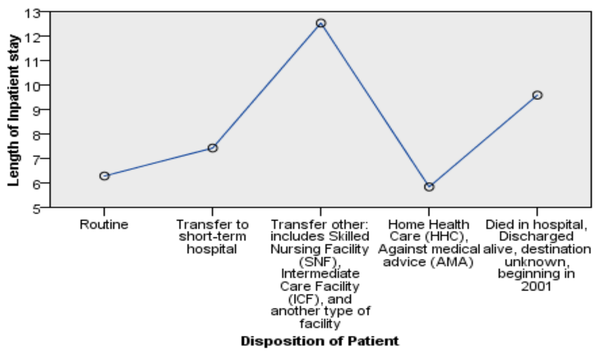


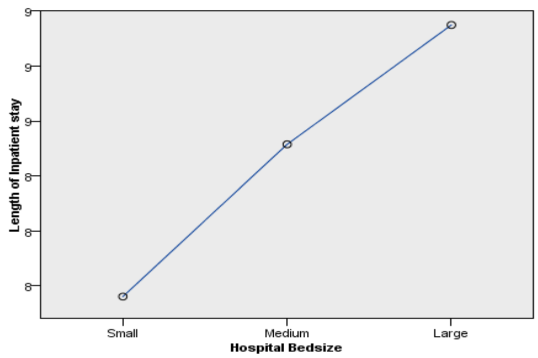


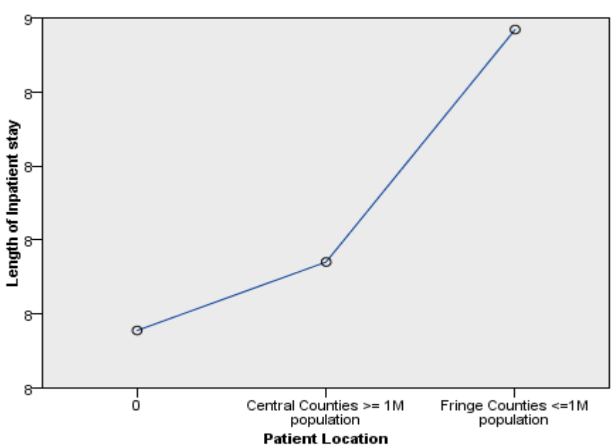
Figures 53-58

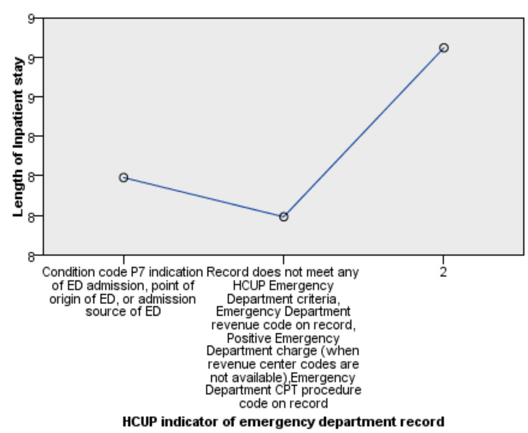












Summary of findings

1. The table 86 shows statistical significance with a p value of 0.000 for the relationship between LOS and gender. The correlation of Cramer's V of 0.067
2. The table 87 shows statistical significance between LOS and hospital region with a p value of 0.000. The Cramer's V for this correlation is 0.080
3. The table 88 shows a p value of 0.000 indicating statistically significant relationship between LOS and NCHRONIC. The Cramer's V is 0.214 and a Pearson's R correlation of 0.373
4. The table 89 shows a p value of 0.000 indicating statistically significant relationship between LOS and NDX. The Cramer's V is 0.252 and a Pearson's R correlation of 0.525. There is a correlation between LOS and diagnosis on discharge record.
5. The table 90 shows a p value of 0.000 indicating statistically significant relationship between LOS and NPR. The Cramer's V is 0.362 and a Pearson's R correlation of 0.608
6. The table 91shows is a correlation between LOS and number of procedures on discharge record.
7. The table 92 shows a p value of 0.000 indicating statistically significant relationship between LOS and Major OR Procedure. The Cramer's V is 0.437 and a Pearson's R correlation of 0.385
8. The table 93 shows there is a correlation between LOS and indication Major OR procedures on discharge record.
9. The table 94 shows a p value of 0.000 indicating statistically significant relationship between LOS and Payer Method. The Cramer's V is 0.059 and a Pearson's R correlation of 0.007
10. The table 95 shows there is a correlation between LOS and Payer Method on discharge record.
11. This table shows a p value of 0.000 indicating statistically significant relationship between LOS and Patient location based on population. The Cramer's V is 0.065
12. The table 96 shows there is a correlation between LOS and indication of patient location on discharge record.
13. This 97 table shows a p value of 0.000 indicating statistically significant relationship between LOS and Race. The Cramer's V is 0.079
14. The table 98 shows a weak correlation between LOS and Race of patient on discharge record.
15. This table 99 shows a p value of 0.000 indicating statistically significant relationship between LOS and Discharge Year. The Cramer's V is 0.084
16. The table 100 shows a weak correlation between LOS and Discharge Year of patient on discharge record
17. This table 101 shows a p value of 0.000 indicating statistically significant relationship between LOS and Median Household Income. The Cramer's V is 0.061
18. The table 102 shows a weak correlation between LOS and median household income of patient on discharge record.

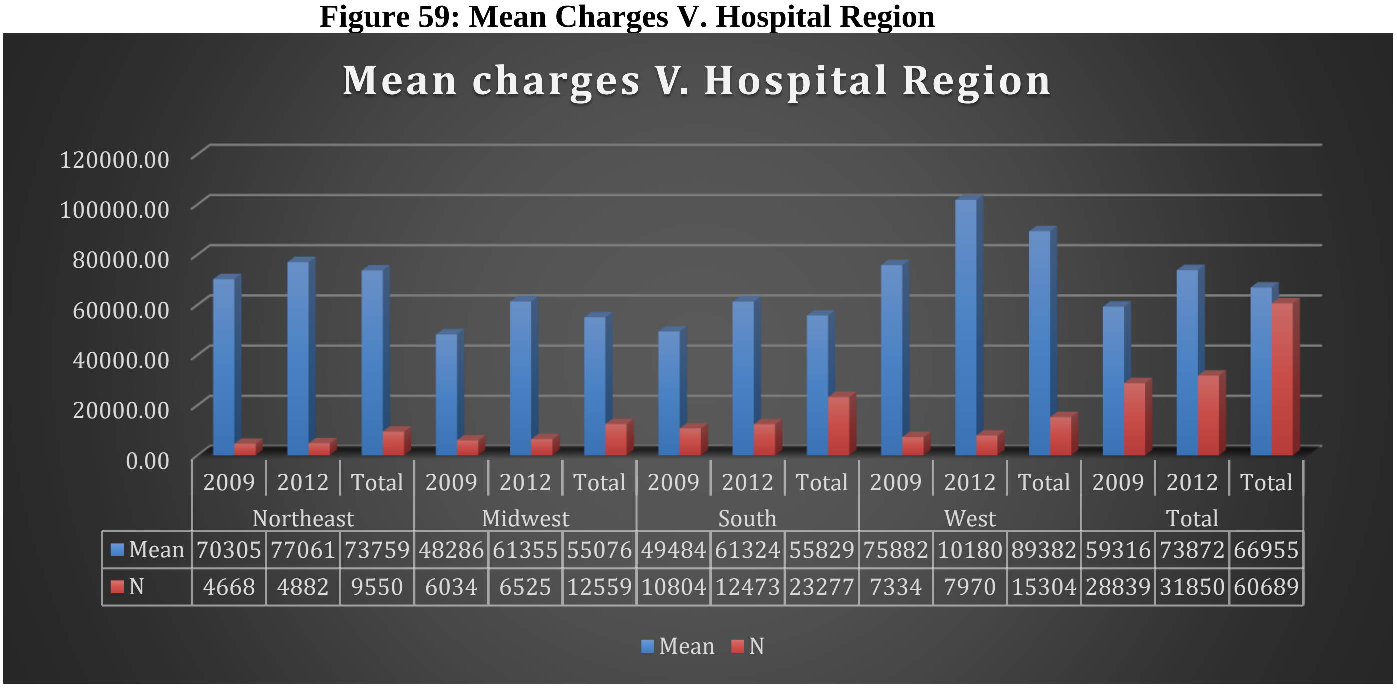
4.5 A: Relationships between Total Charges, Location, Bed size, Teaching capacity, Patient Income ZIP Code (ALL HOSPITAL DEMOGRAPHICS)

Correlations between Total Charges and Hospital Region

Table 90

Hospital Region	Discharge Year	Mean	N	Std. Deviation	% of Total N	% of Total Sum
Northeast	2009	70305.70	4668	132554.669	7.7%	8.1%
	2012	77061.65	4882	150359.668	8.0%	9.3%
	Total	73759.56	9550	141969.275	15.7%	17.3%
Midwest	2009	48286.02	6034	100722.269	9.9%	7.2%
	2012	61355.13	6525	157850.901	10.8%	9.9%
	Total	55076.07	12559	133645.014	20.7%	17.0%
South	2009	49484.62	10804	109872.890	17.8%	13.2%
	2012	61324.74	12473	166527.540	20.6%	18.8%
	Total	55829.17	23277	143168.400	38.4%	32.0%
West	2009	75882.92	7334	138458.333	12.1%	13.7%
	2012	101803.89	7970	249902.742	13.1%	20.0%
	Total	89382.08	15304	204635.185	25.2%	33.7%
Total	2009	59316.89	28839	120471.996	47.5%	42.1%
	2012	73872.49	31850	188002.423	52.5%	57.9%
	Total	66955.73	60689	159682.008	100.0%	100.0%

Figure 59: Mean Charges V. Hospital Region



The table 99 above shows the relationship and diversity in patient distribution, cost or total charges as well as the percentage of cost attributable to each region. The difference in charges could be associated with several factors including labor cost, pharmaceutical medications, hospital charges among many other direct or indirect factors.

Correlations

Table 91

		Hospital Region	Total Charges
Hospital Region	Pearson Correlation	1	.037**
	Sig. (2-tailed)		.000
	N	62338	60689
Total Charges	Pearson Correlation	.037**	1
	Sig	.000	
	N	60689	60689

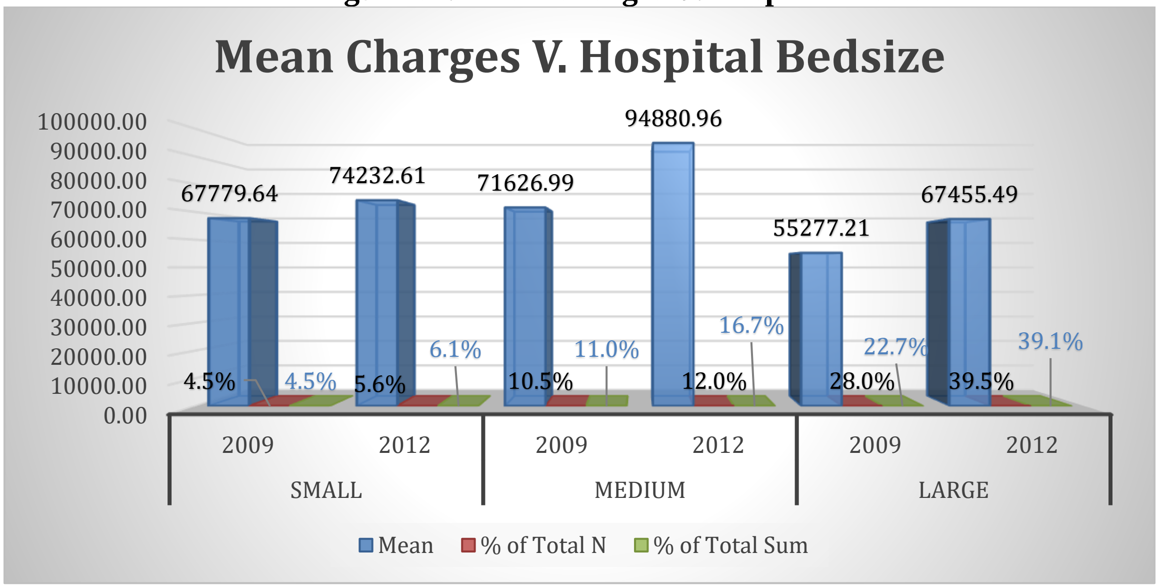
The table shows a p value of 0.037 indicating no statistical significance between the two variables. Pearson correlation for this relationship is 0.037.

Correlations between Total Charges and Hospital Bed Size

Table 92

Hospital Bedsize	Discharge Year	Mean	N	Std. Deviation	% of Total N	% of Total Sum	Sum
Small	2009	67779.64	2499	130110.227	4.5%	4.5%	169369393
	2012	74232.61	3121	220085.066	5.6%	6.1%	231656067
	Total	71363.17	5620	185556.490	10.1%	10.5%	401025460
Medium	2009	71626.99	5858	133353.185	10.5%	11.0%	419606519
	2012	94880.96	6681	237154.853	12.0%	16.7%	633905502
	Total	84016.96	12539	195975.477	22.5%	27.7%	1053512021
Large	2009	55277.21	15607	113494.133	28.0%	22.7%	862725292
	2012	67455.49	22048	164282.758	39.5%	39.1%	1487265220
	Total	62407.88	37655	145522.945	67.5%	61.8%	2349990512
Total	2009	60577.68	23964	120637.981	42.9%	38.2%	1451701204
	2012	73872.49	31850	188002.423	57.1%	61.8%	2352826789
	Total	68164.24	55814	162667.850	100.0%	100.0%	3804527993

Figure 60: Mean Charges V. Hospital Bedside



The above table shows that the population of leukemia patient significantly received medical care at large hospitals and the mean charges for these hospitals were relatively cheaper than small or medium sized hospitals. An observation of negative relationship could be made between hospital bed size and total charges.

Correlations

Table 93		Total Charges	Hospital Bedsize
Total Charges	Pearson Correlation	1	-.039**
	Sig. (2-tailed)		.000
	N	60689	55814
Hospital Bedsize	Pearson Correlation	-.039**	1
	Sig. (2-tailed)	.000	
	N	55814	57460

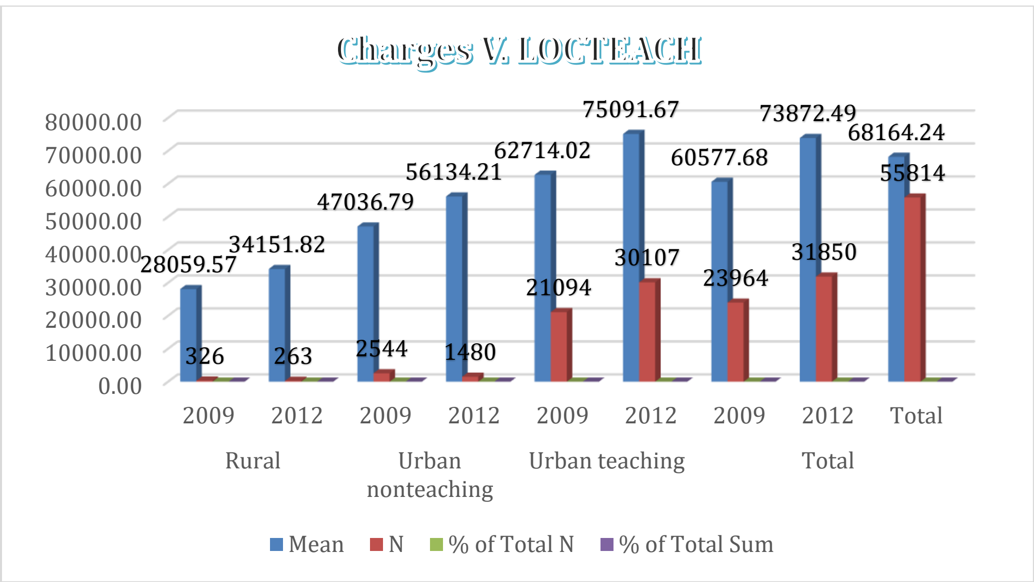
***. Correlation is significant at the 0.01 level (2-tailed).*

The table shows a statistically significant inverse relationship between charges and hospital bed size with a Spearman's Rho of -0.107 and Pearson's correlation of 0.039.

Table 94: Correlations between Total Charges and Hospital Location & Teaching Status

HOSP_LOCTEACH		*Mean*	*N*	*Std. Deviation*	*% of Total N*	*% of Total Sum*
Rural	2009	28059.57	326	90885.880	.6%	.2%
	2012	34151.82	263	63387.401	.5%	.2%
	Total	30779.36	589	79783.985	1.1%	.5%
Urban nonteaching	2009	47036.79	2544	84440.577	4.6%	3.1%
	2012	56134.21	1480	99837.660	2.7%	2.2%
	Total	50382.55	4025	90502.661	7.2%	5.3%
Urban teaching	2009	62714.02	21094	124515.301	37.8%	34.8%
	2012	75091.67	30107	191927.267	53.9%	59.4%
	Total	69992.30	51200	167583.721	91.7%	94.2%
Total	2009	60577.68	23964	120637.981	42.9%	38.2%
	2012	73872.49	31850	188002.423	57.1%	61.8%
	Total	68164.24	55814	162667.850	100.0%	100.0%

Figure 61: Charges V. Teaching location



The table above shows that many of the patients were treated at urban teaching hospital. An estimated more than 90 percent of the total population received care at urban teaching hospital; moreover, significant resource spent on leukemia were allocated for these facilities. One can come to the conclusion that teaching facilities seem to charge more and have more population relative to the low facilities in rural and resources available to no teaching facilities across the country.

Correlations

Table 95

			Total Charges	HOSP_LOCTEACH
Spearman's rho	Total Charges	Correlation Coefficient	1.000	.050**
		Sig. (2-tailed)		.000
		N	54465	48575
	HOSP_LOCTEACH	Correlation Coefficient	.050**	1.000
		Sig. (2-tailed)	.000	
		N	48575	49824

***. Correlation is significant at the 0.01 level (2-tailed).*

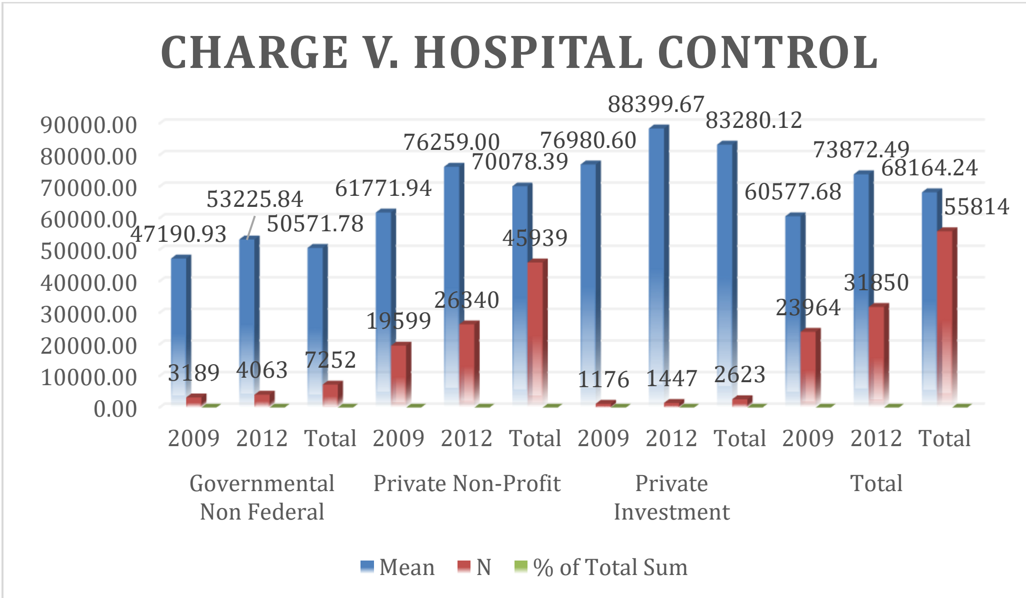
The table shows a statistically significant inverse relationship between charges and hospital bed size with a Spearman's Rho of -0.050 and Pearson's correlation of 0.039.

Table 96: Charges V Hospital Control

Hospital Control		*Mean*	*N*	*Std. Deviation*	*% of Total N*	*% of Total Sum*
Governmental Non Federal	2009	47190.93	3189	104928.310	5.7%	4.0%
	2012	53225.84	4063	127347.163	7.3%	5.7%
	Total	50571.78	7252	118043.745	13.0%	9.6%
Private Non-Profit	2009	61771.94	19599	121987.529	35.1%	31.8%
	2012	76259.00	26340	193547.776	47.2%	52.8%
	Total	70078.39	45939	166968.086	82.3%	84.6%
Private Investment	2009	76980.60	1176	133989.311	2.1%	2.4%
	2012	88399.67	1447	221516.077	2.6%	3.4%
	Total	83280.12	2623	187454.051	4.7%	5.7%
Total	2009	60577.68	23964	120637.981	42.9%	38.2%
	2012	73872.49	31850	188002.423	57.1%	61.8%
	Total	68164.24	55814	162667.850	100.0%	100.0%

Table 96 above shows the relationship between hospital charges and hospital control. An observation could be made that the average total charge for hospitals with governmental control were much less expensive compared to private or non-profits. The figure below further aid in gaining a better understanding of the relationship that exists between the variables and how they impact cost in general.

Figure 62: Charge V. Hospital Control



Correlations

Charges V. Hospital Control		*Table 97*	Total Charges	Hospital Control
Spearman's rho	Total Charges	Correlation Coefficient	1.000	.117**
		Sig. (2-tailed)		.000
		N	54465	48575
	Hospital Control	Correlation Coefficient	.117**	1.000
		Sig. (2-tailed)	.000	
		N	48575	49824

***. Correlation is significant at the 0.01 level (2-tailed).*

The table shows a statistically significant inverse relationship between charges and hospital bed size with a Spearman's Rho of 0.117 and Pearson's correlation of 0.045.

4.5 A: Relationships between Hospital ownership, Location, Bed size, Teaching Capacity, Patient Income ZIP (Sequential Regression)

Table 98A Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Hospital Region[b]		Enter
2	Hospital Bedsize[b]		Enter
	ospital Control[b]		Enter

sted variables entered.

This table shows the inclusion and exclusion of presentations between hospital ownership and hospital region

Table 98B Chi-Square Tests

Hospital Region		Value	df	Asymptotic Significance (2-sided)
Northeast	Pearson Chi-Square	5418.059[b]	4	0.000
	Likelihood Ratio	1867.636	4	0.000
	Linear-by-Linear Association	111.783	1	.000
	N of Valid Cases	9560		
Midwest	Pearson Chi-Square	1181.964[c]	4	.000
	Likelihood Ratio	1096.475	4	.000
	Linear-by-Linear Association	788.516	1	.000
	N of Valid Cases	12083		
South	Pearson Chi-Square	2223.529[d]	4	0.000
	Likelihood Ratio	2954.326	4	0.000
	Linear-by-Linear Association	380.012	1	.000
	N of Valid Cases	19383		
West	Pearson Chi-Square	855.151[e]	4	.000
	Likelihood Ratio	1046.697	4	.000
	Linear-by-Linear Association	272.655	1	.000
	N of Valid Cases	16437		
Total	Pearson Chi-Square	2715.858[a]	4	0.000
	Likelihood Ratio	3294.698	4	0.000

Linear-by-Linear Association	1324.540	1	.000
N of Valid Cases	57463		

The table 99 shows statistical significance between Hospital Control or Ownership and Hospital Region with a p value of 0.000 and degree of freedom of 4. Table 97 below also shows symmetric measures with a Cramer's V of 0.536, 0.221, 0.239 and 0.161 for Northeast, Midwest, South and West respectively.

Table 98C **Model Summary**[f]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.039[a]	.002	.002	162545.365	
2	.053[b]	.003	.003	162441.884	
3	.065[c]	.004	.004	162331.112	
4	.081[d]	.007	.007	162136.708	.[e]

a. Predictors: (Constant), Hospital Region
b. Predictors: (Constant), Hospital Region , Hospital Bedsize
c. Predictors: (Constant), Hospital Region , Hospital Bedsize, HOSP_LOCTEACH
d. Predictors: (Constant), Hospital Region , Hospital Bedsize, HOSP_LOCTEACH, Hospital Control
e. Not computed because fractional case weights have been found for the variable specified on the WEIGHT command.
f. Dependent Variable: Total Charges

This table shows that there is statistically significant difference between all the models. The analysis indicates that the introduction of each independent variable significantly improved the regression model. The coefficient of determination and goodness of fit increased with the introduction of each independent variable.

<u>Equations</u>

Block 1 Score = $B_0 + B_1$ * Total Charges + Ɛ

Block 2 Score = $B_0 + B_1$ * Total Charges + B_2 * Hosp. Bed size + Ɛ

Block 3 Score = $B_0 + B_1$ * Total Charges + B_2 * Hosp. Bed size + B_3 * Hosp. Loc + Ɛ

Block 2 Score = $B_0 + B_1$ * Total Charges + B_2 * Hosp. Bed size + B_3 * Hosp. Loc + B4* Hosp. Control + Ɛ

Table A ***ANOVA[a]***

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2249672270690.000	1	2249672270690.000	85.147	.000[b]
	Residual	1474612054255190.000	55812	26420995661.806		
	Total	1476861726525880.000	55813			
2	Regression	4153017721841.250	2	2076508860920.620	78.693	.000[c]
	Residual	1472708708804040.000	55811	26387365730.944		
	Total	1476861726525880.000	55813			
3	Regression	6187211171130.000	3	2062403723710.000	78.265	.000[d]
	Residual	1470674515354750.000	55810	26351390074.367		
	Total	1476861726525880.000	55813			
4	Regression	9733890105200.750	4	2433472526300.190	92.569	.000[e]
	Residual	1467127836420680.000	55809	26288312088.364		
	Total	1476861726525880.000	55813			

a. Dependent Variable: Total Charges

b. Predictors: (Constant), Hospital Region

c. Predictors: (Constant), Hospital Region , Hospital Bedsize

d. Predictors: (Constant), Hospital Region , Hospital Bedsize, HOSP_LOCTEACH

e. Predictors: (Constant), Hospital Region , Hospital Bedsize, HOSP_LOCTEACH, Hospital Control

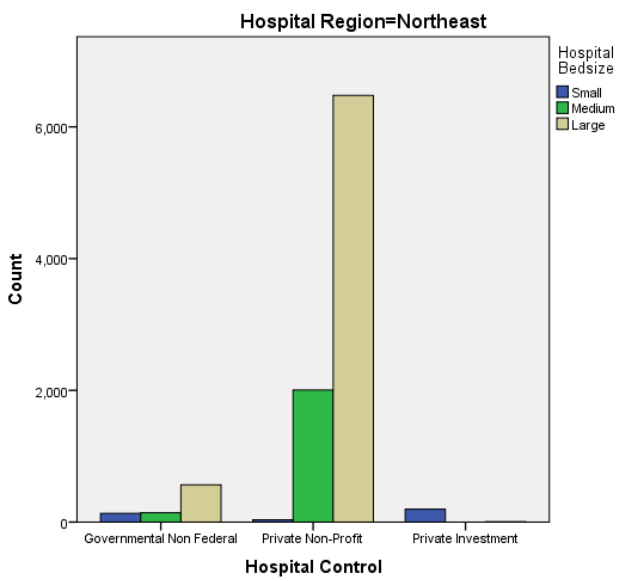


Figure 63: Shows the demographics of hospitals in the Northeast with differentiation from small, medium and large. It shows a significant numbers of facilities were medium and large for governmental control as well as Non-Profits.

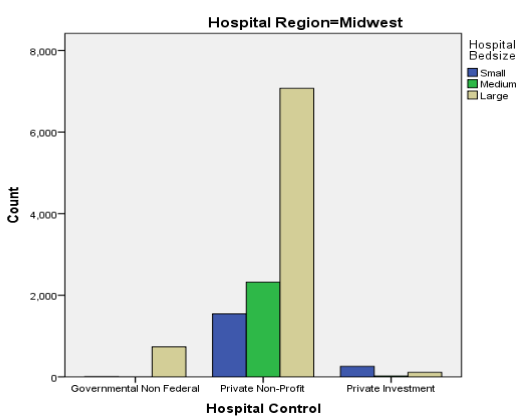


Figure 64: Shows the demographics of hospitals in the Midwest with differentiation from small, medium and large. It shows a significant numbers of facilities were medium and large for Private Non-Profits and very few governmental, private for profit facilities

The table 97 above shows that variations in each region and hospital characteristics impact the cost of care or charges. It also shows that these is statistical significance in this relationship. This information is relevant in understanding that factor affecting cost varies by region based on varieties of factors. The figures above & below provide detailed description of resource availability and their impact on funding. The data shows that more governmental & Investment large facilities compared to the figures above. Non-Profits make up majority of the facilities offering medical services. This figure shows that more governmental & Investment large facilities compared to the first two figures above. Non-Profits make up majority of the facilities offering medical services.

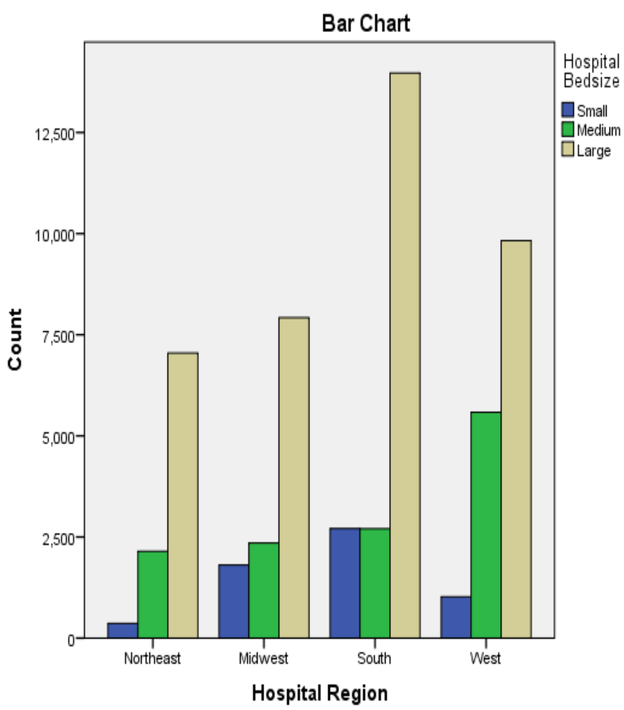


Figure 65: shows the number of hospitals for each hospital region in relation to bed size. Large facilities in the Southern part of the county are more than any other location. The West Coast had more medium sized facilities than the other areas. Northeastern part of the country has fewest number of all healthcare facility categories.

Table 98: Correlations between Hospital Controls by Region & Bedsize

The table shows the inclusion criteria of the total population with leukemia.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*Hospital Control * Hospital Region * Hospital Bedsize*	57463	92.2%	4875.297	7.8%	62338.297	100.0%

Table 99 ***Chi-Square Tests***

Hospital Bedsize		Value	df	Asymptotic Significance (2-sided)
Small	Pearson Chi-Square	3145.949[b]	6	0.000
	Likelihood Ratio	2026.055	6	0.000
	Linear-by-Linear Association	234.646	1	.000
	N of Valid Cases	5908		
Medium	Pearson Chi-Square	922.410[c]	6	.000
	Likelihood Ratio	812.272	6	.000
	Linear-by-Linear Association	37.790	1	.000
	N of Valid Cases	12787		
Large	Pearson Chi-Square	4540.902[d]	6	0.000
	Likelihood Ratio	4716.383	6	0.000
	Linear-by-Linear Association	58.866	1	.000
	N of Valid Cases	38768		
Total	Pearson Chi-Square	4043.354[a]	6	0.000
	Likelihood Ratio	3884.274	6	0.000

Linear-by-Linear Association	32.699	1	.000
N of Valid Cases	57463		

The table 98 shows statistical significance between Hospital Control or Ownership and Hospital Bed size with a p value of 0.000 and degree of freedom of 6. Table 99 below shows symmetric measures with a Cramer's V of 0.516, 0.190 and 0.242 for small, medium and large hospital bed size respectively. This finding supports the rationale that hospital size impacts the cost and their location is also directly related to this presentation.

Table 100 Symmetric Measures

Hospital Bedsize			Value	Asymptotic Standardized Error[a]	Approximate T[b]	Approximate Significance
Small	Nominal by Nominal	Phi	.730			0.000
		Cramer's V	.516			0.000
	Interval by Interval	Pearson's R	-.199	.021	-15.630	.000[c]
	Ordinal by Ordinal	Spearman Correlation	-.214	.018	-16.846	.000[c]
	N of Valid Cases		5908			
Medium	Nominal by Nominal	Phi	.269			.000
		Cramer's V	.190			.000
	Interval by Interval	Pearson's R	.054	.008	6.156	.000[c]
	Ordinal by Ordinal	Spearman Correlation	.033	.008	3.687	.000[c]
	N of Valid Cases		12787			
Large	Nominal by Nominal	Phi	.342			0.000
		Cramer's V	.242			0.000
	Interval by Interval	Pearson's R	-.039	.004	-7.678	.000[c]
	Ordinal by Ordinal	Spearman Correlation	-.042	.004	-8.327	.000[c]
	N of Valid Cases		38768			
Total	Nominal by Nominal	Phi	.265			0.000
		Cramer's V	.188			0.000

Interval by Interval	Pearson's R	-.024	.003	-5.720	.000[c]
Ordinal by Ordinal	Spearman Correlation	-.024	.003	-5.693	.000[c]
N of Valid Cases		57463			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

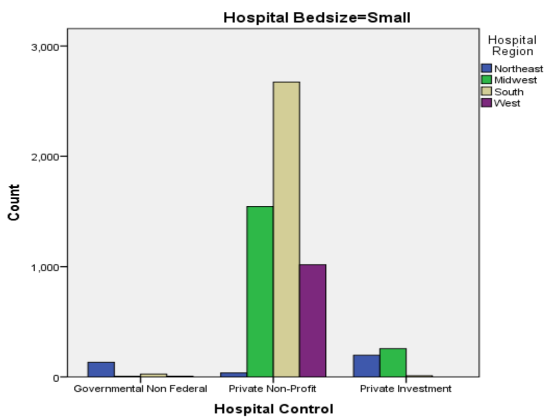


Figure 66: shows the number of small sized hospitals for each hospital region in relation to bed size. One could observe that significant majority of the facilities were private for non-profits. Highest number of facilities in the southern parts of the U.S. Governmental facilities are almost nonexistent in this category

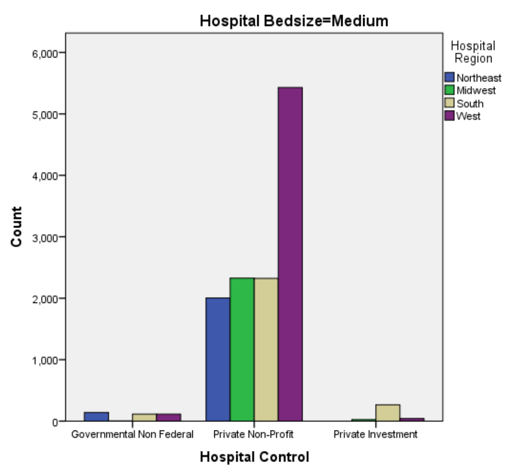


Figure 67: shows the number of small sized hospitals for each hospital region in relation to bed size. One could observe that significant majority of the facilities were private for non-profits. Highest numbers of facilities are located in the Western part of the U.S. Governmental facilities are almost nonexistent in this category.

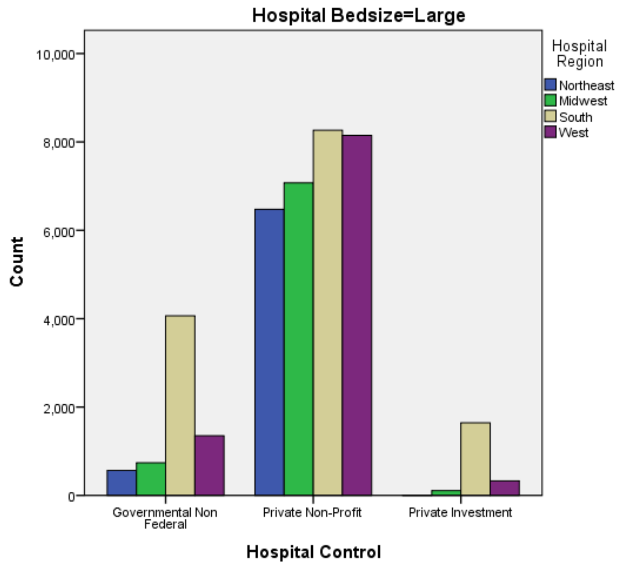


Figure 68: shows the number of small sized hospitals for each hospital region in relation to bed size. One could observe that significant majority of the facilities were private for non-profits. Compared to charts above this shows more diversity in facility ownership for governmental and private investments even though significant majority of facilities are Private Non-Profit.

Table 101: Correlations between Hospital Controls by Region & Teaching

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*Hospital Control * Hospital Region * HOSP_LOCTEACH*	57458	92.2%	4880.297	7.8%	62338.297	100.0%

Table 102 Chi-Square Tests

HOSP_LOCTEACH		Value	df	Asymptotic Significance (2-sided)
Rural	Pearson Chi-Square	177.370[b]	6	.000
	Likelihood Ratio	178.276	6	.000
	Linear-by-Linear Association	17.473	1	.000
	N of Valid Cases	588		
Urban nonteaching	Pearson Chi-Square	1541.920[c]	6	0.000
	Likelihood Ratio	1711.222	6	0.000
	Linear-by-Linear Association	36.883	1	.000
	N of Valid Cases	4134		
Urban teaching	Pearson Chi-Square	2349.210[d]	6	0.000
	Likelihood Ratio	2258.361	6	0.000
	Linear-by-Linear Association	113.545	1	.000

	N of Valid Cases	52736		
Total	Pearson Chi-Square	4044.590[a]	6	0.000
	Likelihood Ratio	3885.654	6	0.000
	Linear-by-Linear Association	32.693	1	.000
	N of Valid Cases	57458		

Table 102 shows statistical significance between the hospital variables. Table 103 below provides the strength of the association between the variable with a Cramer's V of 0.388, 0.432 and 0.149 representing rural, urban non-teaching and urban teaching facilities respectively.

Table 103 ***Symmetric Measures***

HOSP_LOCTEACH			Value	Asymptotic Standardized Error[a]	Approximate T[b]	Approximate Significance
Rural	Nominal by Nominal	Phi	.549			.000
		Cramer's V	.388			.000
	Interval by Interval	Pearson's R	-.173	.058	-4.240	.000[c]
	Ordinal by Ordinal	Spearman Correlation	-.186	.054	-4.595	.000[c]
	N of Valid Cases		588			
Urban nonteaching	Nominal by Nominal	Phi	.611			0.000
		Cramer's V	.432			0.000
	Interval by Interval	Pearson's R	-.094	.010	-6.100	.000[c]
	Ordinal by Ordinal	Spearman Correlation	-.152	.012	-9.903	.000[c]
	N of Valid Cases		4134			
Urban teaching	Nominal by Nominal	Phi	.211			0.000
		Cramer's V	.149			0.000
	Interval by Interval	Pearson's R	-.046	.004	-10.667	.000[c]
	Ordinal by Ordinal	Spearman Correlation	-.042	.004	-9.717	.000[c]
	N of Valid Cases		52736			
Total	Nominal by Nominal	Phi	.265			0.000
		Cramer's V	.188			0.000

Interval by Interval	Pearson's R	-.024	.003	-5.719	.000[c]
Ordinal by Ordinal	Spearman Correlation	-.024	.003	-5.692	.000[c]
N of Valid Cases		57458			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

The hospital control by region in relation to teaching or non-teaching categorization. One could observe that significant majority of the **Rural facilities** were private for non-profits in the Northeast and Midwest. South and West have a small population of rural facilities for all hospital control categories. The figure shows high numbers of private investment facilities in the South and very minimal in West and Midwest. Non Profit facilities were high in West, South and Midwest. The governmental facilities are very minimal in comparison to the other two categories. Private Non-Profit organizations make up a significant majority of facilities categorized as teaching in all regions. Governmental Non Federal affiliated teaching hospitals are highest in the South. Private investment are minimal in this category compare the first two categories. This shows the proportion of each category. Urban teaching facilities make up a significant majority of the population in all hospital control subsets. Teaching facilities make up more than 2 times other facilities combined.

Correlations between Hospital Ownership by Region, Year & Patient Disposition

Statistical significance between the variables for both discharge years. The strength of the association between the variable with a Cramer's V of 0.084 & 0.096 for 2009 and 2012 respectively. This supports the notion that cost has been increasing and astronomically when various approaches to treatment have been factored.

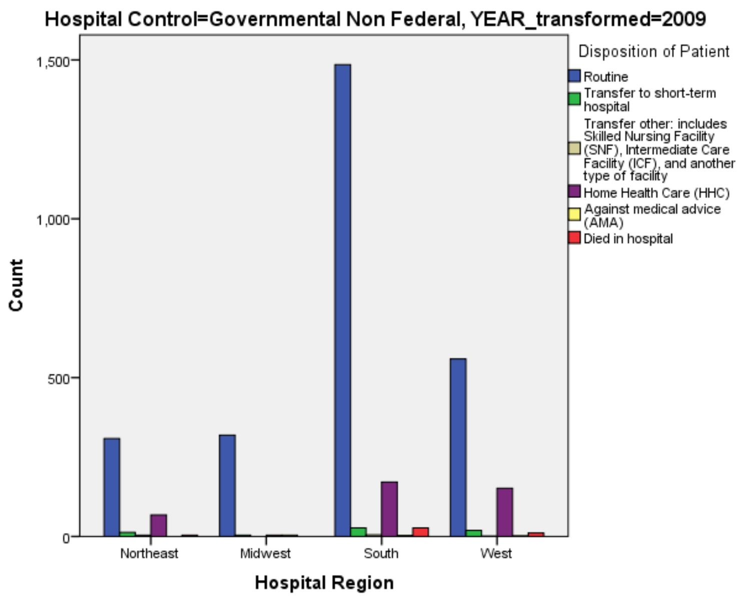


Figure 69: This graph shows patients disposition for 2009 by region. Majority of patients were routine transfer out of inpatient care in all hospital regions. Second subset of these population were transferred to Home Health Care. Small numbers were reported as dead during care on the South and West regions.

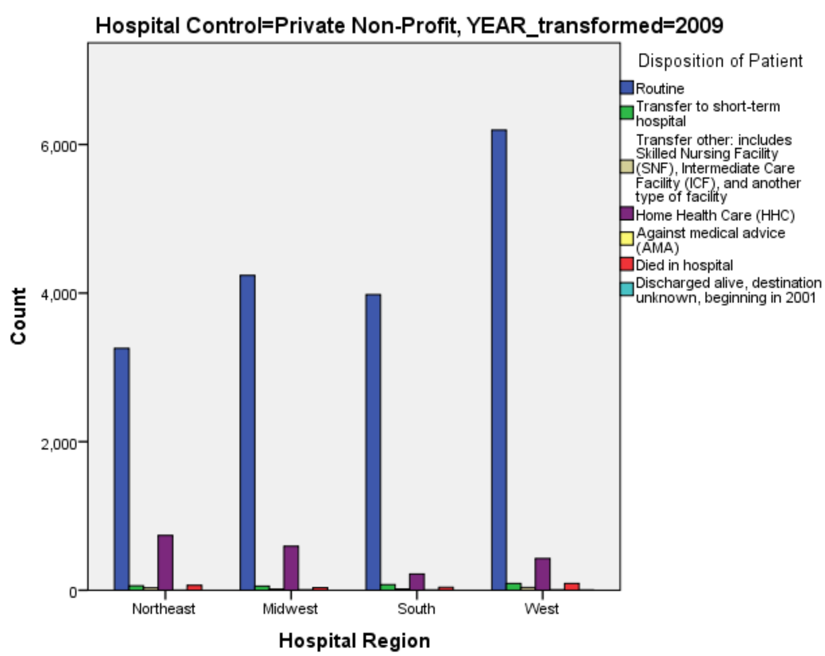


Figure 70: This chart shows patients disposition for 2009 by region. Majority of patients were routine transfer out of inpatient care in all hospital regions. Second subset of these population were transferred to Home Health Care with highest

transfer in the Northeast.

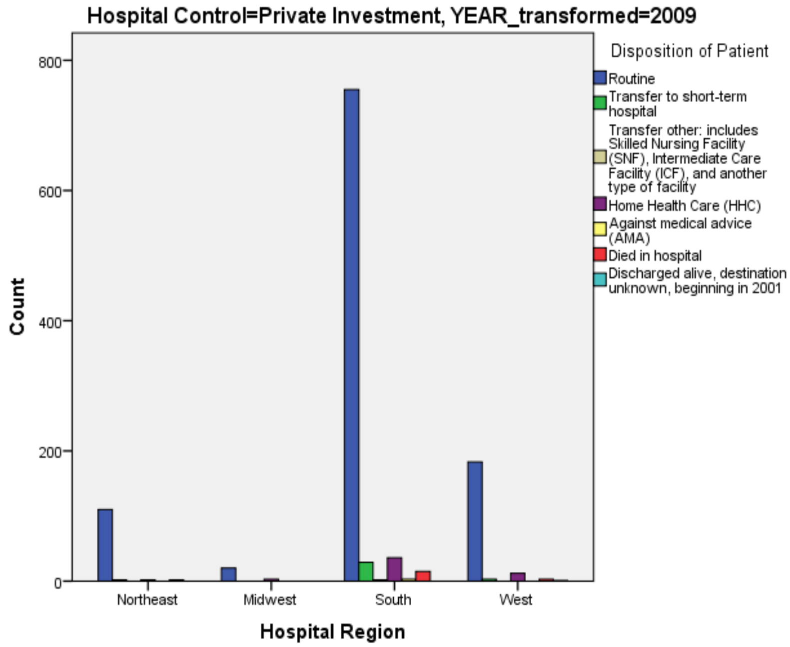


Figure 71: This chart shows patients disposition for 2009 by region. Majority of patients were routine transfer out of inpatient care in all hospital regions. Second subset of these population were transferred to Home Health Care with highest transfer in the South and West. Smaller population subset were reported as died during care.

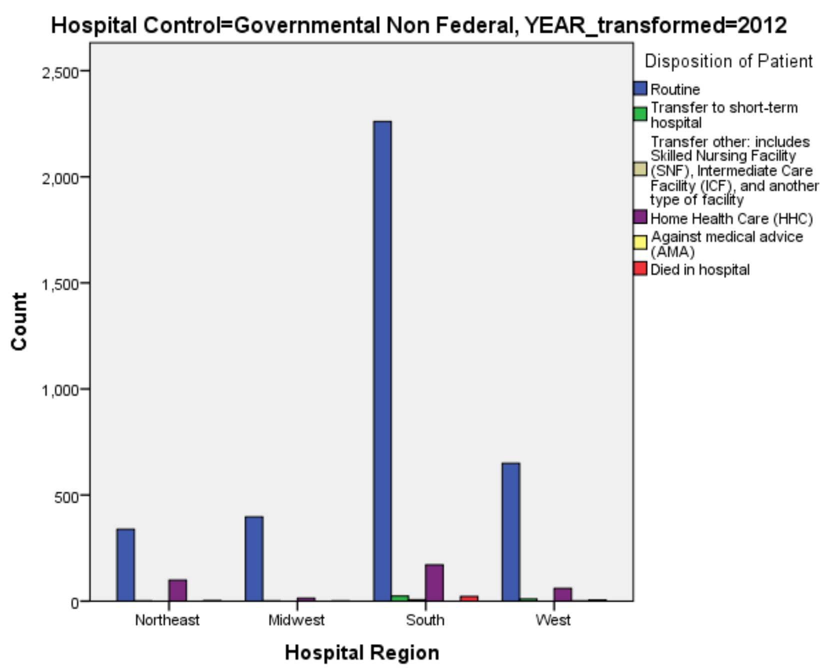


Figure 72: This chart shows patients disposition for 2009 by region. Majority of patients were routine transfer out of inpatient care in all hospital regions with highest frequency in the South. Second subset of these population were transferred to Home Health Care. Some deaths were recorded in all regions as well.

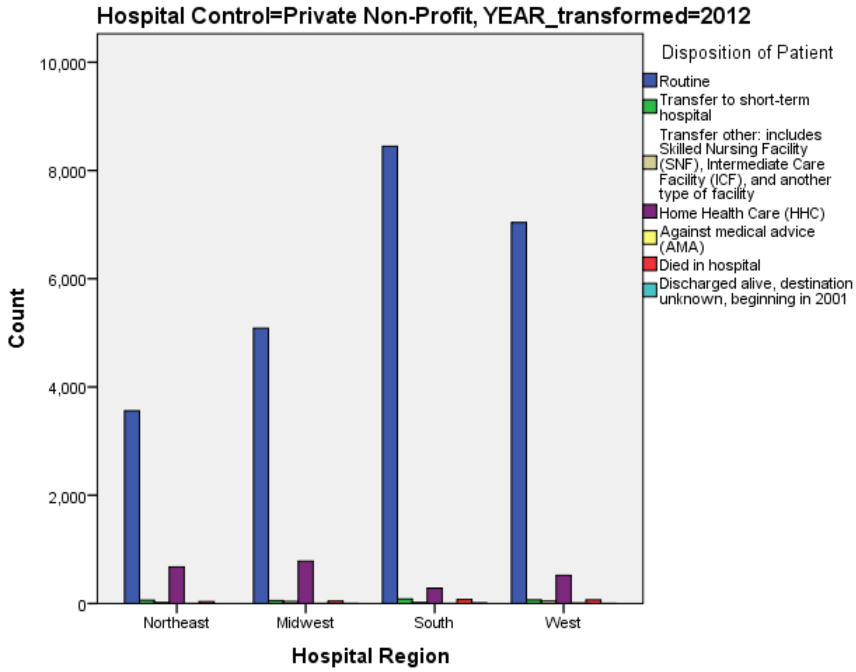


Figure 73: The chart shows significant routine transfer for all regions with highest frequency in the South. Home Health's frequency was more prevalent in the Midwest Northeast and West.

Routine transfer out of impatient care was predominant followed by Home Health and transfer to short term facilities particularly in the South as seen also in the charts above. These shows statistical significance between payment methods, Hospital control and region with a p value of 0.000 for all ownership or control subsets. The strength of association verified with Cramer's V is 0.127 and 0.123 for 2009 and 2012 respectively. Medicaid and Private Payment methods is high in all regions but more profound in the South. Other (Workers compensation, Indian health Service) are also present in the South and West. Medicaid and Private Payment methods is high in all regions but more profound in the South. Other (Workers compensation, Indian health Service) are also present in the South and West. South had more presentations & majority payment mode was Medicaid and private HMO's. The presentation for other regions were less than 200.

Correlations between Hospital Ownership by Region, Year & Patient location

Case Processing Summary

Table 104	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*Hospital Region * Patient Location * Hospital Control*	56388	90.5%	5950.297	9.5%	62338.297	100.0%

Chi-Square Tests

Table 105	*Hospital Control*	Value	df	Asymptotic Significance (2-sided)
Governmental Non Federal	Pearson Chi-Square	980.941[b]	15	.000
	Likelihood Ratio	947.505	15	.000
	Linear-by-Linear Association	58.706	1	.000
	N of Valid	7109		
Private Non-Profit	Pearson Chi-Square	5408.910[c]	15	0.000
	Likelihood Ratio	5499.168	15	0.000
	Linear-by-Linear Association	364.077	1	.000
	N of Valid	46395		
Private Investment	Pearson Chi-Square	602.601[d]	15	.000
	Likelihood Ratio	662.975	15	.000
	Linear-by-Linear Association	47.422	1	.000
	N of Valid	2884		
Total	Pearson Chi-Square	6333.029[a]	15	0.000
	Likelihood Ratio	6329.504	15	0.000
	Linear-by-Linear Association	333.646	1	.000
	N of Valid Cases	56388		

This table shows statistical significance between hospital control, region and patient location. The strength of association is further depicted with a Cramer's V of 0.214, 0.197 & 0.264 for Governmental, Private Non-Profit and Private investment respectively.

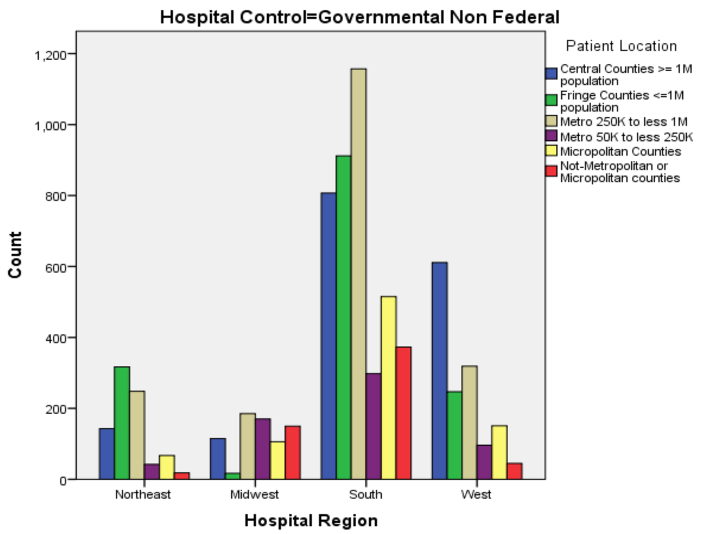


Figure 74: This figure shows the diversity of patient population based on location density classified as rural or urban. Majority of patients were from Fringe, Central and metropolitan areas in all regions. Patients from Micropolitan counties were more prevalent in the South compared to other regions.

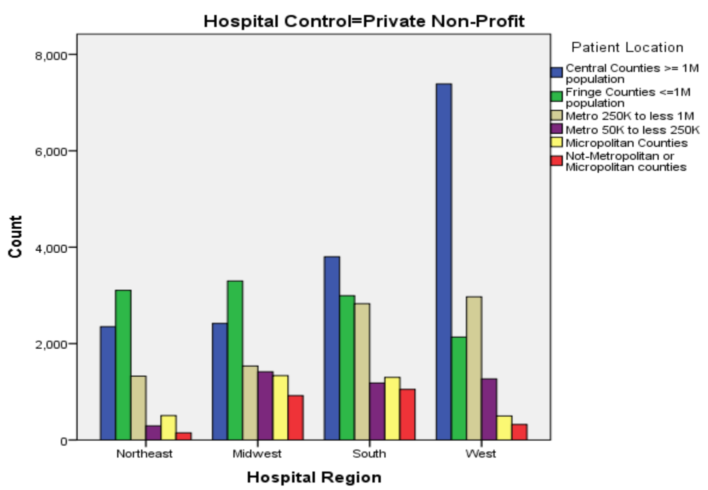


Figure 75: This figure shows the diversity of patient population based on location density classified as rural or urban. Majority of patients were from Central Counties with a population > 1Million in the South and West. Patients from Fringe Counties (<1M) were more prevalent in the Midwest and Northeast.

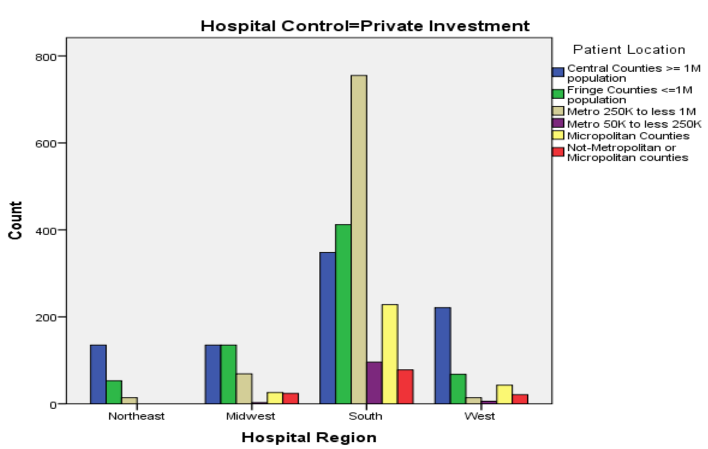


Figure 76: Metro areas, Central and Fringe with > 250K population were most ubiquitous in the South. Micropolitan patient presented at private facilities in the South Midwest and West.

Correlations between Hospital Ownership by Region, Year & Race

Case Processing Summary

Table 106	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*Hospital Region * Race or Ethnicity * Hospital Control*	51447	82.5%	10891.297	17.5%	62338.297	100.0%

Chi-Square Tests

Table 107 Hospital Control		Value	df	Asymptotic Significance (2-sided)
Governmental Non Federal	Pearson Chi-Square	592.636[b]	15	.000
	Likelihood Ratio	613.080	15	.000
	Linear-by-Linear Association	116.025	1	.000
	N of Valid	6695		
Private Non-Profit	Pearson Chi-Square	5562.920[c]	15	0.000
	Likelihood Ratio	5687.787	15	0.000
	Linear-by-Linear	1469.190	1	0.000
	N of Valid	41885		
Private Investment	Pearson Chi-Square	359.441[d]	15	.000
	Likelihood Ratio	374.330	15	.000
	Linear-by-Linear	11.100	1	.001
	N of Valid	2867		
Total	Pearson Chi-Square	5952.170[a]	15	0.000
	Likelihood Ratio	6139.301	15	0.000
	Linear-by-Linear Association	1589.012	1	0.000
	N of Valid	51447		

This table shows statistical significance between hospital control and race with a p value of 0.000 and a df of 14 for Chi-square and Likelihood ratio. The degree of association as measured by Cramer's V is 0.172, 0.210 and 0.204 for Governmental, Non-profits and Private investment respectively.

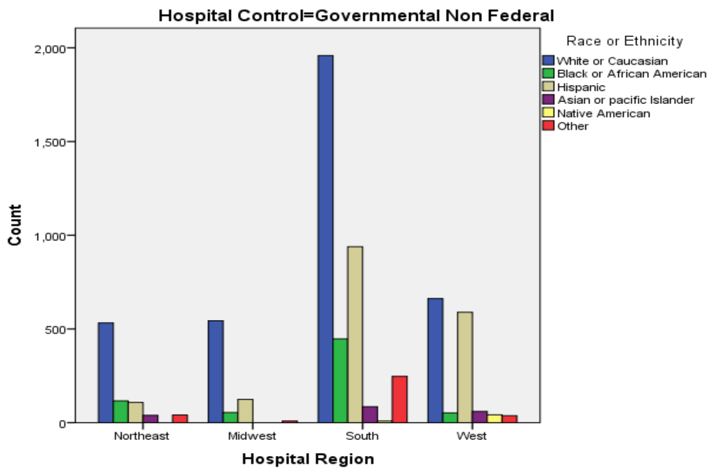


Figure 77: This figure shows that significant majority of patients were Caucasian followed by Hispanics and Black or African American with more cases in the South than any other region.

The Number of Hispanic patients were highest in the Midwest and White/Caucasian patients high in all other regions. Analysis shows a higher Hispanic patient population in the South at private investment facilities

Correlations between Hospital Ownership by Region, Year & Median Household Income

Case Processing Summary

Table 108	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*Hospital Region * Median household income for patient's ZIP Code * Hospital Control*	56220	90.2%	6118.297	9.8%	62338.297	100.0%

Chi-Square Tests

Table 109 Hospital Control		Value	df	Asymptotic Significance (2-sided)
Governmental Non Federal	Pearson Chi-Squ	456.652[b]	9	.000
	Likelihood	473.272	9	.000
	Linear-by-Linear Ass	33.302	1	.000
	N of Valid	6925		
Private Non-Profit	Pearson Chi-Squ	2222.398[c]	9	0.000
	Likelihood	2135.750	9	0.000
	Linear-by-Linear Ass	85.802	1	.000
	N of Valid	46457		
Private Investment	Pearson Chi-Squa	194.726[d]	9	.000
	Likelihood	198.420	9	.000
	Linear-by-Linear Ass	8.144	1	.004
	N of Valid	2838		
Total	Pearson Chi-Sq	3149.770[a]	9	0.000
	Likelihood	3041.400	9	0.000
	Linear-by-Linear Ass	147.352	1	.000
	N of Valid	56220		

This table shows statistical significance with a df of 9 for all subsets. The association degree with a Cramer's V of 0.148, 0.126 & 0.151 for Governmental, Non-profit and Private investment. It shows variance in strength of association as well as certain affinity resource availability.

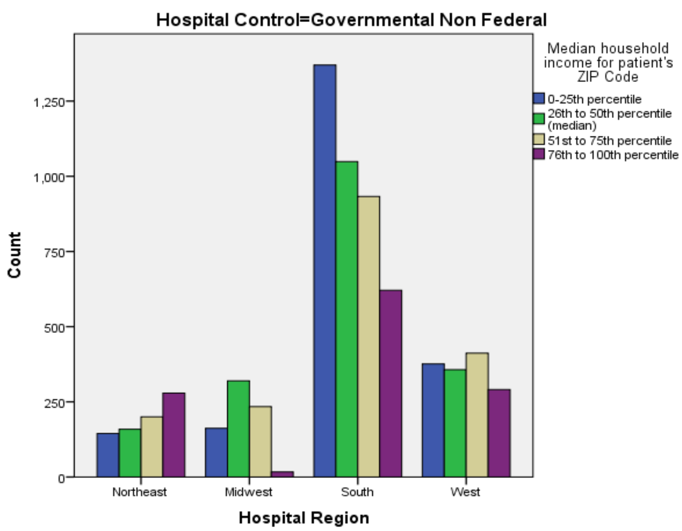


Figure 78: This figure shows the income of majority of patients in the South was less than $40,000. The second and third most prevalent income levels were less than $50,000 and $60,000 respectively.

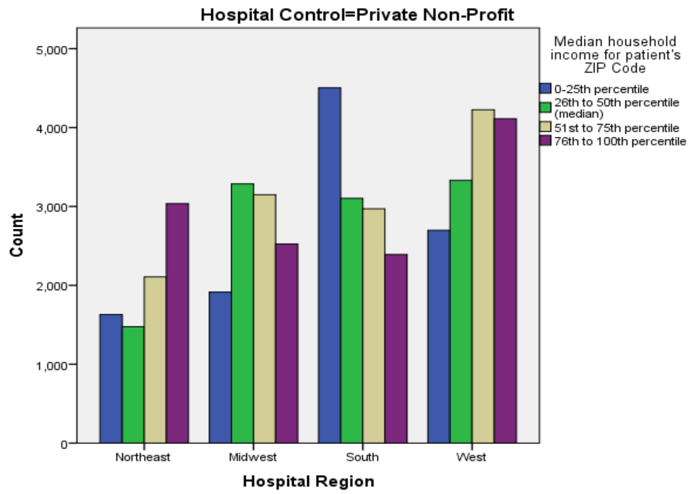


Figure 79: This figure shows a more even distribution of income compared to figure 59 above. Northeast shows a higher income patient population (>65,000) with similar presentation in the West. The South show more low income patients consistent with the above figure.

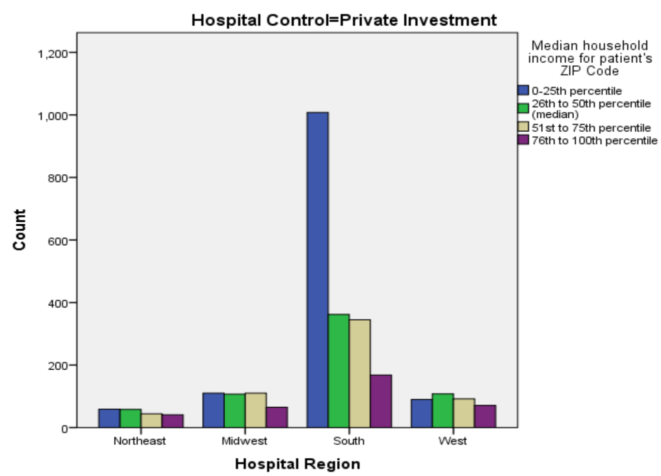


Figure 80: This shows patients with low income mainly received care from private investment healthcare organizations in the South. Northeast shows lowest population receiving care at for profit centers.

Correlations between Hospital Ownership by Region, Severity

Case Processing Summary

Table 110	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*Hospital Region * All Patient Refined DRG: Severity of Illness Subclass * Hospital Control*	54725	87.8%	7613.297	12.2%	62338.297	100.0%

Table 111 ***Chi-Square Tests***

Hospital Control	Value	df	Asymptotic Significance (2-sided)

Governmental Non Federal	Pearson Chi-Sq	30.634[b]	12	.002
	Likelihood	31.385	12	.002
	Linear-by-Linear Ass	.355	1	.551
	N of Valid	7030		
Private Non-Profit	Pearson Chi-Sq	43.378[c]	12	.000
	Likelihood	43.521	12	.000
	Linear-by-Linear	2.560	1	.110
	N of Valid	44818		
Private Investment	Pearson Chi-Sq	19.923[d]	12	.069
	Likelihood	11.206	12	.511
	Linear-by-Linear Ass	.391	1	.532
	N of Valid	2877		
Total	Pearson Chi-Sq	70.874[a]	12	.000
	Likelihood	70.931	12	.000
	Linear-by-Linear	2.638	1	.104
	N of Valid	54725		

This table shows statistical significance for the relationship with a p value of 0.002. The Cramer's V for this relationship is 0.038, 0.018 and 0.048 for governmental, non-profit and private for profit hospitals.

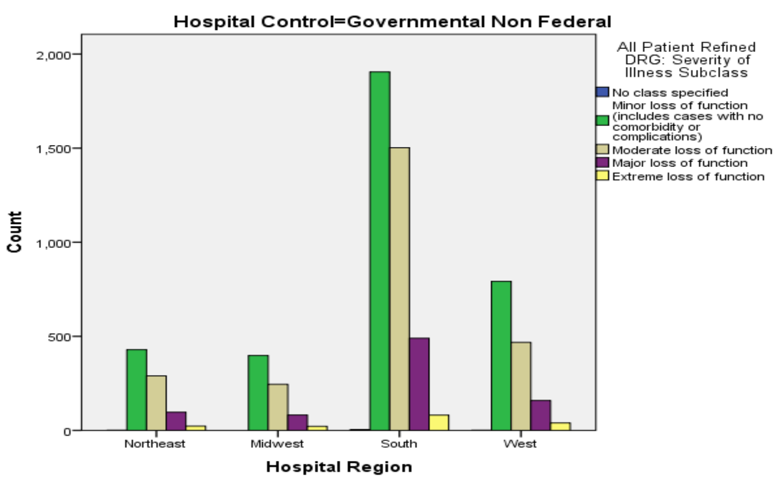


Figure 81: shows high number of patients that received care at governmental facilities had minor function loss for all regions.

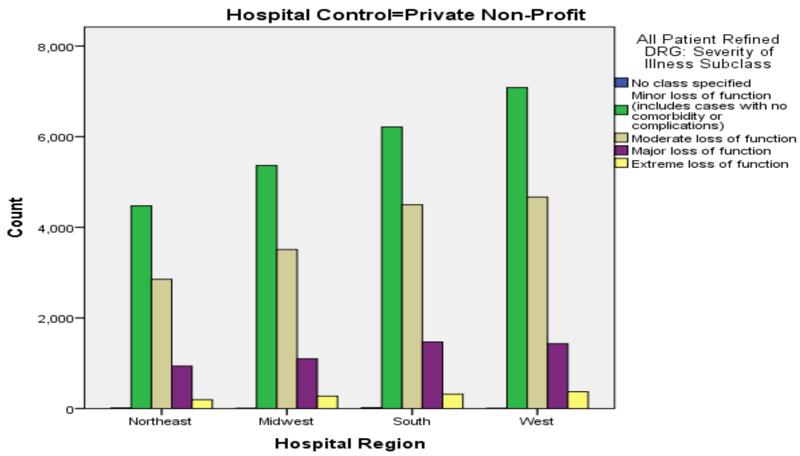


Figure 82: Shows an almost identical patient population dispersion over region. Major and extreme loss of function were the minimal in relation to presentation at non-profit facilities.

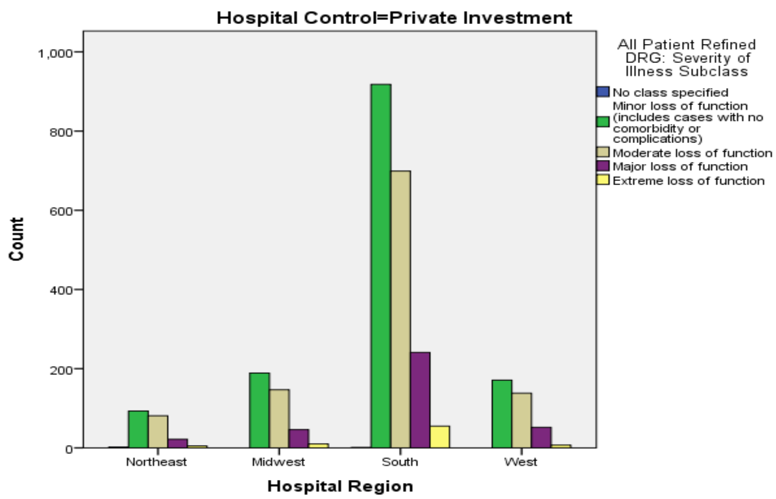


Figure 83: Shows minor and moderate loss of function highest in the South compared to other regions.

Correlations between Hospital Ownership by Region, Mortality

Case Processing Summary

Table 112	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*Hospital Region * All Patient Refined DRG: Risk of Mortality Subclass * Hospital Control*	54722	87.8%	7616.297	12.2%	62338.297	100.0%

Table 113 ***Chi-Square Tests***

Hospital Control	Value	df	Asymptotic Significance (2-sided)

Governmental Non Federal	Pearson Chi-Square	24.127[b]	12	.020
	Likelihood Ratio	26.278	12	.010
	Linear-by-Linear Ass	2.819	1	.093
	N of Valid	7029		
Private Non-Profit	Pearson Chi-Square	100.098[c]	12	.000
	Likelihood Ratio	102.076	12	.000
	Linear-by-Linear Ass	16.653	1	.000
	N of Valid	44818		
Private Investment	Pearson Chi-Square	29.009[d]	12	.004
	Likelihood Ratio	22.532	12	.032
	Linear-by-Linear Ass	2.057	1	.151
	N of Valid	2875		
Total	Pearson Chi-Sq	119.965[a]	12	.000
	Likelihood Ratio	123.097	12	.000
	Linear-by-Linear Ass	21.292	1	.000
	N of Valid	54722		

This Table shows that there is no statistical significance for the variable subset in Governmental. Moreover, there is statistical significance for Private Non-Profit with a p value of 0.000 and 0.002 for nonprofit and investment respectively. The Cramer's V for these population was 0.034, 0.027 and 0.058.

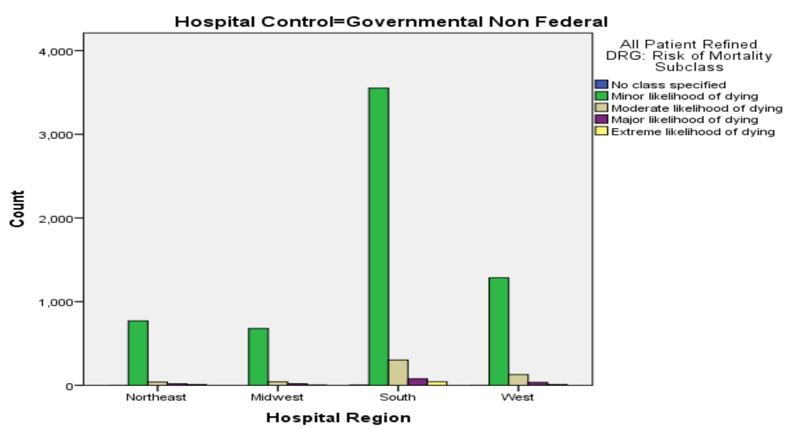


Figure 84: Majority of patients that presented in an inpatient setting had minor likelihood of death in all regions.

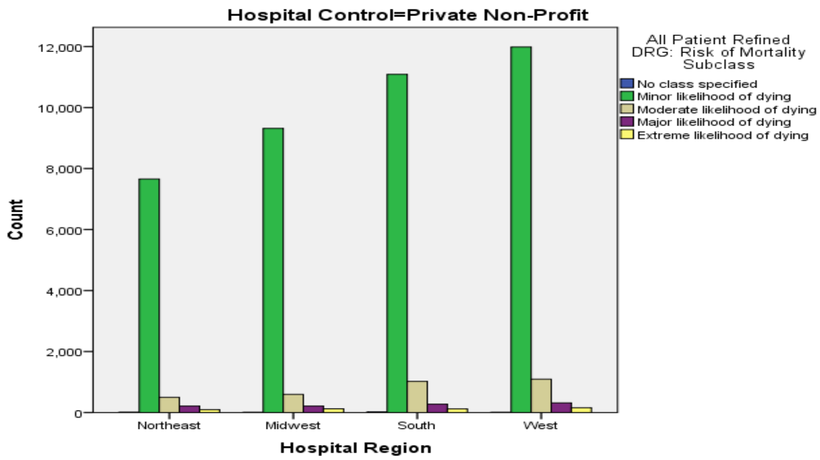


Figure 85: Majority of patients that presented in an inpatient setting had minor likelihood of death in all regions.

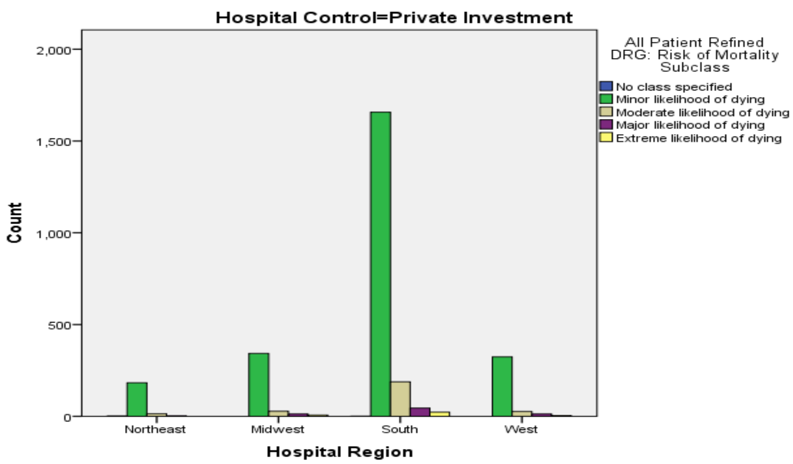


Figure 86: Majority of patients that presented in an inpatient setting had minor likelihood of death in all regions.

4.5 R: Regression between Hospital Ownership & other Characteristics

Table 114 Case Processing Summary

		N	Marginal Percentage
Hospital Control	Governmental Non Federal	5673	13.1%
	Private Non-Profit	35375	81.6%
	Private Investment	2320	5.3%
Hospital Region	Northeast	8239	19.0%
	Midwest	8143	18.8%
	South	13452	31.0%
	West	13533	31.2%
Hospital Bedsize	Small	3723	8.6%
	Medium	10560	24.4%
	Large	29085	67.1%
HOSP_LOCTEACH	Rural	480	1.1%

	Urban nonteaching	2827	6.5%
	Urban teaching	40061	92.4%
Valid		43367	100.0%
Missing		18971	
Total		62338	
Subpopulation		30015[a]	

a. The dependent variable has only one value observed in 30015 (100.0%) subpopulations.

Table 115 Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	51075.964			
Final	41469.481	9606.483	48	0.000

This table shows the statistical significance of the 0.000. More over the Person goodness of fit test has a p value of 0.000. The Pseudo R squared for this regression is 0.287(Nagelkerke). The variation of Hospital control is 26 percent explained by the independent variables.

Table 116 Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	97511.244	59980	0.000
Deviance	41469.481	59980	1.000

Table 117 Likelihood Ratio Tests

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	41469.481[a]	0.000	0	
AGE	41523.642	54.161	2	.000
AMONTH	41470.412	.931	2	.628

DISPUNIFORM	41500.398	30.917	2	.000
DQTR	41469.658	.177	2	.915
ELECTIVE	41475.406	5.925	2	.052
FEMALE	41474.808	5.327	2	.070
LOS	41542.940	73.460	2	.000
PAY1	41508.274	38.794	2	.000
PL_NCHS2006	41754.186	284.705	2	.000
ORPROC	41481.452	11.972	2	.003
NPR	41528.484	59.003	2	.000
RACE	41531.100	61.619	2	.000
TOTCHG	41743.714	274.234	2	.000
YEAR	41545.898	76.417	2	.000
ZIPINC_QRTL	41613.355	143.874	2	.000
APRDRG_Risk_Mortality	41472.663	3.182	2	.204
APRDRG_Severity	41475.305	5.825	2	.054
HOSP_REGION	43624.314	2154.833	6	0.000
HOSP_BEDSIZE	43641.263	2171.782	4	0.000
HOSP_LOCTEACH	44286.095	2816.614	4	0.000

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.
a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

This table shows the likelihood ratios, chi-square, df and p values for the factors as well as covariates being considered in this regression model.

Table 118 ***Parameter Estimates***

Hospital Control[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Boun	Upper Boun
Governmental Non Federal	Intercept	-163.554	41.296	15.686	1	.000			
	AGE	.006	.005	1.358	1	.244	1.006	.996	1.015
	AMONTH	.014	.019	.604	1	.437	1.015	.978	1.052
	DISPUNIFORM	.041	.012	12.485	1	.000	1.042	1.018	1.066
	DQTR	.014	.057	.057	1	.811	1.014	.906	1.134
	ELECTIVE	-.007	.060	.015	1	.901	.993	.883	1.116
	FEMALE	.040	.057	.497	1	.481	1.041	.931	1.163

	LOS	.039	.005	56.689	1	.000	1.040	1.030	1.051
	PAY1	.125	.031	16.047	1	.000	1.134	1.066	1.205
	PL_NCHS2006	.190	.020	86.723	1	.000	1.209	1.162	1.259
	ORPROC	.044	.147	.089	1	.766	1.045	.784	1.393
	NPR	.093	.013	48.361	1	.000	1.097	1.069	1.127
	RACE	-.135	.021	40.446	1	.000	.874	.838	.911
	TOTCHG	.000	.000	220.628	1	.000	1.000	1.000	1.000
	YEAR	.082	.021	15.944	1	.000	1.085	1.043	1.130
	ZIPINC_QRTL	.259	.028	85.933	1	.000	1.295	1.226	1.368
	APRDRG_Risk_Mortality	-.084	.067	1.578	1	.209	.919	.806	1.048
	APRDRG_Severity	-.004	.043	.007	1	.933	.996	.917	1.083
	[HOSP_REGION=1]	-1.147	.109	110.770	1	.000	.318	.257	.393
	[HOSP_REGION=2]	-.568	.120	22.356	1	.000	.567	.448	.717
	[HOSP_REGION=3]	-1.325	.079	281.864	1	.000	.266	.228	.310
	[HOSP_REGION=4]	0[b]			0				
	[HOSP_BEDSIZE=1]	-1.755	.116	230.602	1	.000	.173	.138	.217
	[HOSP_BEDSIZE=2]	-1.020	.095	115.388	1	.000	.361	.299	.434
	[HOSP_BEDSIZE=3]	0[b]			0				
	[HOSP_LOCTEACH=1]	-1.168	.297	15.450	1	.000	.311	.174	.557
	[HOSP_LOCTEACH=2]	-3.530	.090	1525.794	1	0.000	.029	.025	.035
	[HOSP_LOCTEACH=3]	0[b]			0				
Private Non-Profit	Intercept	-279.647	37.289	56.242	1	.000			
	AGE	-.013	.004	9.141	1	.002	.987	.978	.995
	AMONTH	.016	.017	.909	1	.340	1.016	.983	1.050
	DISPUNIFORM	.010	.011	.949	1	.330	1.011	.989	1.032
	DQTR	.020	.051	.149	1	.699	1.020	.922	1.128
	ELECTIVE	-.076	.054	1.987	1	.159	.927	.834	1.030
	FEMALE	.091	.051	3.153	1	.076	1.095	.991	1.211
	LOS	.015	.004	12.440	1	.000	1.015	1.007	1.024
	PAY1	.163	.028	33.357	1	.000	1.177	1.114	1.244
	PL_NCHS2006	.007	.019	.123	1	.725	1.007	.971	1.044
	ORPROC	-.217	.132	2.673	1	.102	.805	.621	1.044
	NPR	.049	.012	17.098	1	.000	1.050	1.026	1.075
	RACE	-.153	.019	64.639	1	.000	.858	.827	.891
	TOTCHG	.000	.000	79.608	1	.000	1.000	1.000	1.000
	YEAR	.141	.019	57.626	1	.000	1.151	1.110	1.194
	ZIPINC_QRTL	.296	.025	138.803	1	.000	1.344	1.280	1.412
	APRDRG_Risk_Mortality	-.021	.060	.121	1	.728	.979	.871	1.102
	APRDRG_Severity	-.053	.039	1.895	1	.169	.948	.879	1.023
	[HOSP_REGION=1]	-.775	.100	60.413	1	.000	.461	.379	.560
	[HOSP_REGION=2]	-.066	.111	.358	1	.550	.936	.753	1.163

[HOSP_REGION=3]	-2.067	.072	820.990	1	.000	.127	.110	.146
[HOSP_REGION=4]	0[b]			0				
[HOSP_BEDSIZE=1]	.142	.085	2.774	1	.096	1.152	.975	1.361
[HOSP_BEDSIZE=2]	.806	.078	106.300	1	.000	2.239	1.921	2.609
[HOSP_BEDSIZE=3]	0[b]			0				
[HOSP_LOCTEACH=1]	-.110	.257	.183	1	.669	.896	.541	1.483
[HOSP_LOCTEACH=2]	-2.953	.061	2362.833	1	0.000	.052	.046	.059
[HOSP_LOCTEACH=3]	0[b]			0				

a. The reference category is: Private Investment.

b. This parameter is set to zero because it is redundant.

Governmental

The log (B) of the and Exp(B) for Region 4 are 3.04 and 20.91 respectively. For the West region (HOSP_REGION=4, 20.91). The chance that someone from West region goes to governmental facility is (1-20.91) 19.91% or 0.0478 times. If choosing only from governmental and private then choosing daily news is 0.954% and the probability of choosing private is 1-0.954 or 0.046%.

For Northeast (Region 1, Exp(B) 0.318) the chance that a Northeastern individual goes to a governmental hospital is (1-0.318) 68 percent lower than the chance of visiting a private investment healthcare facility OR (1/0.318) 3 times lower. Hence if choosing from these two categories only then probability of choosing governmental facility is 0.318/1+0.318=24.13%. Moreover the probability of choosing a private investment facility in the same vicinity is 1-0.24 or 100-24.13= 75.87

Chances that a person in the Midwest goes to governmental hospital is (Region 2, Exp(B)=0.567) is 1-0.567 or 43% lower than going to a private institution or 176 times lower. If the subjects are to choose from governmental and private organizations only then governmental probability is 36% (0.567/1+0.567). The probability for choosing private investment-based organization is 64% (1-0.36).

Chances that a person in the South goes to governmental hospital is (Region 2, Exp(B)=0.266) is 1-0.266 or 0.734% lower than going to a private institution or 3.75 times lower. If the subjects are to choose from governmental and private organizations only then governmental probability is 0.21% (0.266/1+0.266). The probability for choosing private investment-based organization is 19% (1-0.21).

The log (B) of the and Exp(B) for Bed size 3 are 2.755 and 16.038 respectively

The log (B) of the and Exp(B) for LOCTEACH 3 are 4.698 and 109.727 respectively

Private Non-Profit

The log (B) of the and Exp(B) for Region 4 are 2.888 and 17.957 respectively

The log (B) of the and Exp(B) for Bed size 3 are 0.948 and 2.581 respectively

The log (B) of the and Exp(B) for LOCTEACH 3 are 3.063 and 21.391 respectively

4.6: Regression between Procedures, Cost and other Covariates.

Case Processing Summary

Table 119	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*GROUPCHARGES * OR Procedure*	62337	100.0%	1.297	.0%	62338.297	100.0%

Chi-Square Tests

Table 120	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11391.424[a]	35	0.000
Likelihood Ratio	5561.698	35	0.000
Linear-by-Linear Association	3118.667	1	0.000
N of Valid Cases	62337		

a. 12 cells (16.7%) have expected count less than 5. The minimum expected count is .13.

This table shows statistical significance for the relationship with a p value of 0.000. The Cramer's V for this relationship is 0.427.

Symmetric Measures

Table 121		Value	Asymptotic Standardized Error[a]	Approximate T[b]	Approximate Significance
Nominal by Nominal	Phi	.427			0.000
	Cramer's V	.427			0.000
Interval by Interval	Pearson's R	.224	.005	57.296	.000[c]

Ordinal by Ordinal	Spearman Correlation	.232	.003	59.615	.000[c]
N of Valid Cases		62337			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

This table shows the significance of the relationship between procedure numbers and charges for patients diagnosed with lymphoid leukemia.

Mean Charges for Record of Major OR-Procedures

Table 122					*Total Charges*
OR Procedure	Mean	N	Std. Deviation	% of Total Sum	Sum
No major OR procedure on Discharge Record	53242.78	57994	103789.469	76.0%	3087777553
Major OR procedure reported Discharge Record	362079.26	2695	501367.221	24.0%	975699345
Total	66955.73	60689	159682.008	100.0%	4063476899

The mean Charge for individuals with record of procedures exceeds those without procedures.

Relationships between Diagnostic Bone Marrow Procedures and Total Charges (Grouped)

Case Processing Summary

Table 123	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*GROUPCHARGES * OR Procedure * Diagnostic Procedure*	62334	100.0%	4.297	.0%	62338.297	100.0%

Table 124 ***Chi-Square Tests***

Diagnostic Procedure		Value	df	Asymptotic Significance (2-sided)
Non BoneM procedures	Pearson Chi-Square	11769.170[b]	35	0.000
	Likelihood Ratio	5805.921	35	0.000
	Linear-by-Linear Association	3334.461	1	0.000

	N of Valid Cases	58956		
Biopsy Of Bone Marrow	Pearson Chi-Square	192.137[c]	29	.000
	Likelihood Ratio	68.423	29	.000
	Linear-by-Linear Association	10.415	1	.001
	N of Valid Cases	3378		
Total	Pearson Chi-Square	11362.090[a]	35	0.000
	Likelihood Ratio	5546.829	35	0.000
	Linear-by-Linear Association	3108.994	1	0.000
	N of Valid Cases	62334		

This table shows statistical significance for all procedures including Non-Bone marrow related procedures. An observation could also be made that the Cramer's V for both populations are 0.245 and 0.238 respectively. The strength of association could then be said to be more than 40 percent or 0.427.

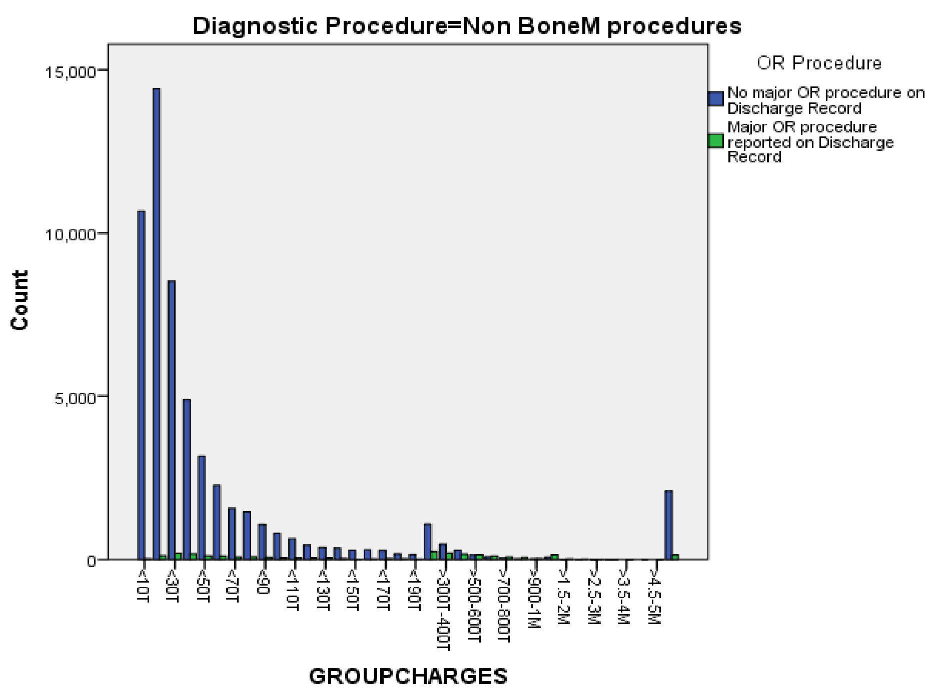


Figure 87: Shows the number of individuals in this population that received procedures not classified as Bone marrow related.

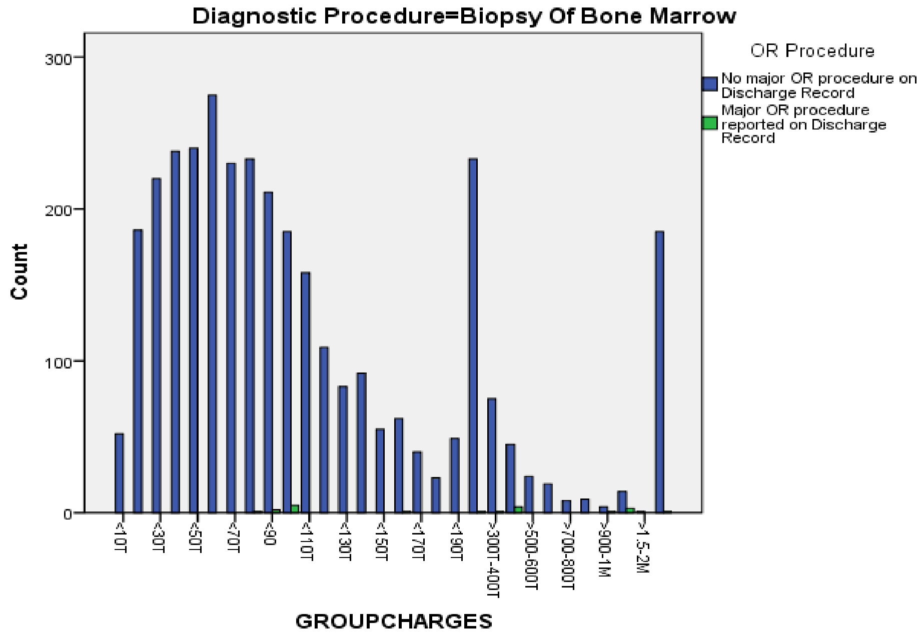


Figure 88: This shows the number of individuals with bone marrow biopsy and major procedure on record.

Mean Charges for Diagnostic Bone Marrow Procedure on Record

Table 135 *Total Charges*

Diagnostic Procedure	Mean	N	Std. Deviation	% of Total Sum	Sum
Non BoneM procedures	64020.29	57381	160063.843	90.4%	3673543573
Biopsy Of Bone Marrow	**117872.77**	3308	143683.254	9.6%	389933326
Total	66955.73	60689	159682.008	100.0%	4063476899

The mean for individuals with biopsy is higher and almost double of those without such procedures.

Relationships between Spinal Tap (LP) Procedures and Grouped Charges

Table 126 *Total Charges*

Indication of Spinal Tap	Mean	N	Std. Deviation	Sum
Other non Spinal Procedures	66821.27	58974	160002.155	3940686690
Spinal Tap	**71619.42**	1714	148285.614	122751315
Other diagnostic procedures on spinal cord and spinal canal structures	25319.00	2	0.000	38894
Total	66955.73	60689	159682.008	4063476899

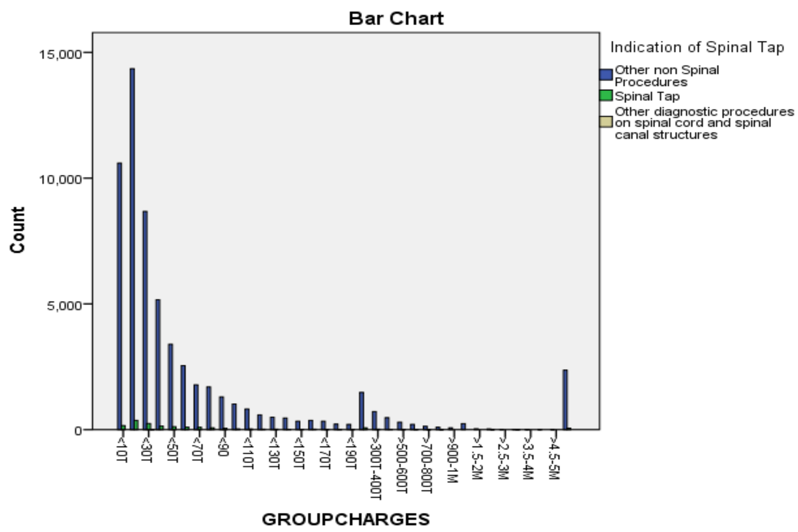


Figure 89: This figure shows that only 2.8 percent of individuals diagnosed with leukemia of lymphoid origin. The average cost for this population is higher than all other procedures as depicted above.

Relationships between Non-Operative Procedures and Grouped Charges

Table 127 ***Case Processing Summary***

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
*Total Charges * Nonoperative Procedures*	60689	97.4%	1649	2.6%	62338	100.0%

Mean Charges and Non-Operative Hormones

Table 128

Nonoperative Procedures	Mean	N	Std. Deviation	Sum
Other	83162.04	33734	198261.341	2805406760
Transfusion Of Blood And Blood Components	49271.29	6709	76748.591	330585116
Injection Or Infusion Of Therapeutic Or Prophylactic Substance	85393.15	1053	128115.537	89941604
Injection Or Infusion Of Other Therapeutic Or Prophylactic Substance	43216.00	18886	85680.289	816185341
Prophylactic Vaccination And Inoculation Against Certain Bacterial Diseases	**166849**.32	3	184592.640	477194
Other Vaccination And Inoculation	24479.21	36	26267.583	892786
Conversion Of Cardiac Rhythm	80796.08	9	84023.387	733361
Therapeutic Apheresis Or Other Injection, Administration, Or Infusion Of Other Therapeutic Or Prophylactic Substance	97710.53	135	157389.263	13197709
Miscellaneous Physical Procedures	67792.48	50	70584.853	3401505
Other Miscellaneous Procedures	36778.50	72	35029.927	2655522
Total	66955.73	60689	159682.008	4063476899

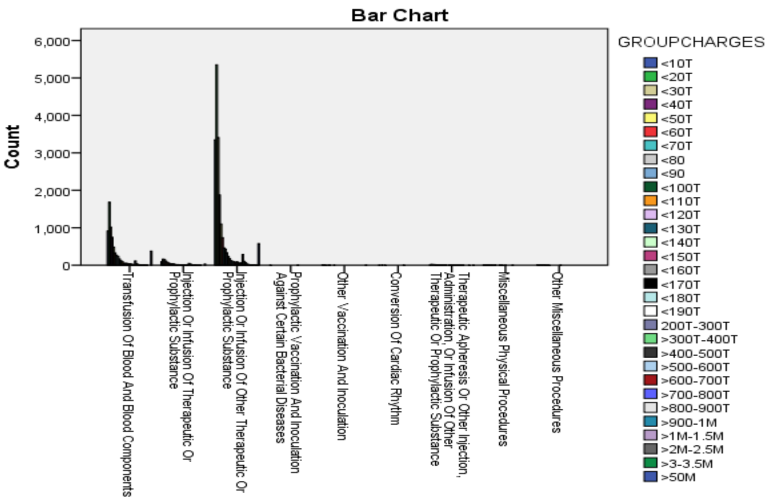


Figure 90: This figure depicts charge and non-operative procedures there is a statistical significance with p value of 0.000 between these variables with a Cramer's V of 0.076.

Relationships between

Pharmaceutical & Other Procedures

and Grouped Charges

Case Processing Summary

Table 129	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
*Total Charges * Procedures And Interventions*	60689	97.4%	1649	2.6%	62338	100.0%

Mean Charges for Other Pharmaceutical Interventions & Procedures

Table 130

Procedures And Interventions	Mean	N	Std. Deviation	Sum
Other	66180.50	60584	155590.737	4009462563
Implantation Of Chemotherapeutic Agent	48161.00	1	0.000	69761
Injection Or Infusion Of Nesiritide	61381.22	22	109513.418	1377583
Injection Or Infusion Of Oxazolidinone Class Of Antibiotics	40687.34	20	80250.226	811780
High-Dose Infusion Interleukin-2 [Il-2]	**1140170.29**	3	302252.047	3301326
Pressurized Treatment Of Venous Bypass Graft [Conduit] With Pharmaceutical Substance	157683.22	16	95314.718	2507670
Infusion Of Vasopressor Agent	186066.32	7	336947.272	1388478
Disruption Of Blood Brain Barrier Via Infusion [Bbbd]	**1187385.77**	14	595062.739	16649480
Transplant From Live Related Donor	**1319922.23**	21	1005726.158	27908258
Total	66955.73	60689	159682.008	4063476899

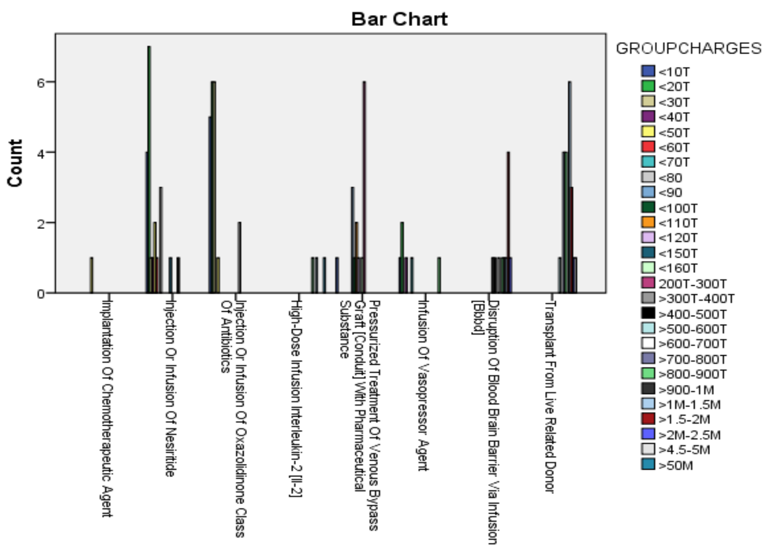


Figure 91: This graph shows the number of presentations with charges (Grouped). It shows a p value of 0.000 & a Cramer's V of 0.691.

Chi-Square Tests

Table 131 *Charges V. Other Procedures*	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	324.374[a]	182	.000
Likelihood Ratio	238.904	182	.003
Linear-by-Linear Association	58.211	1	.000
N of Valid Cases	97		

a. 216 cells (100.0%) have expected count less than 5. The minimum expected count is .01.

Relationships between Lymphatic Procedures and Grouped Charges

Case Processing Summary

Table 132	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
*Total Charges * Operations On Lymphatic System*	60689	97.4%	1649	2.6%	62338	100.0%

Mean Charges for Lymphatic tissue procedures

Table 133					
Operations Lymphatic System	Mean	N	Std. Deviation	Sum	% of Total Sum

Other Non lymph Procedure	66788.64	60603	159385.286	4047590441	99.6%
Incision Of Lymphatic Structures	50651.68	3	48390.822	144984	.0%
Diagnostic Procedures On Lymphatic Structures	**200471.57**	68	313486.625	13533481	.3%
Simple Excision Of Lymphatic Structure	140915.45	16	82291.895	2207993	.1%
Total	66955.73	60689	159682.008	4063476899	100.0%

ANOVA Table

Table 134			Sum of Squares	df	Mean Square	F	Sig.
*Total Charges * Operations On Lymphatic System*	Between Groups	(Combined)	1291596472745.800	3	430532157581.932	16.898	.000
		Linearity	1113803352688.070	1	1113803352688.070	43.716	.000
		Deviation from Linearity	177793120057.723	2	88896560028.862	3.489	.031
	Within Groups		1546152202218540.000	60685	25478320539.565		
	Total		1547443798691290.000	60688			

Chi-Square Tests

Table 135	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	443.329[a]	105	.000
Likelihood Ratio	192.824	105	.000
Linear-by-Linear Association	23.698	1	.000
N of Valid Cases	62335		

a. 107 cells (74.3%) have expected count less than 5. The minimum expected count is .00.

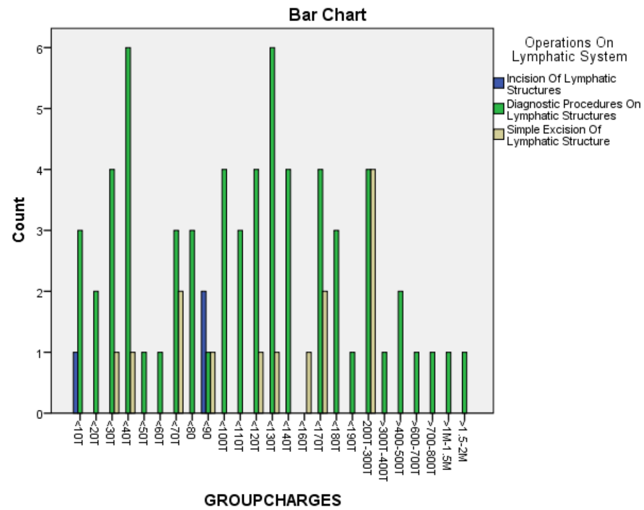


Figure 92: This figure shows a lymphatic procedures and their impact on cost. The table above shows p value of 0.000 and the Cramer's V for the relationship is 0.573.

Relationships between Chemotherapeutic Procedures and Grouped Charges

Case Processing Summary

Table 136	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
*GROUPCHARGES * Injection Or Infusion Of Other Therapeutic Or Prophylactic Substance*	17589	28.2%	44749.297	71.8%	62338.297	100.0%

Report

Table 137					*Total Charges*
Injection Or Infusion Of Other Therapeutic Or Prophylactic Substance	Mean	N	Std. Deviation	Sum	% of Total Sum
Injection or infusion of cancer chemotherapeutic substance	44709.81	17197	88556.591	768861756	100.0%
Implantation of chemotherapeutic agent	48161.00	1	0.000	69761	.0%
Total	44710.10	17198	88552.867	768931516	100.0%

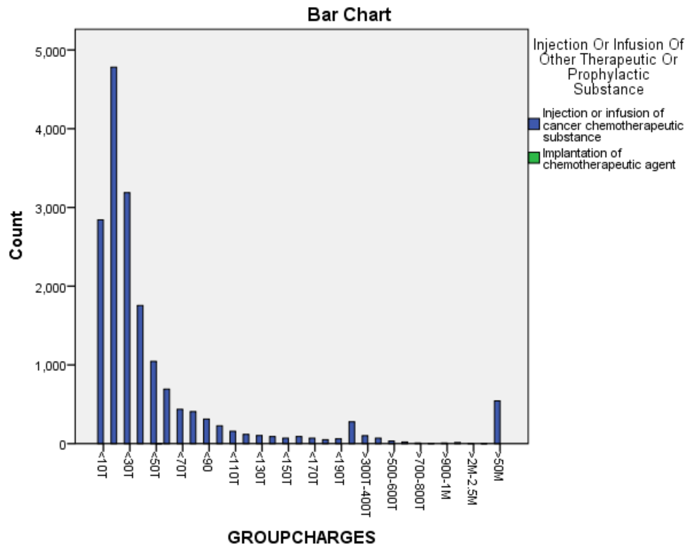


Figure 93: the figure shows cost association with chemo therapy. The above tables show no statistical significance between the variables.

Relationships between Bone Marrow Procedures and Charges

Case Processing Summary

Table 137	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
*Total Charges * Bone Marrow Transplant*	60689	97.4%	1649	2.6%	62338	100.0%

Mean Charges for Bone Marrow procedures

Table 138	*Total Charges*				
Bone Marrow Transplant	Mean	N	Std. Deviation	Sum	Sum%
Non-Marrow Proc	**60633.16**	59959	143080.897	3635529119	89.5%
Bone marrow transplant, not specified	566871.05	5	298143.434	2617955	.1%
Allogeneic bone marrow transplant with purging	516464.38	3	20507.794	1555765	.0%
Allogeneic bone marrow transplant w/o purging	520070.56	219	370412.053	113819102	2.8%
Autologous hematopoietic stem cell	219622.23	3	181127.791	731316	.0%

transplant w/opurging					
Allogeneic hematopoietic stem cell transpant without purging	**543693.58**	319	415322.352	173694810	4.3%
Cord blood stem cell transplant	**793516.47**	148	410931.525	117164766	2.9%
Allogeneic hematopoietic stem cell transplant with purging	556184.90	31	271467.163	17261884	.4%
Autologous bone marrow transplant with purging	682712.00	2	0.000	1102181	.0%
Total	66955.73	60689	159682.008	4063476899	100.0%

ANOVA Table

Table 139			Sum of Squares	df	Mean Square	F	Sig.
*Total Charges * Bone Marrow Transplant*	Between Groups	(Combined)	207764872931680.000	8	25970609116460.000	1176.324	0.000
		Linearity	198628308748593.000	1	198628308748593.000	8996.759	0.000
		Deviation from Linearity	9136564183087.440	7	1305223454726.780	59.119	.000
	Within Groups		1339678925759630.000	60680	22077762825.169		
	Total		1547443798691310.000	60688			

Chi-Square Tests

Table 140	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	501.010[a]	168	.000
Likelihood Ratio	251.247	168	.000
Linear-by-Linear Association	7.604	1	.006
N of Valid Cases	761		

a. 172 cells (86.0%) have expected count less than 5. The minimum expected count is .00.

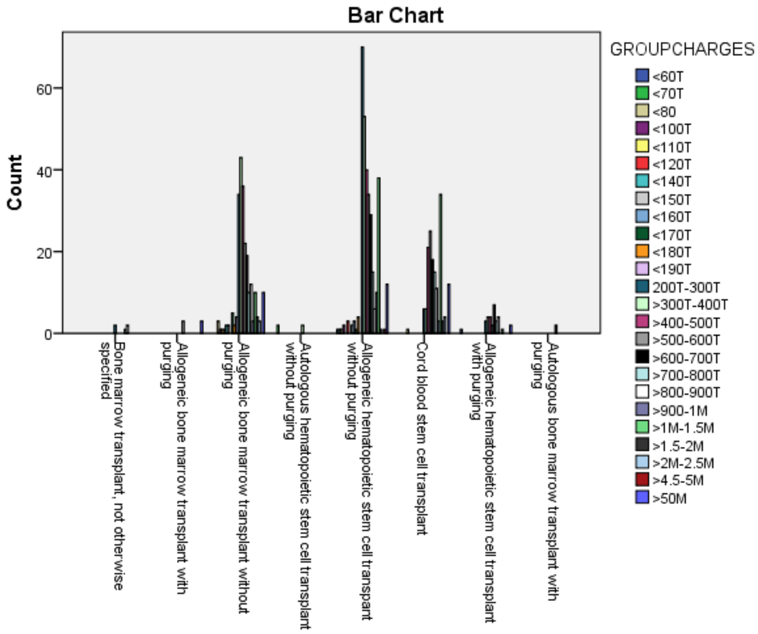


Figure 94: this figure shows more people received allogenic transplant more frequently than others. The table above shows statistical significance and the Cramer's V for this relationship is 0.307.

Relationships between Diagnostic Radiology Procedures and Grouped Charges

Case Processing Summary

Table 141	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
*Total Charges * Diagnostic Radiology*	60689	97.4%	1649	2.6%	62338	100.0%

Mean Charges for Diagnostic Radiology Procedures

Table 142					*Total Charges*
Diagnostic Radiology	Mean	N	Std. Deviation	Sum	Sum%
Other Non-Radio Proc	**66948.55**	59950	159632.909	4013583290	98.8%
Soft Tissue X-Ray Of Face, Head, And Neck	39592.50	68	42878.157	2700311	.1%

Other X-Ray Of Face, Head, And Neck	57694.18	3	35481.000	171990	.0%
X-Ray Of Spine	**266281.00**	1	0.000	354758	.0%
Soft Tissue X-Ray Of Thorax	151008.29	21	60682.669	3120850	.1%
Other X-Ray Of Thorax	**67040.06**	96	150228.371	6412067	.2%
Biliary Tract X-Ray	228220.00	1	0.000	298443	.0%
X-Ray Of Urinary System	62534.55	4	63287.315	280688	.0%
Soft Tissue X-Ray Of Abdomen	86889.42	61	86034.351	5276341	.1%
Other X-Ray Of Abdomen	15159.50	3	5353.034	48947	.0%
Skeletal X-Ray Of Extremities And Pelvis	28082.00	1	0.000	41455	.0%
Other X-Ray	38421.32	16	19914.872	617886	.0%
Arteriography Using Contrast Material	33638.03	18	20488.506	607324	.0%
Angiocardiography Using Contrast Material	14572.00	1	0.000	19414	.0%
Phlebography	25505.22	11	20731.382	292969	.0%
Diagnostic Ultrasound	54684.16	179	102660.748	9801924	.2%
Other including MRI & DEXA	78609.25	252	241377.454	19848241	.5%
Total	66955.73	60689	159682.008	4063476899	100.0%

Chi-Square Tests

Table 143	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	505.345[a]	360	.000
Likelihood Ratio	368.278	360	.370
Linear-by-Linear Association	.124	1	.725
N of Valid Cases	747		

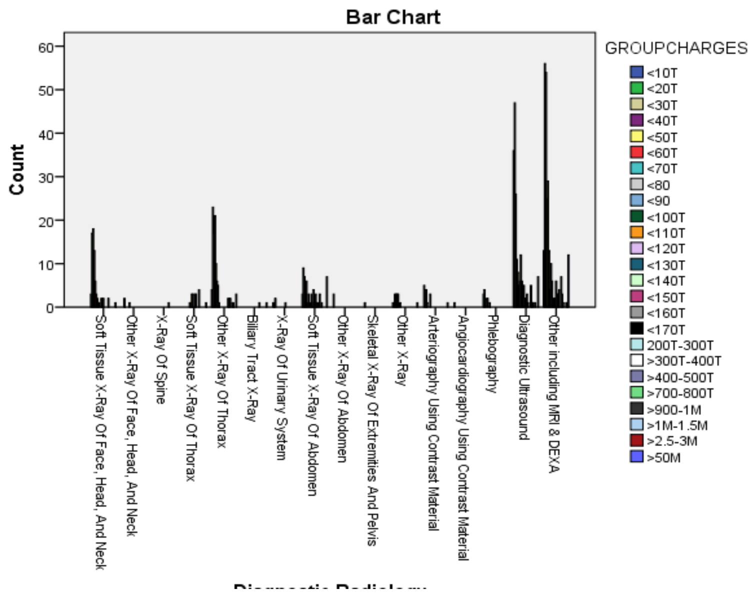


Figure 95: shows that majority of radiographic imaging performed in this population were ultrasound, MRI and DEXA. The table above shows no statistical significance and the Cramer's V is 0.212. The strength of association in this relationship even though small can still have an impact on the total charges.

<u>Relationships between Most Common Procedures and Charges</u>

Case Processing Summary

Table 144	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
*Total Charges * Procedures when ALL=1*	60689	97.4%	1649	2.6%	62338	100.0%

Mean Charges and Common Procedures on Record

Table 145	*Total Charges*				
Procedures when ALL=1	Mean	N	Std. Deviation	Sum	% Sum
Other	29419.07	16727	96748.283	492082240	12.1%

Spinal tap	71619.42	1714	148285.614	122751315	3.0%
Injection of other agent into spinal canal	72007.67	4350	133264.623	313209940	7.7%
Venous catheterization, not elsewhere classified	130670.54	690	189599.377	90111579	2.2%
Allogeneic hematopoietic stem cell transplant without purging	**543693.58**	319	415322.352	173694810	4.3%
Biopsy of bone marrow	117872.77	3308	143683.254	389933326	9.6%
Insertion of totally implantable vascular access device [VAD]	101878.39	1447	96020.705	147450032	3.6%
Transfusion of packed cells	44119.84	5204	63703.466	229611620	5.7%
Injection or infusion of cancer chemotherapeutic substance	44709.81	17197	88556.591	768861756	18.9%
Central venous catheter placement with guidance	153469.83	203	200424.311	31159215	.8%
Allogeneic bone marrow transplant without purging	**520070.56**	219	370412.053	113819102	2.8%
Cord blood stem cell transplant	**793516.47**	148	410931.525	117164766	2.9%
Transfusion of platelets	67645.88	1403	111530.544	94923957	2.3%
Implantation of chemotherapeutic agent	48161.00	1	0.000	69761	.0%
Injection or infusion of oxazolidinone class of antibiotics	61381.22	22	109513.418	1377583	.0%
High-dose infusion interleukin-2 [IL-2]	40687.34	20	80250.226	811780	.0%
Pressurized treatment of venous bypass graft [conduit] with pharmaceutical substance	**1140170.29**	3	302252.047	3301326	.1%
Infusion of immunosuppressive antibody therapy	186066.32	7	336947.272	1388478	.0%
Intravascular imaging of intrathoracic vessels	214791.62	43	316485.614	9160918	.2%
Other computer assisted surgery	47179.04	3	47860.532	123393	.0%
Transplant from live related donor	**1187385.77**	14	595062.739	16649480	.4%
Transplant from live non-related donor	**1319922.23**	21	#########	27908258	.7%

Ventriculopuncture through previously implanted catheter	35789.65	13	34001.833	465741	.0%
Open biopsy of brain	160888.24	12	144656.002	1880273	.0%
Other craniectomy	665656.46	4	497323.632	2937737	.1%
Placement of intracerebral catheter(s) via burr hole(s)	262956.15	3	9479.335	707176	.0%
Other incision of brain	635612.47	10	698611.821	6106926	.2%
Insertion or replacement of external ventricular drain [EVD]	472597.44	12	527986.166	5887632	.1%
Intracranial ventricular shunt or anastomosis	139970.94	21	162049.578	2929577	.1%
Ventricular shunt to abdominal cavity and organs	290040.74	12	583495.221	3371185	.1%
Removal of ventricular shunt	174072.00	2	0.000	298614	.0%
Drainage of face and floor of mouth	135547.00	4	63281.082	598209	.0%
Other exploration and decompression of spinal canal	115561.22	35	163615.214	4001197	.1%
Temporary tracheostomy	**883888.19**	13	514781.412	11887339	.3%
Biopsy of spinal cord or spinal meninges	**914097.15**	3	998230.348	2972282	.1%
Pericardiocentesis	265906.75	20	346149.933	5416121	.1%
Interruption of the vena cava	54460.77	3	40707.330	164054	.0%
Systemic to pulmonary artery shunt	92361.69	23	122362.385	2161870	.1%
Spinal blood patch	30984.62	18	30033.205	571655	.0%
Incision of lymphatic structures	50651.68	3	48390.822	144984	.0%
Regional lymph node excision	55229.00	1	0.000	75980	.0%
Total splenectomy	148826.78	14	189417.582	2016086	.0%
Gastrotomy	402405.00	1	0.000	594029	.0%
Excision or destruction of peritoneal tissue	238647.56	4	261535.191	991865	.0%
Transurethral clearance of bladder	189207.00	1	0.000	274065	.0%
Excision or destruction of testicular lesion	79219.00	1	0.000	103839	.0%
Other local excision or destruction of vulva and perineum	68382.00	1	0.000	97053	.0%
Other local excision or destruction of lesion or tissue of skin and subcutaneous tissue	99489.50	11	156258.174	1131753	.0%
Radical excision of skin lesion	103095.81	4	78601.048	456880	.0%

Enteral infusion of concentrated nutritional substances	70512.27	194	101838.011	13650788	.3%
Therapeutic evacuation of anterior chamber	17745.00	1	0.000	23471	.0%
Other mechanical vitrectomy	**494007.30**	5	334520.356	2253217	.1%
Biopsy of eyeball and orbit	260044.00	2	0.000	419819	.0%
Myringotomy with insertion of tube	54395.77	49	59321.013	2649804	.1%
Control of epistaxis by other means	66746.22	4	46788.172	284170	.0%
Local excision or destruction of intranasal lesion	185440.29	5	165411.953	841827	.0%
Other turbinectomy	421155.71	6	263231.215	2590507	.1%
Aspiration or lavage of nasal sinus through natural ostium	92469.35	4	105728.373	404245	.0%
Closed [endoscopic] [needle] biopsy of nasal sinus	124423.13	9	71740.669	1178287	.0%
Excision of lesion of maxillary sinus with other approach	260276.50	22	312491.382	5845455	.1%
Ethmoidectomy	454737.06	31	531064.661	14029370	.3%
Sphenoidectomy	**1216111.18**	4	905669.827	5316429	.1%
Other surgical extraction of tooth	64373.87	10	44864.668	648884	.0%
Other dental restoration	7960.00	2	0.000	12851	.0%
Biopsy of gum	194907.86	3	116923.451	536599	.0%
Partial sialoadenectomy	21033.94	3	1101.406	58621	.0%
Biopsy of mouth, unspecified structure	39567.58	3	21628.970	106551	.0%
Suture of laceration of lip	236248.00	1	0.000	314022	.0%
Pharyngoscopy	71953.06	13	45038.062	953995	.0%
Laryngoscopy and other tracheoscopy	147575.46	11	230534.244	1673415	.0%
Thoracoscopic excision of lesion or tissue of lung	400914.61	52	787919.188	20864349	.5%
Other local excision or destruction of lesion or tissue of lung	915499.77	11	#########	9636267	.2%
Thoracoscopic lung biopsy	200171.01	264	424079.079	52906165	1.3%
Puncture of lung	246681.34	3	93880.651	664284	.0%
Incision of chest wall	171397.06	65	238477.248	11105959	.3%
Thoracoscopic pleural biopsy	356385.42	15	414616.699	5214062	.1%
Decortication of lung	294988.12	15	312432.371	4443100	.1%
Thoracentesis	141839.73	18	127651.594	2520582	.1%
Pericardiotomy	625601.68	11	408301.312	7181785	.2%

Resection of vessel with replacement, upper limb vessels	37843.00	2	0.000	58132	.0%
Other excision of vessels, upper limb vessels	2434762.00	1	0.000	3594186	.1%
Other surgical occlusion of vessels, abdominal arteries	635451.00	1	0.000	920446	.0%
Venous cutdown	64692.23	150	119636.813	9689442	.2%
Suture of artery	329182.69	6	220213.873	1898436	.0%
Angioplasty of other non-coronary vessel(s)	198155.21	10	172023.109	2067782	.1%
Extracorporeal membrane oxygenation [ECMO]	1118497.00	21	894395.513	22996757	.6%
Insertion of vessel-to-vessel cannula	170761.47	18	202307.729	3152244	.1%
Biopsy of lymphatic structure	200471.57	68	313486.625	13533481	.3%
Excision of deep cervical lymph node	140915.45	16	82291.895	2207993	.1%
Bone marrow transplant, not otherwise specified	447520.47	11	255840.752	4905035	.1%
Cord blood stem cell transplant	562441.05	33	265916.658	18364065	.5%
Closed [aspiration] [percutaneous] biopsy of spleen	345372.00	1	0.000	509837	.0%
Percutaneous [endoscopic] gastrostomy [PEG]	103767.33	45	167439.339	4719355	.1%
Other gastroenterostomy without gastrectomy	605362.20	3	98992.559	1650806	.0%
Laparoscopic procedures for creation of esophagogastric sphincteric competence	700798.31	7	954799.306	5143017	.1%
Other endoscopy of small intestine	100394.36	197	138161.022	19776233	.5%
Closed [endoscopic] biopsy of large intestine	159354.26	39	297963.138	6241982	.2%
Other partial resection of small intestine	739352.31	21	712851.674	15448598	.4%
Exteriorization of small intestine	410994.00	2	0.000	663515	.0%
Laparoscopic appendectomy	65876.50	73	87317.675	4831409	.1%
Closed [endoscopic] biopsy of rectum	229727.57	7	219882.056	1697163	.0%
Other incision of perianal tissue	55062.65	3	20959.516	164645	.0%
Closure of anal fistula	489317.00	1	0.000	648948	.0%

Closed (percutaneous) [needle] biopsy of liver	158483.45	72	174530.692	11417001	.3%
Unilateral repair of inguinal hernia, not otherwise specified	58113.00	2	0.000	89270	.0%
Other laparotomy	252717.59	19	291105.666	4921783	.1%
Incision of peritoneum	40636.01	13	28397.310	546049	.0%
Percutaneous nephrostomy without fragmentation	211499.18	18	257378.503	3738115	.1%
Closed [percutaneous] [needle] biopsy of testis	81722.80	22	67661.184	1819369	.0%
Other unilateral oophorectomy	353935.01	9	530134.800	3141675	.1%
Other incision of bone without division, humerus	70347.60	6	99252.461	440443	.0%
Other division of bone, scapula, clavicle, and thorax [ribs and sternum]	334238.00	1	0.000	443277	.0%
Biopsy of bone, humerus	230267.11	65	454333.145	15041779	.4%
Local excision of lesion or tissue of bone, tibia and fibula	114653.91	9	183202.507	1026540	.0%
Other arthrotomy, hip	69220.77	17	33662.794	1152623	.0%
Intervertebral chemonucleolysis	5665.00	1	0.000	7493	.0%
Percutaneous vertebral augmentation	96108.03	24	98806.073	2307648	.1%
Other incision of soft tissue	186579.52	42	203106.206	7838233	.2%
Excision of lesion of other soft tissue	326217.76	13	260355.658	4267976	.1%
Other incision with drainage of skin and subcutaneous tissue	73729.84	636	114247.511	46888617	1.2%
Closed biopsy of skin and subcutaneous tissue	172667.78	141	307089.771	24383508	.6%
Computerized axial tomography of head	39592.50	68	42878.157	2700311	.1%
Other x-ray of lumbosacral spine	84047.19	118	142632.112	9887675	.2%
Retrograde cystourethrogram	23725.79	3	9392.117	71470	.0%
Computerized axial tomography of abdomen	86889.42	61	86034.351	5276341	.1%
Other computerized axial tomography	37852.54	26	21217.365	971039	.0%
Diagnostic ultrasound of heart	55738.42	175	103760.137	9740712	.2%

Magnetic resonance imaging of brain and brain stem	78609.25	252	241377.454	19848241	.5%
Electroencephalogram	33307.22	92	31589.739	3053631	.1%
Other nonoperative genitourinary system measurements	61200.50	7	63878.524	433735	.0%
Electrographic monitoring	87473.87	9	93054.414	772310	.0%
Total body scan	135789.70	61	411738.367	8242399	.2%
Non-invasive mechanical ventilation	74527.46	139	108609.907	10336388	.3%
Continuous invasive mechanical ventilation of unspecified duration	354152.96	470	400562.688	166511105	4.1%
Insertion of endotracheal tube	206403.10	73	216102.472	15082678	.4%
Exchange transfusion	82537.06	14	72798.880	1160366	.0%
Transfusion of platelets	50369.97	157	55395.758	7928143	.2%
Immunization for allergy	51991.63	2399	95189.020	124744024	3.1%
Injection or infusion of biological response modifier [BRM] as an antineoplastic agent	35517.92	263	55683.829	9342902	.2%
Prophylactic vaccination against influenza	35701.92	46	48444.091	1626147	.0%
Therapeutic plasmapheresis	74790.83	257	122227.225	19254735	.5%
Total	66955.73	60689	159682.008	4063476899	100.0%

ANOVA Table

Table 146			Sum of Squares	df	Mean Square	F	Sig.
*Total Charges * Procedures when ALL=1*	Between Groups	(Combined)	465127108363961.000	140	3322336488314.010	185.861	0.000
		Linearity	16611842894302.200	1	16611842894302.200	929.316	.000
		Deviation from Linearity	448515265469659.000	139	3226728528558.700	180.513	0.000
	Within Groups		1082316690327350.000	60548	17875346264.540		
	Total		1547443798691310.000	60688			

Chi-Square Tests

Table 147	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	68147.875[a]	4900	0.000
Likelihood Ratio	24584.767	4900	0.000
Linear-by-Linear Association	332.396	1	.000
N of Valid Cases	62244		

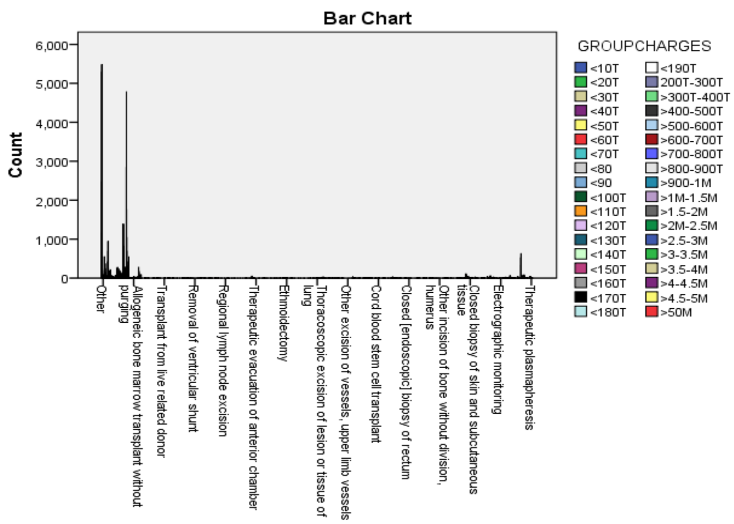


Figure 96: This shows that procedure types varied and so were charges. The p value shows statistical significance and Cramer's V of 0.178.

Summary of Findings

1. **The table 98 shows statistical significance between Hospital Control or Ownership and Hospital Bed size with a p value of 0.000 and degree of freedom of 6. Table 99 below shows symmetric measures with a Cramer's V of 0.516, 0.190 and 0.242 for small, medium and large hospital bed size respectively**
2. **Table 104 shows statistical significance between the variables for both discharge years. The strength of the association between the variable with a Cramer's V of 0.084 & 0.096 for 2009 and 2012 respectively.**
3. **The table 108 shows statistical significance between payment methods, Hospital control and region with a p value of 0.000 for all ownership or control subsets. The strength of association verified with Cramer's V is 0.127 and 0.123 for 2009 and 2012 respectively.**

4. **The table 110 shows statistical significance between hospital control, region and patient location. The strength of association is further depicted with a Cramer's V of 0.214, 0.197 & 0.264 for Governmental, Private Non-Profit and Private investment respectively**
5. **This table 110 shows statistical significance between hospital control and race with a p value of 0.000 and a df of 14 for Chi-square and Likelihood ratio. The degree of association as measured by Cramer's V is 0.172, 0.210 and 0.204 for Governmental, Non-profits and Private investment respectively**
6. **This table 112 shows statistical significance with a df of 9 for all subsets. The association degree with a Cramer's V of 0.148, 0.126 & 0.151 for Governmental, Non-profit and Private investment.**
7. **This table 114 shows statistical significance for the relationship with a p value of 0.002. The Cramer's V for this relationship is 0.038, 0.018 and 0.048 for governmental, non-profit and private for-profit hospitals.**
8. **This Table 116 shows that there is no statistical significance for the variable subset in Governmental. Moreover, there is statistical significance for Private Non-Profit with a p value of 0.000 and 0.002 for nonprofit and investment respectively. The Cramer's V for these population was 0.034, 0.027 and 0.058**
9. **This table 118 shows the statistical significance of the 0.000. More over the Person goodness of fit test has a p value of 0.000. The Pseudo R squared for this regression is 0.287(Nagelkerke). The variation of Hospital control is 26 percent explained by the independent variables.**

10. This table 120 shows the likelihood ratios, chi-square, df and p values for the factors as well as covariates being considered in this regression model.

11. This table 123 shows statistical significance for the relationship with a p value of 0.000. The Cramer's V for this relationship is 0.427.

12. This table 129 shows statistical significance for all procedures including Non-Bone marrow related procedures. An observation could also be made that the Cramer's V for both populations are 0.245 and 0.238 respectively. The strength of association could then be said to be more than 40 percent or 0.427

Primary Lymphoid Leukemia Diagnosis and Total Charges

The data contained a total of 11,259 patients diagnosed with leukemia of lymphoid origin with the total missing cases as primary diagnosis secondary diagnosis as seen in the table below. The number of individuals included in this study constitute 99.6% diagnosed with ALL as depicted it in table below. The table B below provides further details of the relationship between diagnosis of lymphoid leukemia and charge. One can observe that the test for normality show statistical significance between the two. Moreover, evaluation of the charges further indicated there was a difference between the total cost of care for leukemia of lymphoid origin between 2009 and 2012 and depicted on Table C below. In table C, one will observe that the total number of individuals difference treated in an inpatient facility was about 535 (7%). The variation in the location of treatment also showed some variation; this variation is only observed with patient at non-profit health facility in 2012 data compared to 2009. In general, the percentage each hospital demographic has did not change between years.

The total charge for each hospital distribution increased but the rate of increase observed in private or for profit facilities was much higher compared to facilities with some governmental control. A difference of 44,000 on average was observed for the three years period between 2009-2012 data release.

Distribution of Patient Population for Primary Dx

Table 148		Frequency	%	Valid Percent	Cumulative Percent
Valid	Lymphoid leukemia acute	**11212**	18.0	99.6	99.6
	Lymphoid leukemia chronic	14	.0	.1	99.7
	Other lymphoid leukemia	22	.0	.2	99.9

	Unspecified lymphoid leukemia	11	.0	.1	100.0
	Total	11259	18.1	100.0	
Missing	0	51036	81.9		
	Myeloid leukemia acute	38	.1		
	Myeloid sarcoma	5	.0		
	Total	51079	81.9		
Total		62338	100.0		

Mean Charges by Hospital Region

Table 149

Discharge Year		Mean	N	Std. Deviation	Sum	% of Total Sum
		Total Charges				
2009	Northeast	157800.74	976	201993.646	154052750	9.3%
	Midwest	114649.37	1104	160769.236	126565382	7.6%
	South	104259.14	2083	174310.604	217209384	13.1%
	West	161259.33	1452	213803.737	234170134	14.1%
	Total	130348.95	5616	189543.601	731997650	44.0%
2012	Northeast	189899.76	846	240188.581	160695674	9.7%
	Midwest	142241.43	1026	234770.451	145956174	8.8%
	South	146101.29	2003	262871.850	292661279	17.6%
	West	238762.06	1391	396456.154	332229351	20.0%
	Total	176866.15	5267	298994.987	931542478	56.0%
Total	Northeast	172705.09	1822	221071.279	314748424	18.9%
	Midwest	127941.38	2130	200295.226	272521556	16.4%
	South	124769.52	4087	223132.772	509870663	30.6%
	West	199183.95	2844	318937.488	566399485	34.0%
	Total	152862.21	10883	249680.282	1663540128	100.0%

Table 150 ***Chi-Square Tests***

Discharge Year		Value	df	Asymptotic Significance (2-sided)
2009	Pearson Chi-Square	787.040[b]	84	.000
	Likelihood Ratio	754.491	84	.000
	Linear-by-Linear Association	106.923	1	.000
	N of Valid Cases	5837		

2012	Pearson Chi-Square	588.517[c]	99	.000
	Likelihood Ratio	583.193	99	.000
	Linear-by-Linear Association	51.440	1	.000
	N of Valid Cases	5422		
Total	Pearson Chi-Square	1158.031[a]	99	.000
	Likelihood Ratio	1122.625	99	.000
	Linear-by-Linear Association	155.180	1	.000
	N of Valid Cases	11259		

This table shows statistical significance for all years. Moreover, the Cramer's V recorded are 0.212, 0.190 and 0.18 for total respectively.

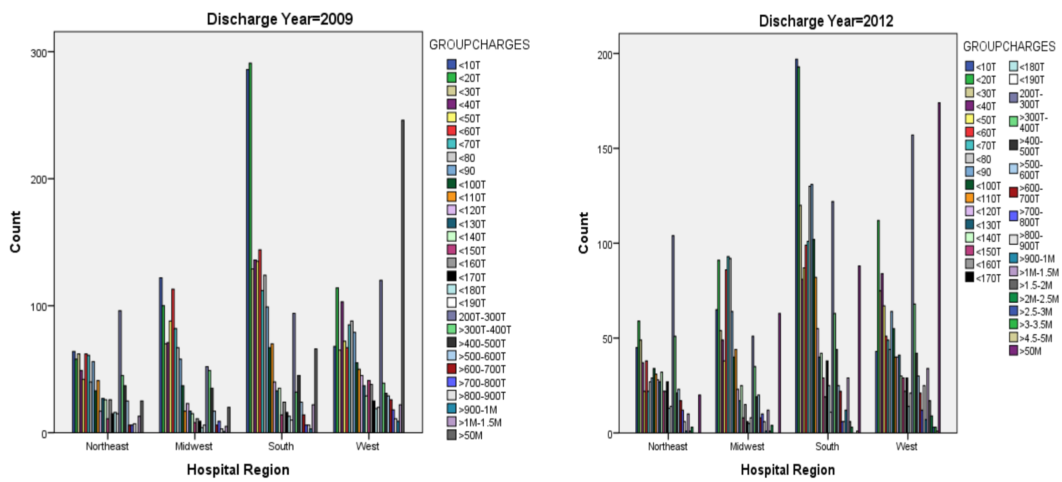


Figure 97-98 above show the distribution of charges in regions

Relationships between Primary Leukemia Diagnosis, Hospital Control and Charges

Case Processing Summary

Table 151	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent

*Total Charges * Discharge Year * Hospital Control*	9957	88.4%	1302	11.6%	11259	100.0%

Mean Charges & Hospital Control

Table 152 *Total Charges*

Discharge Year		Mean	N	Std. Deviation	Sum	% of Total Sum
2009	Governmental Non Federal	106259.71	635	165989.423	67425240	4.3%
	Private Non-Profit	138036.17	3785	195327.994	522493765	33.6%
	Private Investment	123190.93	270	152904.442	33248964	2.1%
	Total	132882.26	4690	189683.689	623167969	40.1%
2012	Governmental Non Federal	140568.57	662	232002.602	93021528	6.0%
	Private Non-Profit	180770.82	4345	305791.400	785506833	50.5%
	Private Investment	204007.04	260	327938.484	53014117	3.4%
	Total	176866.15	5267	298994.987	931542478	59.9%
Total	Governmental Non Federal	123774.35	1296	203046.443	160446768	10.3%
	Private Non-Profit	160875.53	8131	261120.759	1308000599	84.1%
	Private Investment	162833.66	530	257244.401	86263081	5.5%
	Total	156149.36	9957	254388.573	1554710447	100.0%

ANOVA Table[a]

Table 153			Sum of Squares	df	Mean Square	F	Sig.
*Total Charges * Discharge Year*	Between Groups	(Combined)	4799256692254.670	1	4799256692254.670	74.711	.000
	Within Groups		639460318469868.000	9955	64237930462.494		
	Total		644259575162122.000	9956			

*a. With fewer than three groups, linearity measures for Total Charges * Discharge Year cannot be computed.*

Table 154 Chi-Square Tests

Discharge Year		Value	df	Asymptotic Significance (2-sided)
2009	Pearson Chi-Square	127.070[b]	56	.000
	Likelihood Ratio	147.727	56	.000
	Linear-by-Linear Association	23.427	1	.000
	N of Valid Cases	4903		
2012	Pearson Chi-Square	155.839[c]	66	.000
	Likelihood Ratio	157.568	66	.000
	Linear-by-Linear Association	48.736	1	.000
	N of Valid Cases	5420		
Total	Pearson Chi-Square	177.964[a]	66	.000
	Likelihood Ratio	187.214	66	.000
	Linear-by-Linear Association	70.275	1	.000
	N of Valid Cases	10323		

This table shows statistical significance for the relationship between the variables. Moreover, the strength of association as depicted by Cramer's V are 0.114, 0.120 and 0.093 for 2009, 2012 and total respectively.

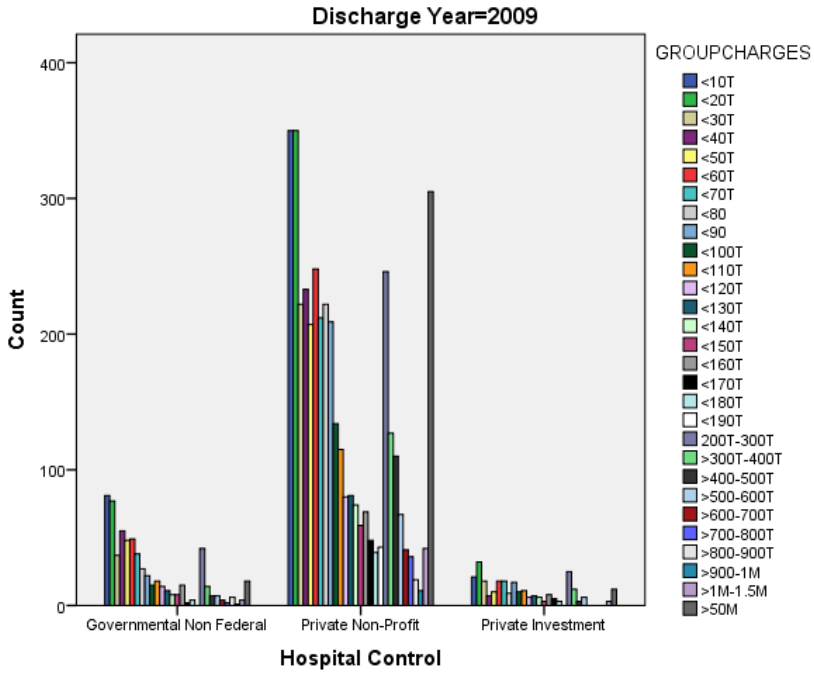


Figure 99

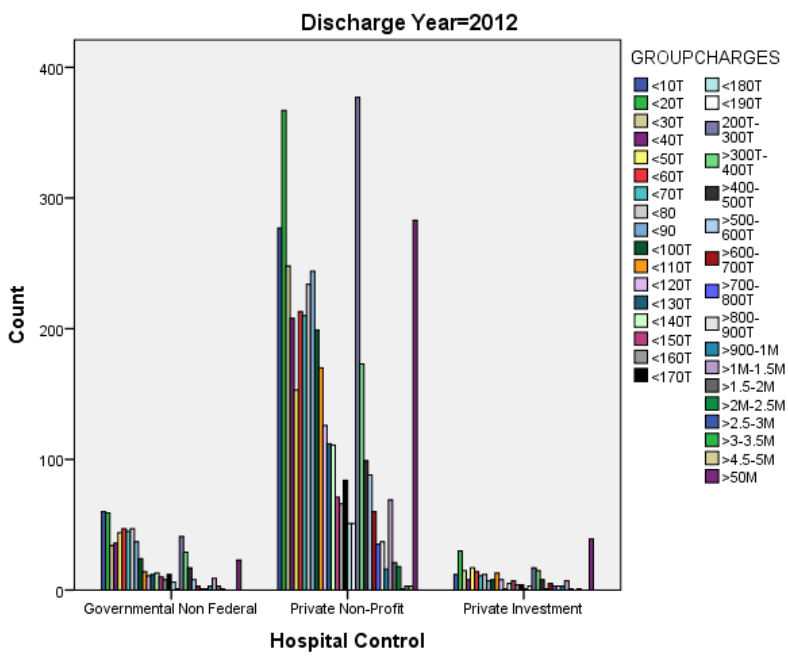


Figure 100

Lymphoid leukemia by Age and sex

The distribution between male and female as depicted in Table 162 shows the higher prevalence of leukemia in male than female for both years. It also shows no significant changes in the number of male; female diagnosis between these years. This finding is also consistent with published data indicating a higher prevalence and incidence of leukemia and ALL specifically in male compared to females. Furthermore, table 164 below provides the average age for individuals that presented with leukemia of lymphoid origin; 8.46 for males and 7.33 for females.

Case Processing Summary

Table 155	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
*Total Charges * Discharge Year * Sex*	10877	96.6%	382	3.4%	11259	100.0%

Mean Charges by Year & Gender

Table 156						*Total Charges*
Discharge Year		Mean	N	Std. Deviation	Sum	% of Total Sum
2009	Male	132422.83	3277	193774.347	433964491	26.1%
	Female	127671.77	2333	183607.678	297863479	17.9%
	Total	130447.05	5610	189610.516	731827970	44.0%
2012	Male	185095.13	3002	325971.140	555601994	33.4%
	Female	165961.70	2265	258622.837	375940485	22.6%
	Total	176866.15	5267	298994.987	931542478	56.0%
Total	Male	157603.83	6279	266602.073	989566485	59.5%
	Female	146534.38	4598	224521.003	673803964	40.5%
	Total	152924.24	10877	249728.270	1663370448	100.0%

ALL as a Primary Diagnosis ***Table 157***		*Mean*	*N*	*% of Total N*
Total	Male	8.46	4396	57.4%
	Female	7.33	3262	42.6%
	Total	7.97	7658	100.0%

Leukemia vs Length of inpatient stay vs Sex

An evaluation of the relationship between gender and inpatient stay shown similar total satay with mean of 14.07 for males and 13.95 for females. Hence there is no relationship between sex and length of stay for patients in the sample. Another observation from this analysis is that the male to female ratio varies; 6465 and 4781 respectively.

Table F below provides the outcome of the evaluation

Mean LOS for Year and Gender

Table 158 *Length of Inpatient stay*

Discharge Year		Mean	N	Std. Deviation	Sum	% of Total Sum
2009	Male	13.55	3386	17.247	45894	29.1%
	Female	14.01	2436	19.938	34141	21.7%
	Total	13.75	5822	18.421	80035	50.8%
2012	Male	14.64	3079	20.453	45078	28.6%
	Female	13.89	2345	18.765	32572	20.7%
	Total	14.31	5424	19.742	77650	49.2%
Total	Male	14.07	6465	18.848	90972	57.7%
	Female	13.95	4781	19.370	66713	42.3%
	Total	14.02	11246	19.071	157685	100.0%

Table 159 *Length of Inpatient stay*

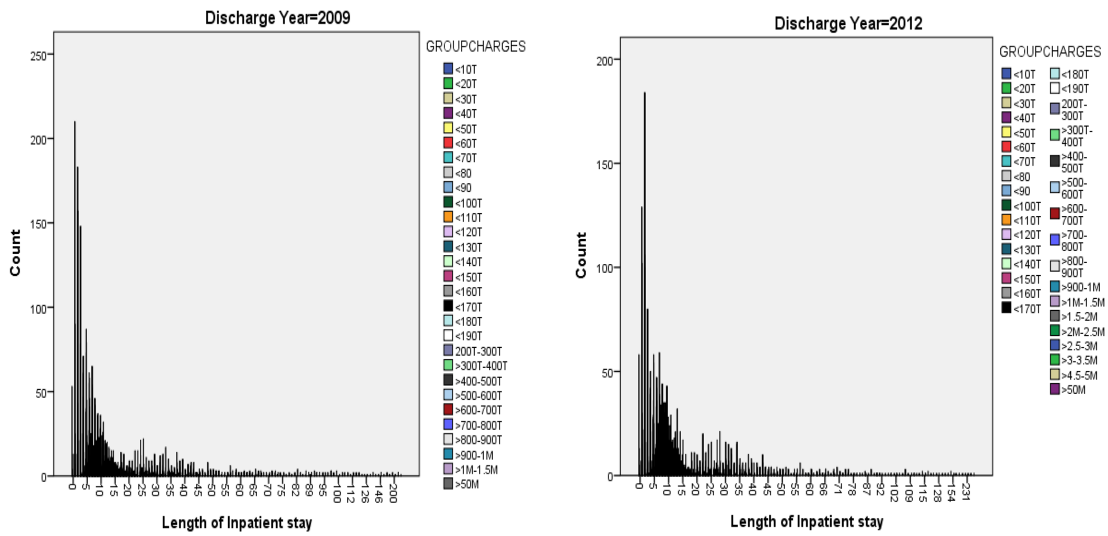
ALL as a Primary Diagnosis		Mean	N	% of Total N
Total	Male	14.07	6465	57.5%
	Female	13.95	4781	42.5%
	Total	14.02	11246	100.0%

Table 160 ***Chi-Square Tests***

Discharge Year		Value	df	Asymptotic Significance (2-sided)
2009	Pearson Chi-Square	23076.133[b]	3276	0.000
	Likelihood Ratio	11322.041	3276	0.000

	Linear-by-Linear Association	1487.541	1	0.000
	N of Valid Cases	5851		
2012	Pearson Chi-Square	35232.359[c]	3861	0.000
	Likelihood Ratio	10246.823	3861	0.000
	Linear-by-Linear Association	1080.508	1	.000
	N of Valid Cases	5313		
Total	Pearson Chi-Square	60870.851[a]	4719	0.000
	Likelihood Ratio	19762.991	4719	0.000
	Linear-by-Linear Association	2546.852	1	0.000
	N of Valid Cases	11164		

This table show significance for the variables. Moreover, one may observe that the strength of association (Cramer's V) of 0.406



Figures 101-102 depicts LOS and mean charges.

Primary Lymphoid Leukemia and Number of Chronic Diagnosis

The number of chronic diagnosis on patient record is imperative in understanding the wide range of complexities that could be associated with care. Moreover, it provides a preview into how it can directly or indirectly affect the charges and severity. The image below (Figure 1) shows how many individuals are within a certain range with chronic conditions and leukemia as a primary diagnosis. Furthermore, it show the relationship with cost and age and one can observe that there are outliers between 1-7 chronic diagnosis on both ends. One can also observe that there all age groups were susceptible to high or lower charge. An observation can also be made on regards to outliers between 2-4 chronic conditions on record.

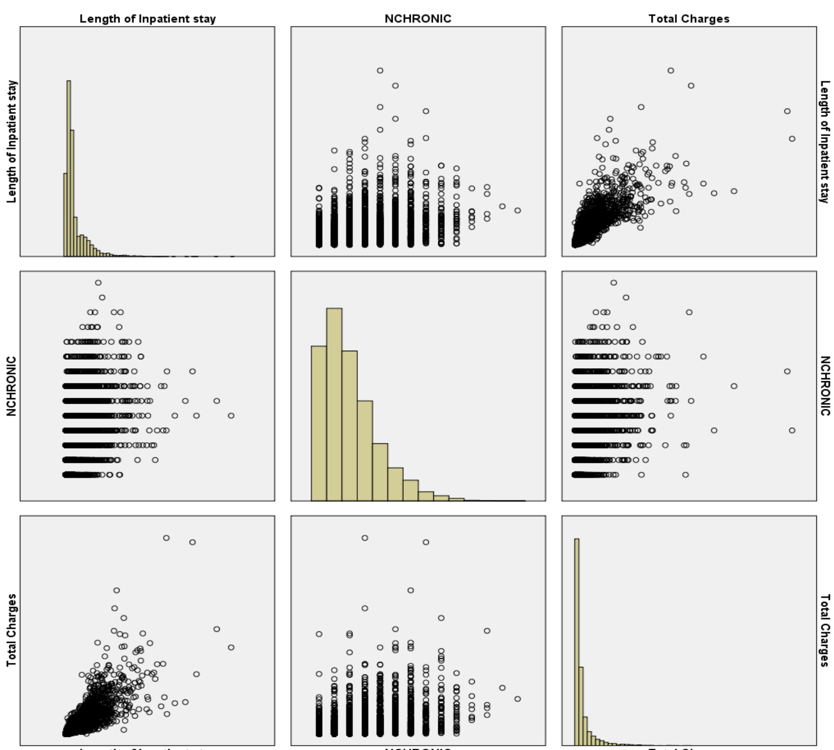


Figure 103: This figure provides detailed relations between primary lymphoid leukemia diagnosis, number of chronic conditions and charges.

4.7R: Linear Regression for Charges and other variables (Except hospital and Procedure) for Primary Lymphoid Leukemia Diagnosis

Model Summary

Target	Total Charges
Automatic Data Preparation	On
Model Selection Method	Forward Stepwise
Information Criterion	235,936.799

The information criterion is used to compare to models. Models with smaller information criterion values fit better.

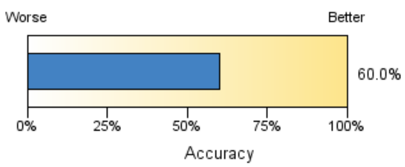


Figure 104: This image shows a summary of the regression on cost of primary leukemia diagnosis.

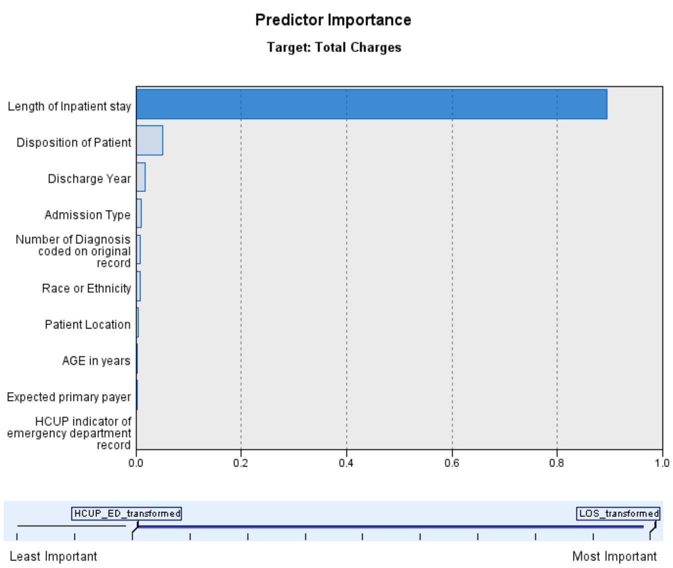
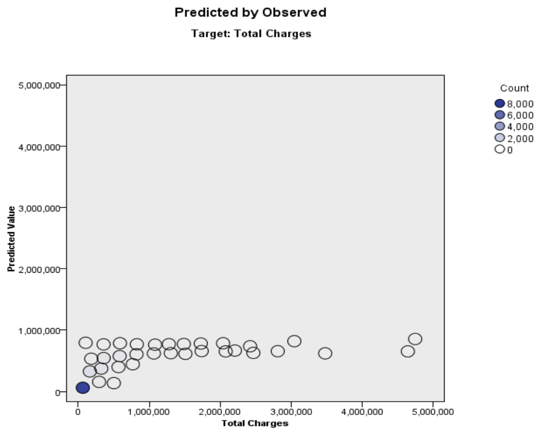
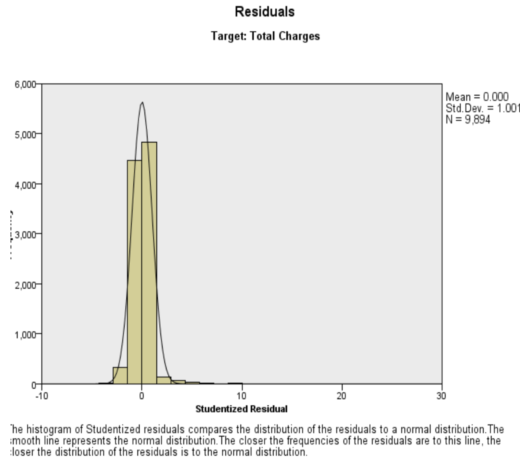
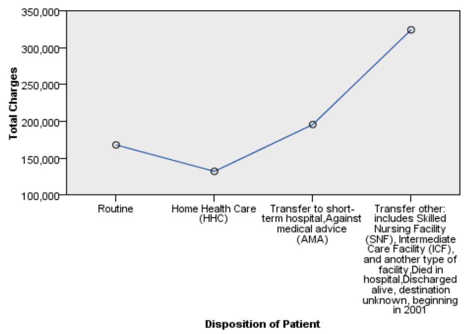
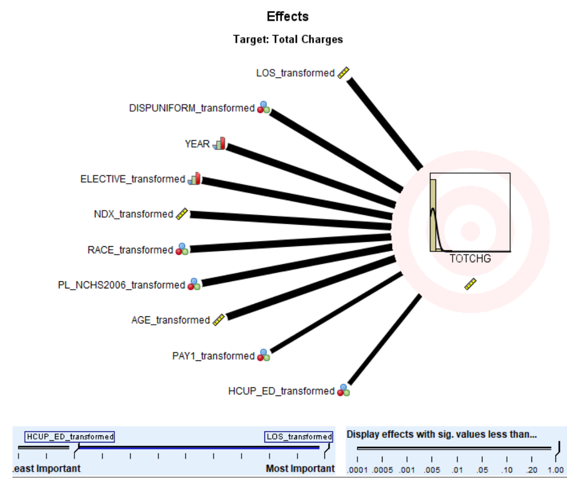


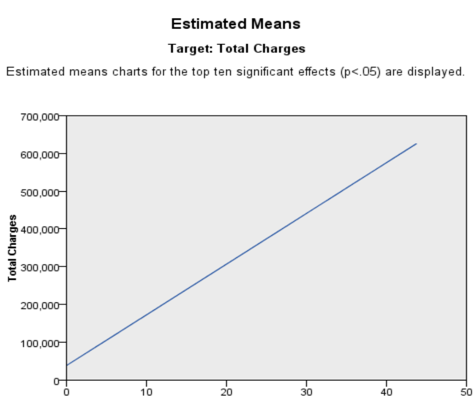
Figure 105: This shows the variables the have the most effect on total charges. LOS, Patient Disposition and discharge year have the most impact on total charges.



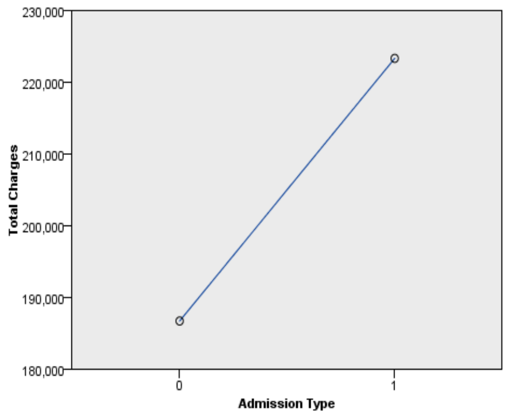


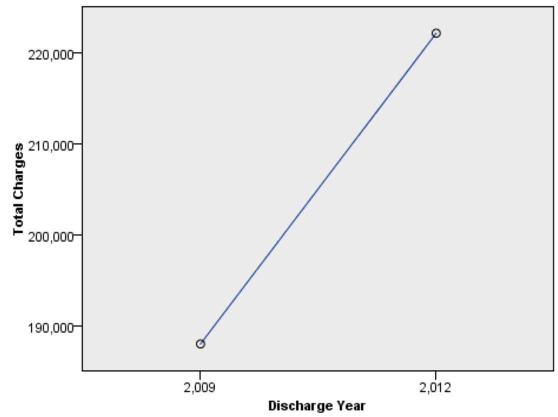


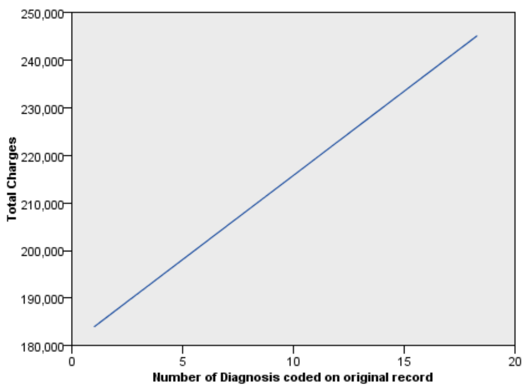


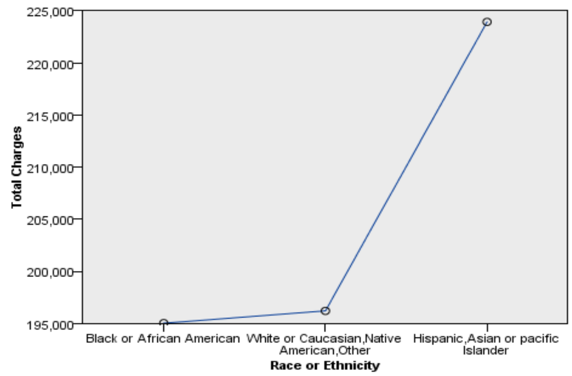


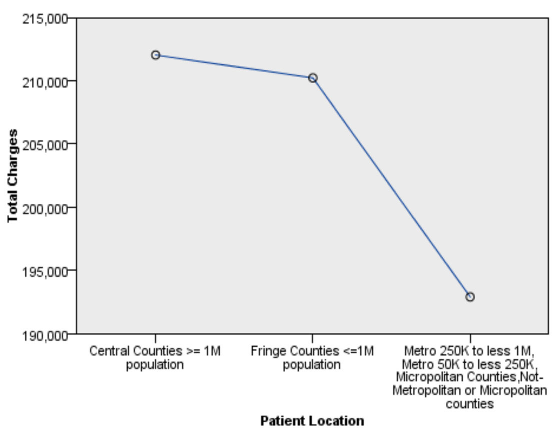
Figures 106-109 :

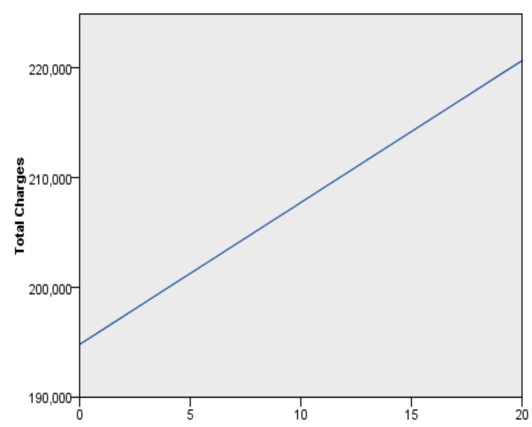




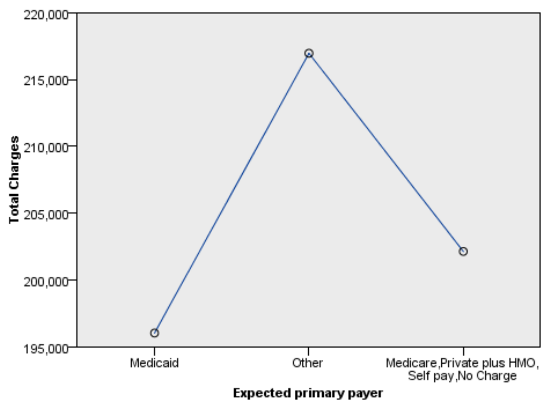








Figures 109-115



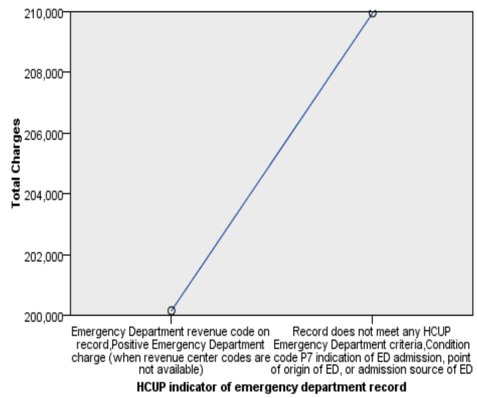


Figure 116-117

Table 167 ***Model Summary[c]***

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.839[a]	.704	.703	140962.098	.704	1217.894	17	8719	0.000	.[b]

a. Predictors: (Constant), Sex, Median household income for patient's ZIP Code, HCUP indicator of emergency department record, Discharge Year, Admission Month , Disposition of Patient , Patient Admitted on a WEEKEND , AGE in years, Race or Ethnicity, Expected primary payer, Length of Inpatient stay, Indication of Transfer, Admission Type, Patient Location , NCHRONIC, Discharge Quarter, Number of Diagnosis coded on original record

b. Not computed because fractional case weights have been found for the variable specified on the WEIGHT command.

c. Dependent Variable: Total Charges

Table 168 ***ANOVA[a]***

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	411398963155483.000	17	24199939009146.000	1217.894	.000[b]
	Residual	173255132351287.000	8719	19870312991.729		
	Total	584654095506770.000	8736			

a. Dependent Variable: Total Charges

b. Predictors: (Constant), Sex, Median household income for patient's ZIP Code, HCUP indicator of emergency department record, Discharge Year, Admission Month , Disposition of Patient , Patient Admitted on a WEEKEND , AGE in years, Race or Ethnicity, Expected primary payer, Length of Inpatient stay, Indication of Transfer, Admission Type, Patient Location , NCHRONIC, Discharge Quarter, Number of Diagnosis coded on original record

Summary of main findings

1. **This table 157 shows statistical significance for all years. Moreover, the Cramer's V recorded are 0.212, 0.190 and 0.18 for total respectively.**
2. **This table 161 shows statistical significance for the relationship between the variables. Moreover, the strength of association as depicted by Cramer's V are 0.114, 0.120 and 0.093 for 2009, 2012 and total respectively**
3. **This table show significance for the variables. Moreover, one may observe that the strength of association with a Cramer's V of 0.406**
4. **An observation could be made from table 167 that the strength of association depicted in R-squared is 0.7. This indicates that the selected variables explain 70% of the variation in charges. Moreover, it provides a p-value of 0.000 indicating statistical significance in the relationship.**

Chapter 4.8: New Jersey Statewide Lymphoid Leukemia Outpatient Characteristics

TABLE 169
LYMPHOID LEUKEMIA PRESENTATION BY COUNTY

NJ COUNTY	Mean	N
ATLANTIC COUNTY	$ 18,357	1
BERGEN COUNTY	$ 11,786	8
BURLINGTON COUNTY	$ 6,927	5
CAMDEN COUNTY	$ 11,994	2
ESSEX COUNTY	$ 7,179	6
GLOUCESTER COUNTY	$ 4,393	2
HUDSON COUNTY	$ 7,539	14
MERCER COUNTY	$ 6,316	27
MIDDLESEX COUNTY	$ 9,344	135
MONMOUTH COUNTY	$ 9,041	105
MORRIS COUNTY	$ 6,666	5
OCEAN COUNTY	$ 8,205	94
PASSAIC COUNTY	$ 6,618	15
SALEM COUNTY	$ 5,198	1
SOMERSET COUNTY	$ 5,247	42
SUSSEX COUNTY	$ 16,201	2
UNION COUNTY	$ 6,798	20
WARREN COUNTY	$ 7,290	7
TOTAL	$ 8,266	491

This table show the distribution of patient presentation by county in the state of New Jersey. Furthermore, it shows the mean charges by county. It shows a clear patient presentation in Middlesex, Monmouth & Ocean counties. The patient distribution by counties also shows a clear variation in charges based on patient presentations. Locations with less charges show a higher mean charge. This could be because of the severity of disease of the lack of accessibility to specific treatment. Presentation in these cases can also be associated with the race demographics in each of the counties that have highest patient presentation. The figure 102 below shows the variations in race presentation for the population by race in each county.

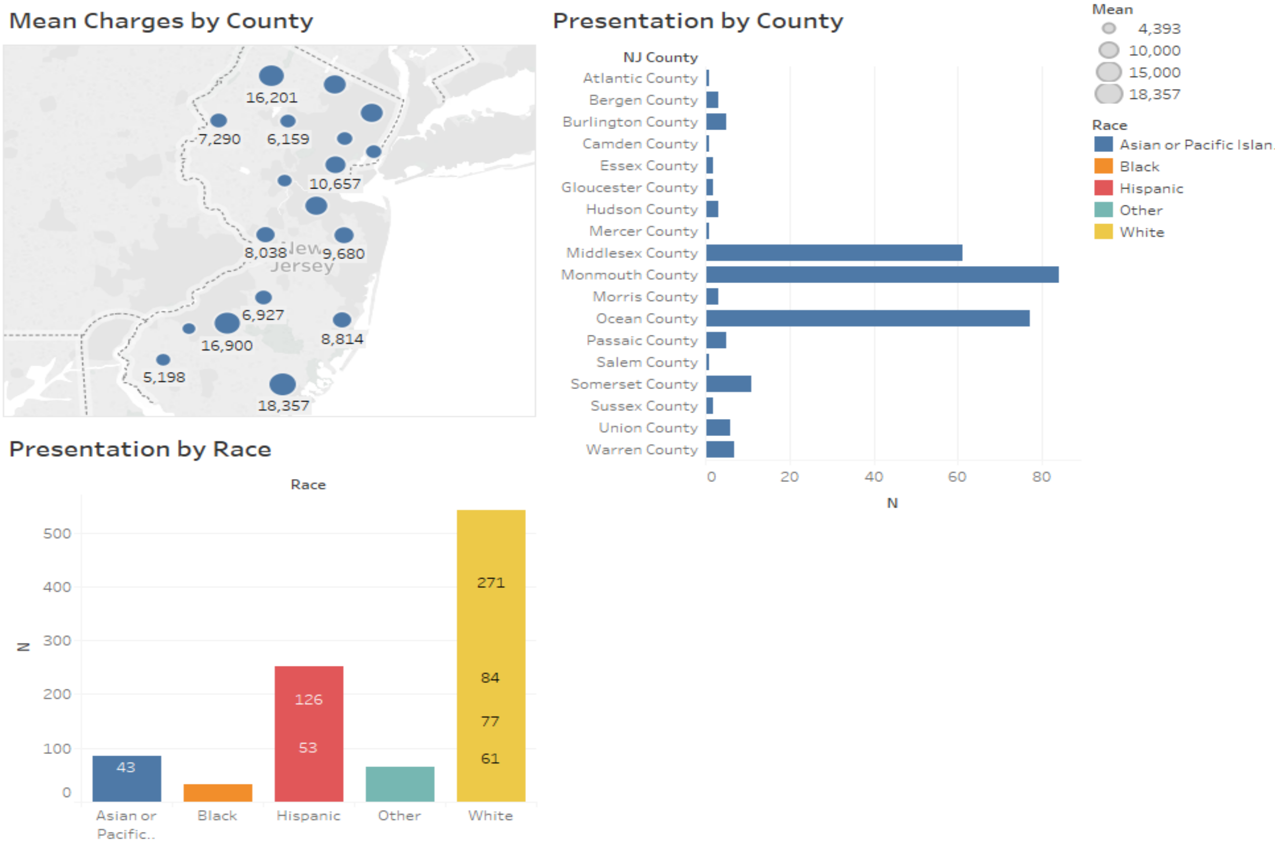
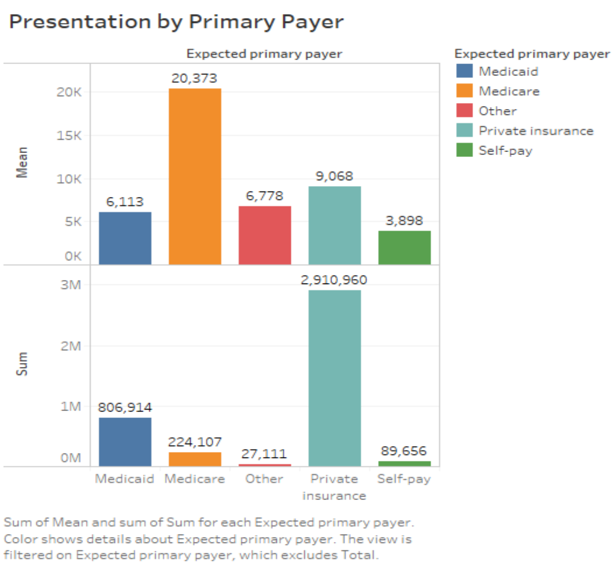


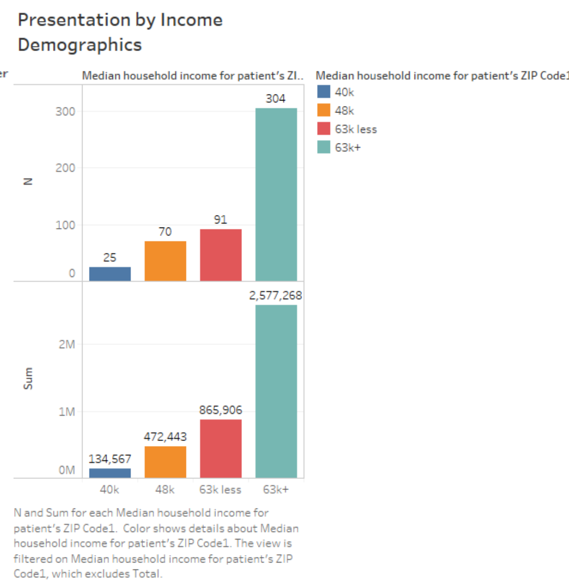
Figure 118: Patient Demographics by County.

Further analysis shows differences in charges and age presentation. Older population seemed to have a higher need for care and presentation. further analysis of these presentation shows families with higher income (>$63000) were more likely to present with leukemia. The sum of total presentation for these populations also corresponds to total charges. Payer difference shows private payment make up a significant payment method followed by Medicaid. It is interesting to see that mean charges for Medicare ($20377) were higher than any compensation as seen on table 172. Self-Pay showed the lowest mean charges for patients and distribution between counties is relative. It could be observed that more higher income counties have more self-pay compared to other low-income counties in the state.

TABLE 170 PRIMARY PAYER	MEAN	N	STD. DEVIATION	SUM
MEDICARE	$ 20,373	11	43244.93	$ 224,107
MEDICAID	$6,113	132	5809.249	$ 806,914
PRIVATE INSURANCE	$ 9,068	321	11380.77	$ 2,910,960
SELF-PAY	$3,898	23	3634.548	$ 89,656
OTHER	$6,778	4	2239.333	$ 27,111
TOTAL	$8,266	491	11758.93	$ 4,058,748

Figure 119: Presentation by Household Income & Payer Method





Disease Presentation

The relationship within the patient demographics shows ALL presentation was highest among the population. This presentation and finding corresponds to inpatient presentation and statistics. Further analysis shows a variation in the total cost of care when performed inpatient vs outpatient with inpatient cost significantly higher. One can observe that the relationship between cost of care and demographics shows statistically significance. The figures below show detailed relationship between the most prevalent leukemia of lymphoid presentation charges and sum. An evaluation of the admission type shows elective admission for majority of patient presentation.

Figure 119: Disease Presentation

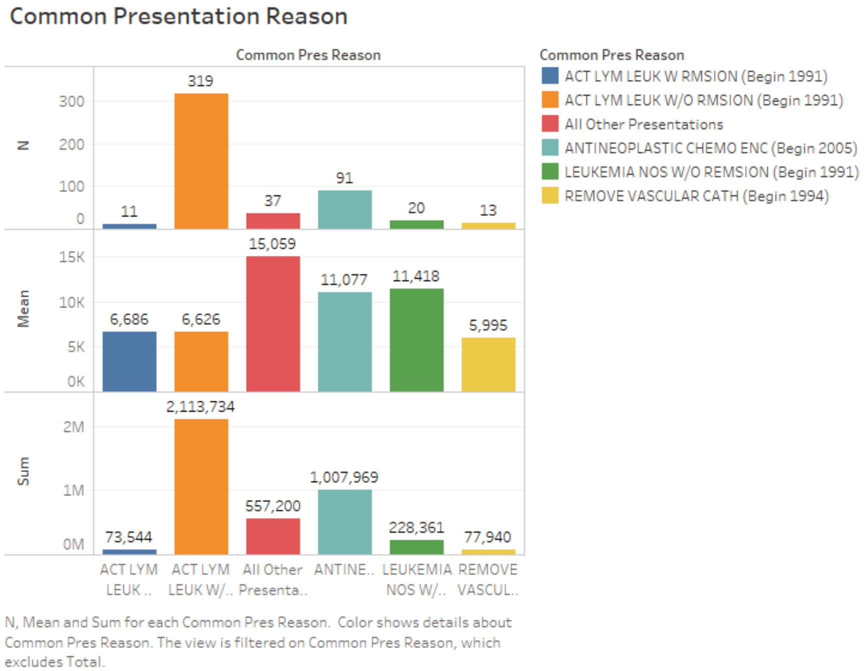
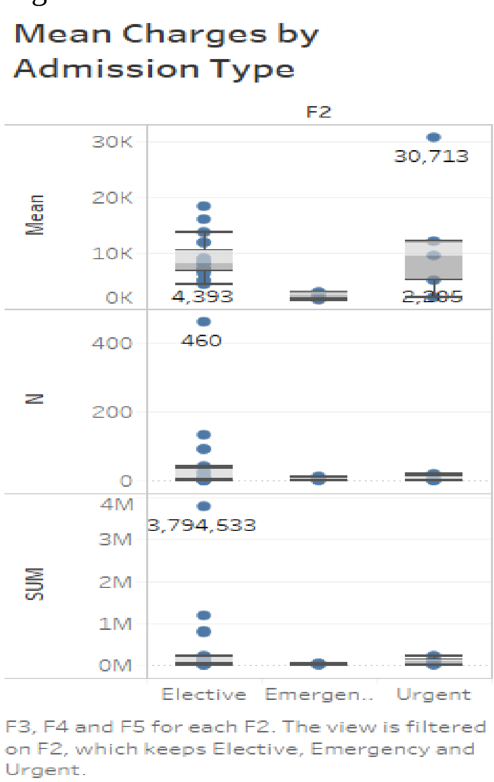


Figure 120



This figure shows the average charges for type of presentation in an outpatient setting. One can observe that the mean charges for urgent presentation is higher than emergent and elective presentation. The variation of admission type are more diverse in counties with higher patient presentation (Ocean, Middlesex, Monmouth). Figure 106 below shows that the most common procedure performed were administration of chemotherapy followed by other diagnostic procedures and bone marrow biopsy. Moreover figure 107 show that observation in an outpatient setting results in higher charges compared to non-observation designation.

Figure 121: Mean Charges by Common Procedures

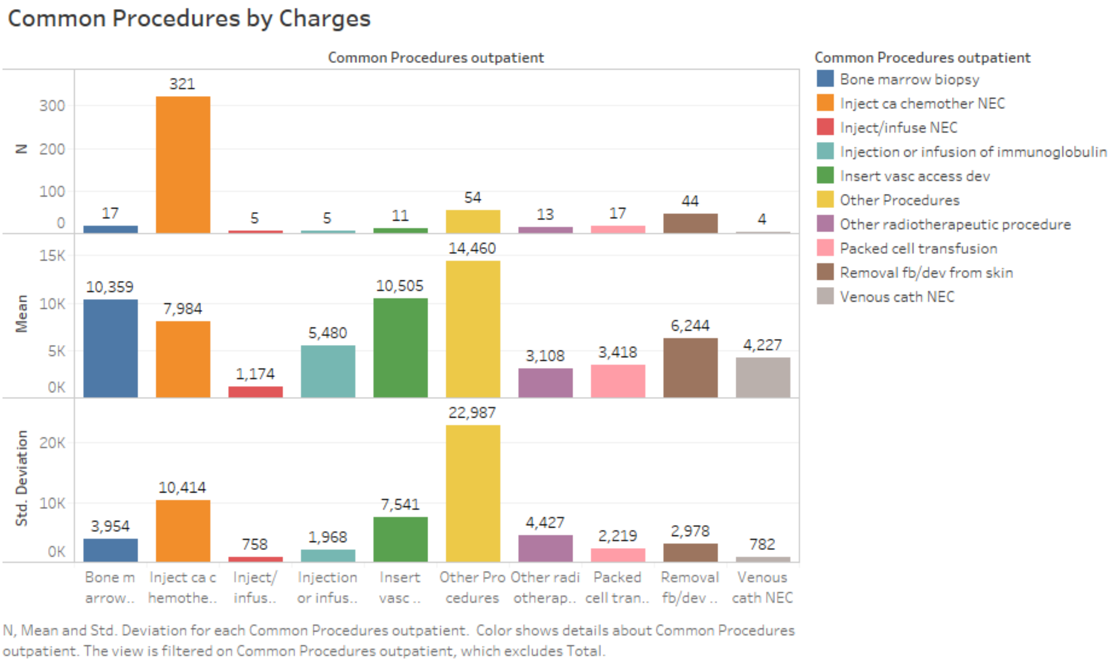


Figure 122: Patient Observation Requirement and Charges

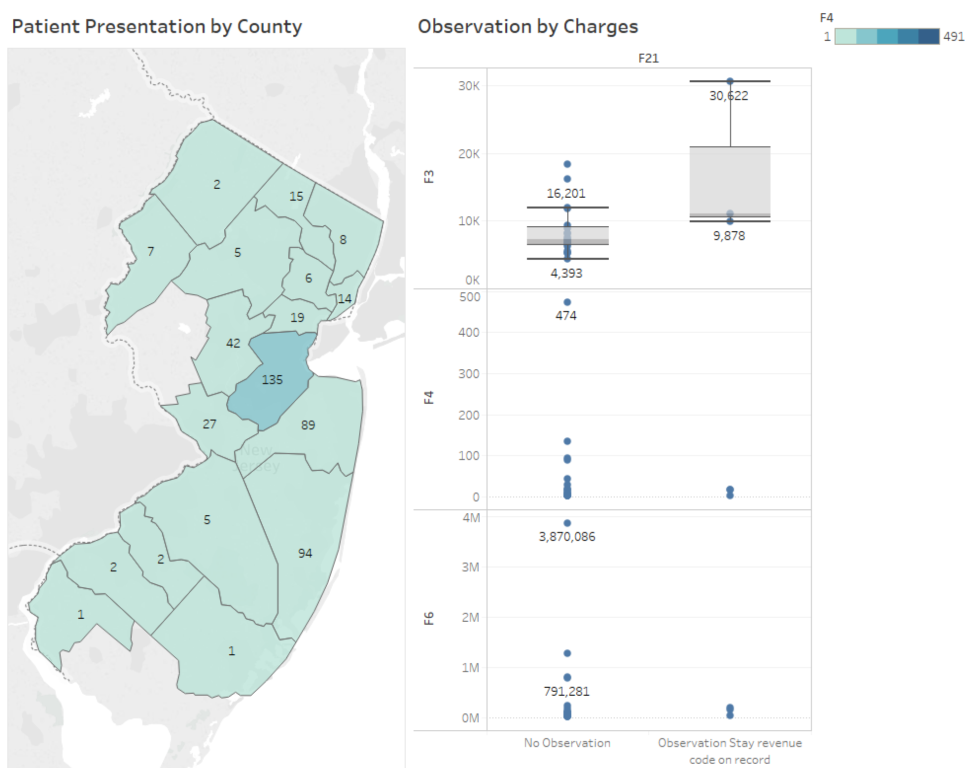


TABLE 171 CHRONIC CONDITIONS	MEAN	N	STD. DEVIATION	SUM
1	$ 6,785	108	5406.023	$ 732,833
2	$7,916	349	10180.892	$ 2,762,727
3	$9,155	25	7572.115	$ 228,868
4	$26,589	5	33854.155	$ 132,947
5	$50,343	4	67170.47	$ 201,373
TOTAL	$8,266	491	11758.931	$ 4,058,748

The table above shows the relationship between chronic condition presentation and its impact on charges. It shows a statistically significant relationship between the number of chronic condition and charges. It also shows patient presentation is more characterized with 2 chronic condition with a total of 349 presentation out to the total 491 ambulatory presentation. The relationship is different when an analysis is made between presentation and the number of diagnosis made during an inpatient presentation. the figure 108 below shows the variation in cost in comparing diagnosis and chronic conditions. Careful observation shows more than 3-fold increase from 2 diagnosis to 3. This is a sharp rise in cost of care compared to the relative stable variation in cost from 1 diagnosis to 2.

Figure 123

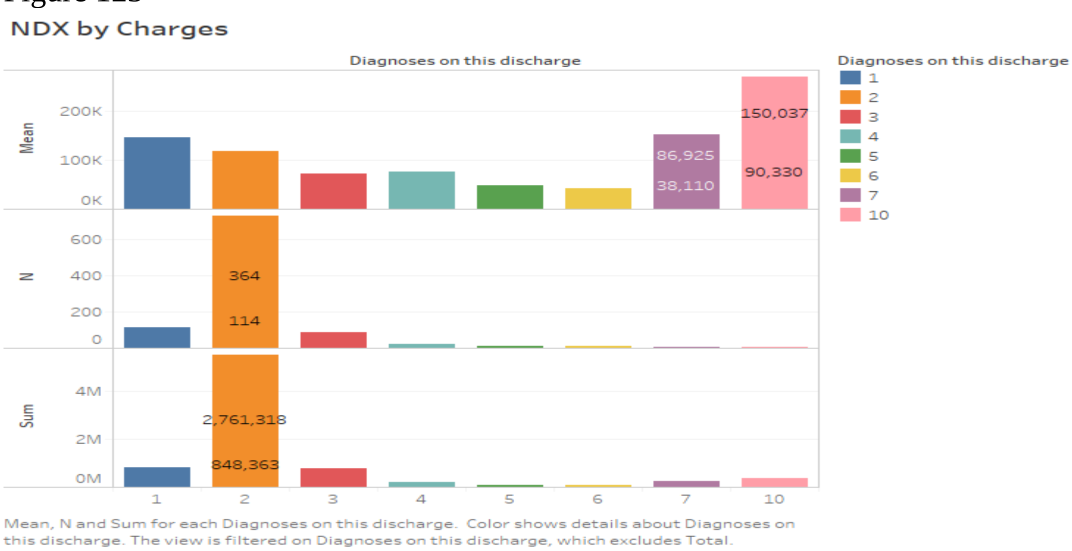
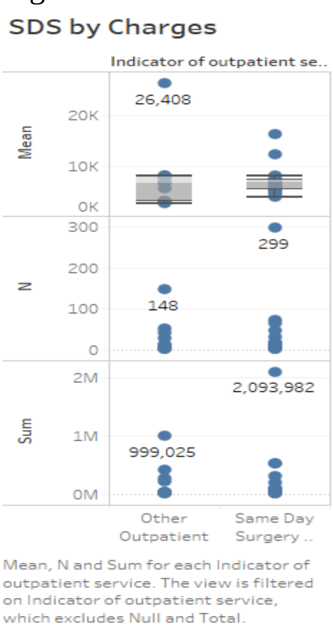


TABLE 172 PROCEDURES	MEAN	N	STD. DEVIATION	SUM
0	$ 10,434	32	8505.624	$ 333,873
1	$ 8,300	135	15637.209	$ 1,120,466
2	$ 7,125	286	9126.013	$ 2,037,761
3	$16,161	30	14874.957	$ 484,835
4	$ 11,285	7	4200.144	$ 78,996
6	$ 2,817	1	.	$ 2,817
TOTAL	$ 8,266	491	11758.931	$ 4,058,748

Procedures significantly increase the mean charges for each patient and the table above shows a varied impact of procedures and all patient population. The highest mean procedures of three cost the most with a mean charge of about $16161 and highest number of procedures performed to be 2 per presentation. A variation however could be observed when procedures are further subcategorized into same day surgery (SDS) and other non-same day procedures as seen in figure 109 below. Same day procedures had a higher mean than other procedures.

Figure 124



Chapter 4.8R: Regression: Total Charges by Patient Characteristics

Table 173: Model Summary[f]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.215[a]	.046	.038	11533.210	.046	5.881	4	486	.000	
2	.218[b]	.047	.036	11549.041	.001	.334	2	484	.716	
3	.288[c]	.083	.066	11368.245	.035	6.172	3	481	.000	
4	.317[d]	.100	.080	11281.682	.018	4.705	2	479	.009	
5	.439[e]	.193	.162	10766.120	.092	7.711	7	472	.000	1.875

a. Predictors: (Constant), AWEEKEND, Age in years at admission, AMONTH, Admission type

b. Predictors: (Constant), AWEEKEND, Age in years at admission, AMONTH, Admission type , Disposition of patient, Discharge quarter

c. Predictors: (Constant), AWEEKEND, Age in years at admission, AMONTH, Admission type , Disposition of patient, Discharge quarter, Median household income for patient's ZIP Code , Length of stay, Hours in Emergency Department

d. Predictors: (Constant), AWEEKEND, Age in years at admission, AMONTH, Admission type , Disposition of patient, Discharge quarter, Median household income for patient's ZIP Code , Length of stay, Hours in Emergency Department, FEMALE, HCUP indicator of observation stay record

e. Predictors: (Constant), AWEEKEND, Age in years at admission, AMONTH, Admission type , Disposition of patient, Discharge quarter, Median household income for patient's ZIP Code , Length of stay, Hours in Emergency Department, FEMALE, HCUP indicator of observation stay record, Expected primary payer, Race, Major operating room ICD-9-CM procedure indicator, Number of chronic conditions, Procedures on this discharge , Common Procedures outpatient, Diagnoses on this discharge

f. Dependent Variable: Total charges

The table above shows statistical significance between the total charges and variables of interest with an R-Square of 0.193. the p value of the module shows p-0.000 in the relation between charges and the variables of interest. Variation in total charge is explained by independent variable by about 19%. The analysis indicates that there is weak association between dependent and independent variables (R^2-0.162>0.30) Variation of the independent variables can be explained by the variable variations as attested in the table above. The assumption of independence of error is satisfied as supported by Durbin-Watson test of 1.875 (1.50-2.50). the ANOVA table below shows statistical significance for all modules based on the sequential regression.

Table 174		**ANOVA[a]**				
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3129051096.460	4	782262774.115	5.881	.000[b]
	Residual	64645258796.969	486	133014935.796		
	Total	67774309893.430	490			
2	Regression	3218222837.042	6	536370472.840	4.021	.001[c]
	Residual	64556087056.387	484	133380345.158		
	Total	67774309893.430	490			
3	Regression	5611311025.486	9	623479002.832	4.824	.000[d]
	Residual	62162998867.943	481	129237003.883		
	Total	67774309893.430	490			
4	Regression	6808936781.098	11	618994252.827	4.863	.000[e]
	Residual	60965373112.332	479	127276353.053		
	Total	67774309893.430	490			
5	Regression	13065106218.537	18	725839234.363	6.262	.000[f]
	Residual	54709203674.892	472	115909329.820		
	Total	67774309893.430	490			

a. Dependent Variable: Total charges

b. Predictors: (Constant), AWEEKEND, Age in years at admission, AMONTH, Admission type

c. Predictors: (Constant), AWEEKEND, Age in years at admission, AMONTH, Admission type , Disposition of patient, Discharge quarter

d. Predictors: (Constant), AWEEKEND, Age in years at admission, AMONTH, Admission type , Disposition of patient, Discharge quarter, Median household income for patient's ZIP Code , Length of stay, Hours in Emergency Department

e. Predictors: (Constant), AWEEKEND, Age in years at admission, AMONTH, Admission type , Disposition of patient, Discharge quarter, Median household income for patient's ZIP Code , Length of stay, Hours in Emergency Department, FEMALE, HCUP indicator of observation stay record

f. Predictors: (Constant), AWEEKEND, Age in years at admission, AMONTH, Admission type , Disposition of patient, Discharge quarter, Median household income for patient's ZIP Code , Length of stay, Hours in Emergency Department, FEMALE, HCUP indicator of observation stay record, Expected primary payer, Race, Major operating room ICD-9-CM procedure indicator, Number of chronic conditions, Procedures on this discharge , Common Procedures outpatient, Diagnoses on this discharge

Summary of Findings

1. **The tables 173 & 174 above shows statistical significance between the total charges and variables of interest with an R-Square of 0.193. the p value of the module shows p-0.000 in the relation between charges and the variables of interest. Variation in total charge is explained by independent variable by about 19%. The analysis indicates that there is weak association between dependent and independent variables (R^2-0.162>0.30) Variation of the independent variables can be explained by the variable variations as attested in the table above. The assumption of independence of error is satisfied as supported by Durbin-Watson test of 1.875 (1.50-2.50). the ANOVA table below shows statistical significance for all modules based on the sequential regression.**
2. **Procedures significantly increase the mean charges for each patient and the table above shows a varied impact of procedures and all patient population. The highest mean procedures of three cost the most with a mean charge of about $16161 and highest number of procedures performed to be 2 per presentation.**
3. **The table 174 above shows the relationship between chronic condition presentation and its impact on charges. It shows a statistically significant relationship between the number of chronic condition and charges. It also shows patient presentation is more characterized with 2 chronic condition with a total of 349 presentation out to the total 491 ambulatory presentation**
4. **One can observe that the relationship between cost of care and demographics shows statistically significance. The figures 148 above shows detailed relationship between the most prevalent leukemia of lymphoid presentation charges and sum. An**

evaluation of the admission type shows elective admission for majority of patient presentation.

Chapter 5: Discussion, Implications, limitations, Conclusions & Recommendations

The scope and use of a national database for evaluation of leukemia cost and its relationship to variables such as age, demographics, income, race is crucial in addressing the issue of continuous increase in cost. This stipulation is further supported by the significant difference in average charges per patient between 2009 and 2012 data release. Furthermore, the variation in cost for patients saw a considerable gap when comparing governmental organizations to private for-profit healthcare organizations. The data indicates that there are some areas in which different significance or relationship between the variable exists. One can also say that an increase in charge or cost did not show any association with improvement in disease severity or mortality.

The number of chronic conditions and diagnosis showed a relationship with the increase in Charges. Further analysis shows there is a direct relationship between charges, LOS, NDX, and NCHRONIC. This study shows that in areas classified as not metro or micropolitan areas cost are much lower than metropolitan areas. Furthermore, NCHRONIC between 9,10,13 &18 shows a significant increase in cost. Moreover, 7,8 and 11 shows a relative lower charge considering the comorbidities associated with these chronic conditions. Another finding shows how impactful OR procedure is on charges as well as relative presentation and cost for these procedures based on the size of healthcare facility. The relative difference in cost between regions could be said the Midwest and South had similar charges, North East had about $10,000 higher charges and West with a significantly disproportionate charge.

An understanding of the type and number of procedures performed on patients also aided in providing a clearer picture of its impact on charges. Another crucial aspect of understanding this will be the duration between admittance to the procedure of change in classification of severity. The study indicates that the earlier specific procedures were performed, the less likely their mortality as well as severity and LOS. The relationship between cost and hospital region varies; Southern part of the country showed a higher charge for services that were provided in other parts of the country with a significant difference. It also showed the different relationship between hospital control and charges in all areas. When the disease severity is considered and compared to its impact on cost regionally, one observes a higher severity with lower charges in certain parts for a patient with less than three chronic conditions and 2 diagnoses (Northeast, West).

Another interesting finding is the relationship between specific cancer therapeutic and diagnostic procedures and cost in an inpatient setting vs. outpatient. The main charges for individuals with the same severity and mortality risk seeking the same procedure in an outpatient facility is significantly lower than inpatient care for the same procedure. The variation in disease prevalence based on income zip code showed a significantly higher probability in higher income households across all regions and demographics. Factors such as resource availability and location, hospital ownership and teaching designation all seem to have an indirect impact on the total charges.

This study illustrates that the average cost of care for male and female varied with a difference of about 5 percent for both years. Moreover, an observation of the increased cost could be made for all sex groups for both years recorded. A difference of about 600 million dollars was spent on leukemia of lymphoid origin with a gap of about three thousand more diagnoses. The difference between treatment costs also showed no significant variation between male and females. The age demographics for this population could be said to be non-uniformly distributed across all age group in the pediatric population. The highest community with the presentation of leukemia of lymphoid origin were the individuals between 3-12 years old with almost 60% of the pediatric population. Further analysis of the data also indicates that only 17.6 percent of the population had any form of emergency medical services provided to them during inpatient care. The average LOS showed an almost insignificant variation between 2009-2012 (7.19, 7.01 days). This could mean that there has been some improvement in the treatment protocols, but that has not demonstrated any significance in reduction of total LOS for these populations. The number of individuals with other chronic conditions or diagnosis is significant with more than 85 percent of the people in this category. In some instances, some individuals (minority) were found to have as much as 55 diagnoses during inpatient treatment. Private payers had more than 50 percent of the coverage for these populations with governmental coverage (Medicare, Medicaid) with an estimated 43 percent. An evaluation of hospital characteristics shows high presentation in the South, urban large, non-profit hospitals with the highest inpatient treatment.

The population less than one-year-old showed higher mean than all other classified population with less than 1 percent of the population. Furthermore, the populations higher than 1 and less than 14 shows a drastic increase in the cost of care in 2012 compared to 2009. On average The analysis indicates that the mean charge difference between male and female was not significant even though leukemia of lymphoid origin presentation was higher in males compared to females. The number of individuals discharged to other healthcare facilities, individuals with an unknown point of care, NCHRONIC, NDX reception presented with the higher cost of care. An analysis of LOS indicates that the higher an individual stay in an inpatient setting, the more likely an increase in cost is observed. Moreover, an observation of payer shows that private payers and Medicare patients charges were higher than all other payments methods. Smaller population centers showed the very small number of leukemia presentation and hence fewer charges averagely compared to large metropolitan areas by several thousand dollars. The cost of care for Caucasians (54%) is more than 27,000 differences to second highest race (Hispanics 30%); moreover, same analysis could be made in comparing other population with the Caucasian population in the dataset. The analysis indicates that there is substantial statistical significance for age, patient disposition, gender, number of a chronic condition, race, year and indication of emergency record with total charges.

Evaluation of disease severity shows some significance concerning gender, admission type, NCHRONIC, NDX, year of discharge and mortality in the population diagnosed with any leukemia of lymphoid origin. Moreover, the relationship with age at diagnosis, patient disposition, discharge quarter, payer, patient location, race, and income demographics. These findings support the publications of other researchers that examined the cost of care in states such as Utah [22]. This finding also shows that the NCHRONIC and NDX are essential variables or factors that directly affect LOS and increased modification of total charges on record. Mortality shows statistical significance for with age at diagnosis, hospital region, NCHRONIC, NDX, NPR, discharge year and hospital size. One can observe that this presentation is very similar to what was seen in the relationship between the variables and severity. Furthermore, based on the output of the regression the analysis indicates that even though there was some statistical significance in the relation the variation in mortality is only explained by the independent variables in less than 50 percent of cases.

Length of inpatient stay (LOS) is one of the most critical factors that directly affect the charges. Moreover, it is as an essential factor in the evaluation of impact on mortality and disease severity. The LOS varied for a diverse population with factors such as age, AMONTH, patient disposition, elective admission, hospital region, NCHRONIC, NDX, NPR, primary payer, patient, and location. As observed by other studies, the highest age population affected by leukemia of lymphoid origin/ increased LOS are individuals between 2-12 years old. Further evaluation also shows that increased LOS directly changes the disposition of individuals including death as demonstrated by a Cramer's V of 0.174 and 0.298 respectively. Another critical observation could be seen between LOS and hospital characteristics such as region, control and bed size. There is a variation for hospital LOS as compared to regions with the southern part of the county having more extended inpatient stays compared to other sections of the United States. Medicare (5 days), patients are less likely to have a higher LOS compared to private payer with a mean LOS of about seven days.

An evaluation of charges and hospital characteristics is imperative in gaining a better understanding of how variations of this factors impact cost. The variation in cost for hospital region is \$73759, \$55076, \$55829, and \$89382 for Northeast, Midwest, South, and West respectively. The interesting finding looking at this data shows that the southern region of the United States had the most presentation of leukemia with 38.4% of total presentation. The west region with only 25.2 percent of the population averages higher than south with a difference of more than 30 thousand dollars. Further analysis of the relationship between severity and mortality does not show higher presentation in the West but rather in the South. An observation could also be made that charges increased in all areas across the United States as did survival. Hospital size showed a majority of individuals received care from larger teaching medical facilities with an average charge of $62407 (67.5% population) compared to medium-sized hospitals (22% population) with an average charge of $84016. The highest difference in average charges for leukemia care occurred with medium-sized facilities between 2009 to 2012 with a difference of over $20000. The difference between these variables and severity and mortality does not show statistical significance. Private for-profit hospitals showed a higher average ($83280, 4.7% population) compared to non-profits ($70078, 82.3% population) and governmental ($50571, 13% population). Further evaluation of the data also shows a significant difference between indications of any procedures performed on the patients with leukemia.

The average for individuals with no procedures was about $53242 compared to those with the procedure of $362079. A difference of over $300,000. This finding further supports the idea that the complexities associated with leukemia of lymphoid origin in the pediatric population. A further breakdown of most common procedures performed on these population shows some interesting findings such as high cost associated with diagnostic marrow procedures, spinal tap and their association with severity and relatively low cost of other, not marrow or spinal related. Further analysis of marrow procedures shows significant variation in the charges associated with $793516 to $219622. A comparison of these charges with other non –operative procedures indicates a higher cost for infection related treatment. These infections pertaining treatment shows higher fees when compared to chemotherapeutic agents which average between $85393-$43216 and vaccination and infection treatment averaged $166849 between 2009-2012 data. Further analysis of pharmaceutical interventions in the process of care shows a highly significant variation in the cost or charges depending on the agent or medication used in treatment with high dose Interleukin infusion average of over a million dollars. Another critical factor that impacts cost in care processes are diagnostic radiologic studies; the finding that these studies do not have a significant impact on the cost of care is imperative in future resource allocation for these populations.

ALL which is the most common type of leukemia is shows an average cost of $130348 (2009) and $176866(2012). Moreover, this statistic is associated with an increase in inpatient presentation in 2012. A similar characteristic is observed as seen with all leukemia presentation in the United States in this population as well. There was an increase in charges from 2009-2012, with private facilities charging $204,007 (3% population) compared to non-profits $180,770 (50% population) or governmental $140,568 (6% population) between 2009-2012. Another observation of this population shows that the average age for a male to female is 8 to 7. The length of inpatient stay for both populations also shows an increase by one day averaging 13 to 14 before 2009 and after respectively. The cost of procedures seems to be continuously increasing every years and this could be related to new approaches to treatment and utilization of more targeted therapy.

Lymphoid leukemia at the state level (NJ) shows varied presentation with Middlesex, Monmouth and Ocean counties showing highest cases in the state. The charges for similar care varied by county and this could be because of other procedures not included or coded for. Another factor that may be affecting presentation is the availability of cancer treatment facilities in various counties. Majority of patient presentation were routine with only 1 patient being transferred to an inpatient facility after a presentation. Patient and physician contact hours do not show a statistically significant relationship with total charges with a mean of $8,266. The number of chronic conditions varied significantly compared to inpatient presentation. It could also be observed that the total charges for similar procedures cost significantly less when comparing inpatient and outpatient care. ALL were the most frequent presentation with higher charges and higher severity likelihood in an inpatient setting. As this study has shown, there is a variation in cost when comparing the location of services. Inpatient cost for common procedures associated with leukemia of lymphoid origin care is significantly higher than that of outpatient care.

Limitations of the Study

This study is limited by the lack of breakdown in cost and subcategorization of all cost or charges associated with care. An analysis of cost instead of general charges will aid in gaining a better knowledge of how the region and various healthcare organizations allocate health care cost. An important factor that could be studied with a detailed breakdown of charges in outcomes and how effects, severity, mortality, and length of inpatient stay cost. For instance, an understanding of the analysis of individual cost by hospitals will be crucial in understanding areas in which some amount of waste exists and the development of effective strategies for addressing such problems. Another limitation is the of lack specification about treatment with pharmaceutical products. The specification of such treatment will be essential in studying outcomes and effectiveness of one cancer medication over another. The general categorization of the treatment makes such outcomes measurement impossible from the dataset.

Another essential aspect that limits the scope of the studying is lack of genetic data and cost associated with genetic testing for these patients. Genetic testing are increasingly imperative in developing targeted therapy and personalized care. Such data would allow a comparison of the diverse patient presented with the clinical protocol to develop effective, cost-effective ones for patients. Moreover, the availability of such data would aid in understanding the importance, relevance, and impact of such studies in providing targeted therapies as well as practical understanding of health outcomes about cost and expenditures.

The utilization of only one state outpatient data limits the generalization because of various factors that may impact cancer care by regions. New Jersey's high population and relatively high urban populations may mask specific impact on cost such as rural- urban demography. As the inpatient analysis has shown there are varied relationships between the variables from one region to the next and this statewide approach limits understanding of nationwide impact factors. A single year analysis may also not show relative changes in outcomes for the patient population and could limit broader understanding of treatment protocols.

Implications

Such a study will aid healthcare, and governmental organizations understand the various areas that significantly affect the cost of care associated with leukemia. It would also most importantly aid healthcare providers understand health outcome through in-depth analysis of treatment approaches, medications, protocols as well as evaluating the cost-benefit analysis of all areas associated with the care of these populations. Such a study on a governmental level will aid in the reduction of the tremendous amount of cost since a significant amount of the population (43%) depend on governmental services for care (Medicare, Medicaid). Another significant indication is that such a study further shows the necessity for some parity in services provided because an observation of lower cost when individuals with similar disease severity seek medical care in private compared to the governmental facility. On the national stage, such policies could aid in addressing the continuous debate on healthcare cost and the need for strategies to cut the cost of care. Programs such as CHIP and other governmental support programs for children will at less risk of suspension because of efficient resource allocation.

On an organizational perspective, a study such as this allows for individuals healthcare organization gain better understandings of effective treatment approaches being utilized by other organizations with better outcomes. Moreover, it will aid organizational management in resource allocation decision making especially as it relates to chronic illnesses such as leukemia. An in-depth understanding of all factors associated with treating such patient populations would also aid administrators in proper anticipation and better budgeting and revenue generation strategies for services provided. Such a study could be utilized by healthcare organizations regardless of size in gaining new ground in offered specific services required by these populations. For example, community hospital of one with some governmental affiliation (Non-Federal) could improve their services in this regard to gain a foothold in specific areas that are underserved. Approaches such as outpatient clinics and urgent care centers with tools necessary for active evaluation of blood sample not far from large metropolitan areas could be essential in increasing organizational service areas as well as a revenue stream.

Private coverage which makes up almost 50% of the payment system for these patient population shows how much studies that decrease cost could have a direct impact on patients and their families. Studies have shown that there is tremendous amount of cost associated with care that is not usually calculated or taken into account for cancer treatment especially for the pediatric population [30]. This study has shown that individuals tend to favor receiving care in urban centers at large teaching hospitals compared to smaller governmental facilities. But these facilities tend to charge less for similar presentation (severity and mortality) and produce similar outcomes. The continuous emphasis on inpatient care is directly related to LOS which is an important factor in determining over 60% of cost.

Conclusion

Childhood leukemia is the most common malignancy in the pediatrics and hence takes vast resources for cancer care in these populations. An understanding of the processes of care and how the astronomical cost is utilized will aid in finding cost reduction strategies. As we understand treatment approaches, it is imperative to look at protocols and what could be utilized in cutting the high costs that come with care. A one-day extended stay at a healthcare facility tremendously increases the cost as reported by several researchers [24, 25, 26]. The main factors affecting cost include LOS, NCHRONIC, NDX, procedure cost, hospital ownership, and region. The Western part of the country with 25% of the patient presentation was allocated 34% of total charges nationwide; this is a significant variation in cost compared to Northeast (17%), Midwest (17%) and the South (32%) where cost seems to be evenly distributed. The significant difference in cost in the western part of the country could be associated with several factors including labor cost and higher hospital charges.

The lack of variance in outcomes between the West and other regions supports the argument that more expenditure or higher cost is not proportional to a better outcome. It also necessitates the discussion and implementation of quality improvement strategies that evaluates process, structural measures to improve health outcomes. Governmental health care facilities in all regions charged lower prices for shorter LOS with similar outcomes concerning severity and mortality risk. These findings support the idea of utilizing alternative treatment and discharge protocols are possible and need to be inculcated into inpatient treatment. Moreover, outpatient facilities and home care service could aid in the continuity of care and to decrease the LOS and the total cost of care. The Southern part of the country showed higher patient presentation and relatively low cost of care and no significant difference in outcomes compared to other areas. This presentation could be associated with population size and race demographic differences in the regions and country. LOS in the South was generally lower in comparison to other regions even though there was a higher emergency presentation. These findings and the low mean charges in this region further supports the idea that care could be provided at a lower cost without compromising outcomes.

Furthermore, it shows that there are variances in treatment approaches, protocols, cost and utilization of service across regions. The utilization of skilled, intermediate care facilities and home health is associated with lower charges as this study has shown. Development of protocols that ensure patient transfer or treatment at other facilities could play a key role in addressing the continuously increasing cost of care.

The cost of procedures both in an inpatient and outpatient setting shows an increase over the years without significant variation in patient readmittance, mortality or severity risk. Several procedures, when conducted in an outpatient setting, showed lower charges as demonstrated in the analysis of outpatient data in this study. Diagnostic and therapeutic procedures including bone marrow transplantation and radiologic imaging increases could be attributed to several factors including worsening of conditions and infections. The variance in the utilization of diagnostic procedures across regions without changes in mortality and severity risks can serve as an avenue for cost reduction in care processes. Evidenced-based treatment protocols could aid in addressing and directing the use of such healthcare resources which could lead to cost reduction. Adoption of such initiatives could aid in improving health outcomes by decreasing readmittance and emergency service utilization. Tailored Outpatient care shows the most cost-effective approach to care for some procedures in these populations across all regions.

Leukemia of lymphoid origin presentation in low-income families (<$38,999) was generally distributed across the country except in the South region where there is a consistent higher presentation. Income differences could also be observed when a race is considered with Caucasians having a higher household income and presentation than other populations. The Hispanic population showed the highest presentation with low income followed by African Americans. These findings can be directly associated with health outcomes in these populations. The Hispanic population severity and mortality risk were higher than other populations in the low-income subset. Generally, household income of less than $38,999 can be associated with higher mortality, severity risk, ER presentation and increased cost of care. Factors such as education, lack of access and insurance coverage in certain minority communities could be the reason for such findings. The unique environmental characteristics of these populations necessitate a public health approach and further research to understand better factors contributing to the lack of improvement of outcomes in these populations. A clear understanding of these factors could contribute to the development of effective strategies that would address cost and health outcomes.

The complexities associated with cancer treatment, in general, makes it almost impossible to provide care outside of a hospital. However, utilization of alternative facilities in non-emergent cases cost less and show no difference in outcomes. The unpredictable nature of the acute patient presentation, as well as the necessity for specialized care for this population, is directly related to the continuous increase in the cost of care. The need for specialized acute oncological centers associated with major pediatric hospitals is evident now more than ever because of many of the issues discussed above. As with urgent care, this approach will likely decrease time patient wait at an ER and also receive specialized care with providers that have detailed patient records to provide quality care. Furthermore, such approaches are necessary for decreasing hospital-associated infections as well as complications that may come with it.

It is essential for all stakeholders in the healthcare industry to understand the various factors that directly and indirectly impact cost and outcomes. This understanding is essential in devising strategies that address cost-related concerns without compromising on improving care quality. Understanding how pharmaceuticals medications, copayment, access, race, malignancy type impact cost holds the key to health outcomes improvement and useful resources allocation. External factors such as prescription medication, copayments and access to cancer care centers also impact the cost of care. These structural factors directly or indirectly affect factors such as ER presentation, readmittance and increase cost.

Furthermore, they indirectly affect parental income because of the intensive time constraints of medical appointments and constant interaction with health care providers. These factors need to be studied to get a full understanding of cost for these patient population. An understanding of the population’s ability to afford treatment for these medical diagnoses is imperative in formulating strategies for financing, health initiatives, and research.

Recommendations

There are several areas where the cost of care could be decreased both inpatient and outpatient setting. These cost reduction approaches require modification in the approach to caring for these populations. It also necessitates a review of several factors including hospital compensation, modified outpatient care and increased utilization of alternative care approaches before discharge. Below are recommendations that could aid in addressing the areas that could aid in cost reduction and affecting cost the most.

1. Development of a nationwide quality improvement (QI) program with clear outcome, process and structural measures for treatment of Leukemia of Lymphoid origin. Such an initiative will aid in addressing improving quality of care as well as cost based on individual dynamics at the hospital, county, state and national level. Initiatives such as the Alliance for Innovation on Maternal Health (AIM) have proven the effectiveness of such approaches.

2. A clear set of compensation guidelines, incentives programs that apply to all hospital ownership types is necessary to ensure the utilization of alternative treatment setting is utilized in the care processes of these populations. The variance in charges across the country for patients with a similar outcome as shown in this study necessitates such approaches.

3. An evidence-based approach to care including clear approaches to provider and hospital procedures compensation is necessary for cost reduction. The variation on the cost of procedures from one region or state to the next is a significant factor impacting total charges for procedures. As this study has shown, there is a stark difference in charges for procedures such as chemotherapeutic administration, stem cell transplants among many others when comparing hospitals by ownership and region.

4. Modification of care approaches and utilization of outpatient, home care and facilities other than inpatient care for a patient with less mortality and severity risk could aid in substantial cost reduction as observed in this study. Utilization of such alternative care approached could

significantly impact cost since the LOS affects about 60% of total charges. Over 50% of leukemia of lymphoid LOS was no more than five days with the other half taking up more than 70% of total expenditure.

5. Development and support for community-based health care facilities that provide treatment at cheaper cost compared to private for-profit and non-profit healthcare facilities. Such initiatives could aid in improving access to care in minority communities and aid in improving health outcomes.

6. A collaborative mechanism between primary care providers and oncologic specialists is needed to improve certain aspects of health outcomes. Chronic conditions in these patients' populations affect disease severity and mortality as indicated by the findings of this study. It is, therefore, necessary for primary care providers to be adequately involved in the treatment plan to ensure adequate treatment of chronic conditions.

7. Development of outreach, educational and support programs could aid in addressing the issue of higher severity, mortality, and charges in low-income households and minority communities. Such outreach programs could include treatment facilities that are closer to these communities. Other programs could also include shuttle and assistance services that could assist in transporting patients to and from healthcare facilities.

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Appendix A
ICD-9-CM LEUKEMIA OF LYMPHOID ORIGIN CODES

Medical Diagnosis	ICD-9-CM
Acute lymphoid leukemia, without mention of having achieved remission	204.00
Acute lymphoid leukemia, in remission	204.01
Acute lymphoid leukemia, in relapse	204.02
Chronic lymphoid leukemia, without mention of having achieved remission	204.10
Chronic lymphoid leukemia, in remission	204.11
Chronic lymphoid leukemia, in relapse	204.12
Subacute lymphoid leukemia, without mention of having achieved remission	204.20
Subacute lymphoid leukemia, in remission	204.21
Subacute lymphoid leukemia, in relapse	204.22
Other lymphoid leukemia, without mention of having achieved remission	204.80
Other lymphoid leukemia, in remission	204.81
Other lymphoid leukemia, in relapse	204.82
Unspecified lymphoid leukemia, without mention of having achieved remission	204.90
Unspecified lymphoid leukemia, in remission	204.91
Unspecified lymphoid leukemia, in relapse	204.92

Appendix B

Data Elements and Charactaristics

11 New Hampshire, Maine, and Mississippi participate in HCUP, but did not provide data in time for the 2012 KID.

12 States and areas in italics do not participate in HCUP. **All States, by Region12**

Region	**States**
1: Northeast	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont.
2: Midwest	Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin.
3: South	*Alabama*, Arkansas, *Delaware*, *District of Columbia*, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia.
4: West	Alaska, Arizona, California, Colorado, Hawaii, *Idaho*, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.

For prior years, refer to documentation on HCUP-US (e.g. the table of data element availability by years http://hcup-us.ahrq.gov/db/nation/kid/Availability_of_KID_Data_Elements_2012.pdf or previous versions of the KID Introduction). **Type of Data Element**	**HCUP Name**	**Coding Notes**
Admission day of week or weekend	AWEEKEND	Admission on weekend: (0) admission on Monday-Friday, (1) admission on Saturday-Sunday
Admission month	AMONTH	Admission month coded from (1) January to (12) December
Transferred into hospital	TRAN_IN	Transfer In Indicator: (0) not a transfer,

		(1) transferred in from a different acute care hospital [ATYPE NE 4 & (ASOURCE=2 or POO=4)], (2) transferred in from another type of health facility [ATYPE NE 4 & (ASOURCE=3 or POO=5, 6)]
Admission type	ELECTIVE	Indicates elective admission: (1) elective, (0) non-elective admission
Age at admission	AGE	Age in years coded 0-124 years
Chronic Conditions	NCHRONIC	Number of chronic conditions
Clinical Classifications Software (CCS) category	DXCCS1 – DXCCS25	CCS category for all diagnoses. Beginning in 2009, the diagnosis array was increased from 15 to 25.
	PRCCS1 – PRCCS15	CCS category for all procedures
Diagnosis information	DX1 – DX25	Diagnoses, principal and secondary (ICD-9-CM). Beginning in 2003, the diagnosis array does not include any of external cause of injury codes. These codes have been stored in a separate array ECODEn. Beginning in 2009, the diagnosis array was increased from 15 to 25.
	HOSPBRTH	Birth diagnosis, in this hospital
	NDX	Number of diagnoses coded on the original record
	UNCBRTH	Normal, uncomplicated birth in hospital
Diagnosis Related Group (DRG)	DRG	DRG in use on discharge date
	DRG_NoPOA	DRG in use on discharge date, calculated without Present On Admission (POA) indicators
	DRGVER	Grouper version in use on discharge date
	DRG24	DRG Version 24 (effective October 2006 - September 2007)
Discharge quarter	DQTR	Coded: (1) Jan - Mar, (2) Apr - Jun, (3) Jul - Sep,

Type of Data Element	HCUP Name	Coding Notes
		(4) Oct - Dec
Discharge weights	DISCWT	Weight to discharges in AHA universe for national estimates. In 2000, the discharge weight DISCWTCHARGE should be used for estimates of total charges.
Discharge year	YEAR	Calendar year
Disposition of patient (discharge status)	DIED	Indicates in-hospital death: (0) did not die during hospitalization, (1) died during hospitalization
	DISPUNIFORM	Disposition of patient, uniform coding used beginning in 1998: (1) routine, (2) transfer to short term hospital, (5) other transfers, including skilled nursing facility, intermediate care, and another type of facility, (6) home health care, (7) against medical advice, (20) died in hospital, (99) discharged alive, destination unknown
	TRAN_OUT	Transfer Out Indicator: (0) not a transfer, (1) transferred out to a different acute care hospital, (2) transferred out to another type of health facility
External causes of injury and poisoning	ECODE1 – ECODE4	External cause of injury and poisoning code, primary and secondary (ICD-9-CM). Beginning in 2003, external cause of injury codes are stored in a separate array ECODEn from the diagnosis codes in the array DXn. Prior to 2003, these codes are contained in the diagnosis array (DXn).
	E_CCS1 – E_CCS4	CCS category for the external cause of injury and poisoning codes
	NECODE	Number of external cause of injury codes on the original record.

Gender of patient	FEMALE	Indicates gender for KID beginning in 1998: (0) male, (1) female
Hospital information	HOSP_REGION	Region of hospital: (1) Northeast, (2) Midwest, (3) South, (4) West Prior to 2012, region of hospital is only available in the KID Hospital File.
KID_STRATUM		Hospital stratum used for weights.
Indicates Emergency Department service	HCUP_ED	Indicator that discharge record includes evidence of emergency department (ED) services: (0) Record does not meet any HCUP Emergency Department criteria, (1) Emergency Department revenue code on record, (2) Positive Emergency Department charge (when revenue center codes are not available), (3) Emergency Department CPT procedure code on record, (4) Admission source of ED, (5) State-defined ED record; no ED charges available
Length of Stay	LOS	Length of stay, edited
Median household income for patient's ZIP Code	ZIPINC_QRTL	Median household income quartiles for patient's ZIP Code. Because these estimates are updated annually, the value ranges for the ZIPINC_QRTL categories vary by year. Check the HCUP-US Website for details.
Neonatal/ maternal flag	NEOMAT	Assigned from diagnoses and procedure codes: (0) not maternal or neonatal, (1) maternal diagnosis or procedure, (2) neonatal

		diagnosis, (3) maternal and neonatal on same record
Payer information	PAY1	Expected primary payer, uniform: (1) Medicare, (2) Medicaid, (3) private including HMO, (4) self-pay, (5) no charge, (6) other
Procedure information	PR1 – PR15	Procedures, principal and secondary (ICD-9-CM)
NPR		Number of procedures coded on the original record
ORPROC		Major operating room procedure indicator: (0) no major operating room procedure, (1) major operating room procedure
PRDAY1		Number of days from admission to principal procedure.
PRDAY2 – PRDAY15		Number of days from admission to secondary procedures.
Race of Patient	RACE14	Race, uniform coding: (1) white, (2) black, (3) Hispanic, (4) Asian or Pacific Islander, (5) Native American, (6) other
Record identifier, synthetic	RECNUM	HCUP unique record number
Total Charges	TOTCHG	Total charges, edited
Hospital Characteristics	KID_STRATUM	Hospital stratum used for weights
HOSP_BEDSIZE		Bed size of hospital (STRATA): (1) small, (2) medium, (3) large
H_CONTRL		Control/ownership of hospital (STRATA): (1) government, nonfederal, (2) private, non-profit, (3) private, invest-own
HOSP_LOCTEACH		Location/teaching status of hospital (STRATA): (1) rural, (2) urban non-teaching, (3) urban teaching
HOSP_REGION		Region of hospital (STRATA): (1) Northeast, (2) Midwest, (3) South, (4) West
HOSP_DIVISION		Census Division of hospital: (1) New England, (2) Middle Atlantic, (3) East North Central, (4) West North Central, (5) South Atlantic, (6) East South Central, (7) West South Central, (8) Mountain, (9) Pacific

Discharge Year	YEAR	Calendar year