Analysis of Hospitalization Outcomes of Patients with Drug Abuse Comorbidity

By

Memory Ndanga

A Dissertation Submitted in Fulfillment of the Requirements for the Degree of Doctor in Philosophy in Biomedical Informatics

Department of Health Informatics

School of Health Professions

Rutgers, the State University of New Jersey

August 2019

RUTGERS
School of Health Professions

Final Dissertation Defense Approval Form

Analysis of Hospitalization Outcomes of Patients with Drug Abuse Comorbidity

BY
Memory Ndanga

Dissertation Committee:

Shankar Srinivasan Ph.D.

Suchismita Ray PhD

Thomas Hunt PhD

Approved by the Dissertation Committee:

_____ Date:_____

_____ Date:_____

_____ Date:_____

ABSTRACT

BACKGROUND: Drug abuse has been on the increase over the last few years, contributing to the healthcare cost. An understanding of the overall impact of drug abuse hospitalizations is essential in combatting the drug abuse epidemic.

OBJECTIVE: The objective of this study is to examine hospitalization outcomes of total charges, and length of stay, among other elements associated with drug abuse comorbidity patients. The study will compare drug abuse comorbidity patients with non-drug abuse admission. The focus is on patients that were discharged in the United States between 2010 and 2014. Drug abuse comorbidity increases the intricacy of hospitalized patients; it is necessary to analyze the outcomes. The Center for Medicare and Medicaid (CMS) also implemented a value-based care model which allows healthcare providers, including hospitals and physicians, to be paid based on patient hospitalization outcomes. Therefore an understanding of this outcome is necessary for payment and resource allocation.

METHOD: This study utilized the National (Nationwide) Inpatient Sample (NIS) for the years 2010 to 2014. The data source is an inpatient hospitalization dataset produced every year. The NIS is a publicly available all-payer inpatient health care dataset with national estimates of hospital inpatient stays. NIS collects data from more than 7 million hospital stays each year. It is estimated to be collecting more than 35 million hospitalizations nationally. NIS is a Federal-State-Industry partnership sponsored by the Agency for Healthcare Research and Quality (AHRQ). In this retrospective study, we demonstrated the estimation of inpatient outcomes for total charges and length of stay. The SPSS statistical analysis software was used to analyze the data. Various descriptive

and inferential analysis was performed on the filtered data sets above for the years 2010 to 2014. Results of the outcome analysis that had a p-value less than 0.05 were noted to be significant.

RESULTS: Drug abuse comorbidity cases within the five years were 2,258,235. Descriptive analysis showed that the prevalence of drug abuse comorbidity to be among males (58%), and they were more likely to be admitted compared to females (42%). This population, the median age at admissions, was 42 for males, and 40 for female. The average hospitalization length of stay was 4.5 days for non-drug abuse and 5.5 days for drug abuse comorbidity (P<0.001). Most drug abuse comorbidity hospitalization cases were charged to government-related insurance Medicaid (36.7%), Medicare (22.6%), and Private (18.2%), Self-pay (15.1% and other or unknown insurance (5.4%) P<0.001. Mean charges for drug abuse comorbidity (3.6% of population) was $36,735.98 while non-drug abuse cases (96.4% of study population) was $35,200.85 P< 0.001. The mean charges were highest in the Midwest $13,500.00 for non-drug abuse and $14,000.00 for those with drug abuse comorbidity on record. The lowest charges of $12,900 for drug abuse comorbidity and $13,300 for non-drug abuse were recorded in the Northeast. The most common primary condition associated with drug abuse comorbidity were mood, personality, and psychotic disorders.

CONCLUSION: The study revealed several significant factors related to the hospitalization of drug abuse comorbidity patients. Total charges are significantly higher for drug abuse comorbidity than general admissions. Drug abuse comorbidity

hospitalization cases showed a longer length of stay than non-drug abuse cases. These results will aid as a reference for resources allocation, hospital utilization review, and policy changes related to drug abuse. Further research is necessary to find innovative care plans for people with drug abuse comorbidity.

ACKNOWLEDGMENT

I want to acknowledge everyone who has been part of this dissertation project over the past few years. This dissertation would not be complete without the guidance and support of those who have helped me throughout the dissertation. I want to acknowledge my committee chair, Dr. Shankar Srinivasan, for his critical feedback and full engagement in this process, which was invaluable to the successful completion. I would also like to thank my committee team, Dr. Thomas Hunt and Dr. Suchismita Ra, for their continuous guidance through the progression of the research. They asked insightful questions to lead me to an innovative research goal. The committee team played a valuable role in modeling my research goals and supported me throughout the research.

I would also like to express my sincere gratitude to Rutgers Biomedical Health Sciences - School of Health Professions for allowing me to fulfill my goal of pursuing higher education. A big thank you to the Department of Health Informatics faculty and staff who supported me throughout the years. To Dr. Kirk for her continuous encouragement and mentoring- Thank you.

Thank you to my study mates who were continuously supportive throughout the past year.I would also want to thank my family for being there for me. Their continuous support helped to complete this dissertation and I would not have been able to do it alone.

DEDICATION

I would like to Thank God for giving me the strength for face each day.

I dedicate this PhD to my family. Their continued support and inspiration helped me to keep focused and achieve my goal.

To Kumbi for sacrificing a lot to see me through this journey. I will always be grateful for your support because I would not have completed this without your encouragement.

To Seth, my son for the time I spent away from you during this research. May God continue to watch over you and always be the anointed person he has destined you.

To my sister Rudo, even with the distance, you kept me in check. Remember with God, all things are possible.

To Loveness Ndanga and Josephine Ndanga though you did not get a chance to see this through, I know you would have been proud of me for making it this far.

TABLE OF CONTENTS

CHAPTER III:

METHODS

CHAPTER IV:

RESULTS

LIST OF FIGURES

Page

LIST OF TABLES

Page

CHAPTER I

INTRODUCTION

1.1 Introduction to the study

Drug abuse has sharply sky-rocketed over the past years, but there is no clear understanding of the impact this has on the healthcare system. This study is designed to analyze and understand the hospitalization outcomes of patients with drug abuse comorbidity compared to non-drug abuse cases. The study will examine drug abuse comorbidity data from the Healthcare Cost and Utilization Project (HCUP). Drug abuse comorbidity aid to the overall complexity of a patient's clinical outcome; therefore, contributes to the longer length of stay and overall hospital resource utilization. This study will analyze hospitalization outcomes of total charges and length of stay of drug abuse comorbidity compared to non-drug abuse. The study will also focus on variables such as demographics, race, discharge dispositions, hospital region, and expected primary payer. This retrospectives study will also identify common conditions that are associated with drug abuse comorbidity. Drug abuse comorbidity studies are of importance in resources allocation and can be used as a necessary reference tool primarily as the nation is geared towards combating the current drug abuse problem.

Most studies have focused on different types of drugs as the principal diagnosis, but analyzing the drug abuse comorbidity will give a better understanding of the impact this has on the length of stay and total charges. This study will not focus on a specific

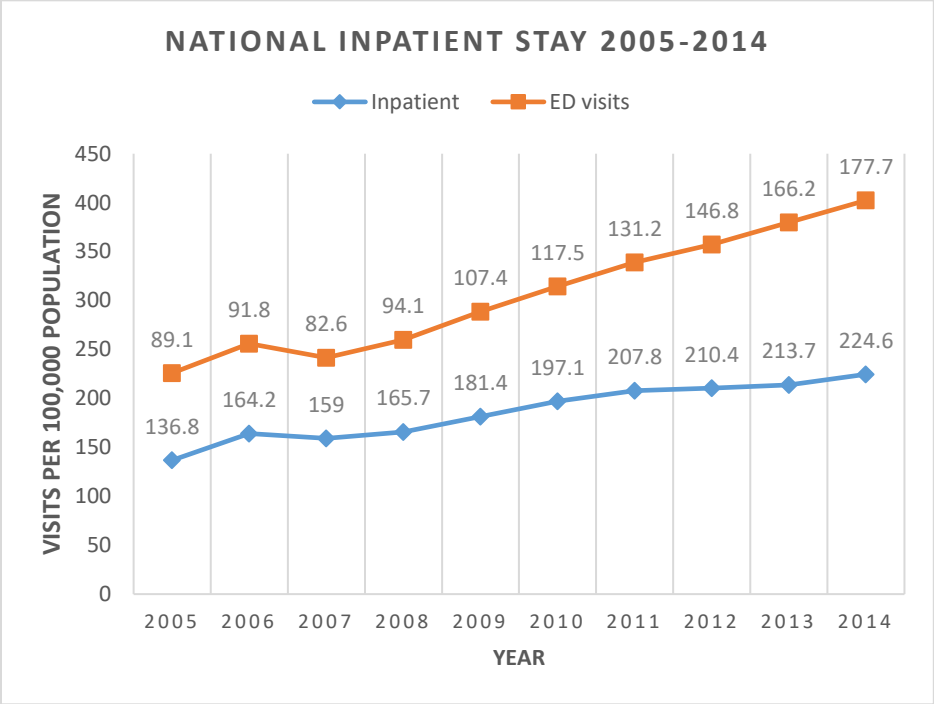
drug but explore the impact of drug abuse comorbidity for hospitalized patients. Comorbidity substance abuse should be analyzed because it can affect the patient's progress and clinical outcome significantly. While previous studies have only focused on the effects of a drug as the principal diagnosis, this study fills the literature gap in understanding drug abuse comorbidity outcomes. Results of this study will be beneficial to policymakers, hospital, and healthcare organizations as they focus on strategies to improve outcome, value-based care, and cost reduction.

The background, specific goals, and hypothesis are provided in this chapter. Literature review of this study will be covered in chapter two. The literature review will cover previous studies that have analyzed overall healthcare cost and length of stay related to drug abuse. Other relevant theoretical frameworks that serve as a basis for this analysis will also be included. Methods, results, and discussion of specific goals will be discussed in the rest of the chapters. The final chapter will provide the conclusion of this study

1.2 Background of the problem

Drug abuse has increased in the past two decades, causing a substantial burden not only to the families but to the healthcare system and the U.S economy as a whole. The majority of us know someone with a substance use disorder or someone who has lost a relative or friend due to substance misuse. Drug abuse has become more prevalent such that it is not a surprise that there were 27 million adults Americans who self-reported the misuse of illegal drugs or opioid-based prescription drugs [1]. Drug abuse hospitalization cost was over $21 billion in 2010 and is expected to grow as the epidemic continues. The business sector has also identified the second largest expense for large and small businesses, apart from salary, like health care for their employees. Productivity losses related to personal and family health problems are estimated to cost U.S. employers $1,685 per employee per year, or $225.8 billion annually [2], of which drug abuse is a contributing factor. The Office of National Drug Control Policy (ONDCP) reported that drug abuse and addiction has also been estimated as costing American society close to $200 billion in healthcare, criminal justice, legal, and lost workplace production/participation costs. Total healthcare expenditure for 2014 was set to have increased by 4.1 percent [3]. Hospital admissions of drug-related diagnosis are potentially avoidable, saving the health care system a substantial amount of money and resources [4, 5]. AHRQ reported that the national rate of drug abuse-related inpatient stays and emergency department (ED) visits increased 64.1 percent and 99.4 percent, respectively, in 2005-2014 [6]. Therefore there is a need to analyze the comorbidity pattern. The figure shows the national hospital visits for both inpatient and emergency room departments.

Figure 1 National inpatient stay volume



Comorbidities are known to contribute to the patient progress, and a principle emerging from scientific research is the need to treat comorbid conditions concurrently [7]. Identifying common trend assist in directing early interventions and likely to improve healthcare outcomes.

Besides the cost of healthcare, drug abuse has significantly contributed to high mortality rates, which have forced the U.S department of health to take measures to address issues related to drug abuse. The drug abuse epidemic is not only affecting the United States economically but socially due to a drug overdose. Mortality rates for drug abuse continue to increase across the country such that the Centers for Disease Control and Prevention reported that 46,471 of our citizens died of a drug overdose in 2013 [2]. It is estimated that nearly half a million people in the United States have died from drug

overdoses and of that 47,055 drug overdose deaths occurred in 2014 alone [8]. The rate of deaths from drug overdoses increased 137%, including a 200% increase in the rate of overdose deaths involving opioids pain reliever and heroin [6]. Substance abuse disorders contribute significantly to the morbidity and mortality of hospitalized medical patients [1]

1.3 Statement of the problem

There is a continuous increase in healthcare cost associated with drug abuse, therefore the need to analyze the impact the hospitalization cases have on the healthcare system. Since attaining effective patient healthcare outcomes while containing cost is one of the principal purposes of healthcare systems, it is imperative that the outcomes are measured and analyzed in order to encourage change. For this study, total healthcare charges typically represent expenditures incurred during the inpatient stay. Analysis of the hospitalization outcome of patients with drug abuse comorbidity will help in resource allocation and possibly direct the intervention methods that could be implemented. Though many research resources have been plowed into clinical components of drug abuse, there has not been much literature on the hospitalization outcomes as it relates to drug abuse comorbidity. Therefore, this study will examine the association of drug abuse comorbidity and hospitalization outcomes of length of stay, total charges, and mortality. This study will also analyze any association of drug abuse comorbidity to the primary diagnosis and incorporate the severity of complications as it is necessary to estimate the relation.

1.4 Definitions of terms

The terms used in this study are defined below:

- **Comorbidity** is when two or more disorders or illness occur in the same person simultaneously. Comorbidity also implies that the illness is likely to effects the course and prognosis of both.
- **Substance abuse** refers to the harmful or hazardous use of psychoactive substances, including alcohol and illicit drugs. A maladaptive pattern of substance use leading to clinically significant impairment or distress is manifested by one or more of the following, occurring within 12 months. DSM-IV criteria for substance abuse focus on the top five substances, which are marijuana, opiates—mostly prescription opiates, not illicit opiates such as heroin, stimulants, and cocaine. The coding system utilized by the DSM-IV is designed to correspond with codes from the International Classification of Diseases, Ninth Revision, and Clinical Modification, commonly referred to as the ICD-9-CM.
- **Tolerance** use of drugs over which means that they need higher and or more frequent doses of the drug to get the desired effects.
- **Dependence** occurs with repeated use, causing the neurons to adapt, so they only function generally in the presence of the drug. The absence of the drug causes several physiological reactions, ranging from mild in the case of caffeine, to potentially life-threatening, such as with heroin. Some chronic pain patients are dependent on opioids and require medical support to stop taking the drug.

- **Addiction** is a chronic disease characterized by compulsive, or uncontrollable, drug seeking and use despite harmful consequences and long-lasting changes in the brain. The changes can result in harmful behaviors by those who misuse drugs, whether prescription or illicit drugs.
- **Substance misuse** is defined as the use of medication intended for a medical purpose for other purposes other than indicated or other than for its original purpose. Any use of an illegal drug or the voluntary self-administration of a medication for a nonmedical purpose such as altering one's state of consciousness [9].
- **Substance Dependence** a maladaptive pattern of substance use leading to clinically significant impairment or distress, as manifested by a need for increasing amounts of the substance to achieve intoxication, markedly diminished effect of the substance with continued use, the need to continue to take the substance in order to avoid withdrawal symptoms, and other behavioral severe effects, occurring at any time in the same 12-month period.

According to the American Psychiatric Association's, the definition of substance dependence Requires a patient to meet at least three of the seven criteria listed below

- Craving
- Relapse
- Priming
- Physical or physiological dependence
- Reward

- Sensitization
- Substance abuse
- Substance dependence
- Withdrawal syndrome

1.5 Objectives of the study

The objective of this project is to examine the trends in hospitalization outcome for patients with drug abuse comorbidity. Although it is well understood that hospitalization cost accounts for a large portion of the total medical cost, hospitalization cost for patients with drug abuse commodity have not been thoroughly examined. Therefore, this research is carried out with a focus on understanding the impact of comorbidity drug abuse has on inpatient charges and length of stay. Other studies that have looked at drug abuse cost have focused on the principal diagnosis and not the impact of drug abuse comorbidity. The study aims to analyze the hospitalization outcomes of a patient with a drug abuse comorbidity compared to non-drug abuse cases. The main objective of the study is to:

(a) Analyze the hospital charges of drug abuse comorbidity and non-drug abuse

(b) To identify if there is a difference in length of stay for patients with drug abuse comorbidity compared to non-drug abuse related cases. An understanding of the impact of other variables such as discharge disposition will also shed light on healthcare cost because patients that are discharged to other facilities such as skilled nursing or short term hospitals are likely to incur more additional cost and impose more substantial care burdens on the healthcare system when compared with a patient that discharges routinely

In this stud, we sought to answer the following questions.

- Is there a relationship between drug abuse comorbidity and length of stay compared to non-drug use?
- Is there a relationship between drug abuse comorbidity and total charges compared to non-drug use?
- Is there a difference in gender for drug abuse comorbidity hospitalizations?
- Is there a difference in the race for drug abuse comorbidity hospitalizations?
- Do geographic regions show variation for drug abuse hospitalizations and non-drug use?
- Is there a difference in insurance payee for drug abuse hospitalizations and general admissions?

1.6 Study hypothesis

The study will explore the followings hypothesis:

Aim 1: To examine the association between the presence of drug abuse comorbidity and hospitalization charges.

Hypothesis 1: Total Charges for drug abuse comorbidity cases are higher compared to non-drug abuse.

Null Hypothesis 1a: There is no significant cost difference in drug abuse comorbidity hospitalization cases and non-drug abuse.

Alternate Hypothesis 1b: There is a significant difference in the cost of drug abuse comorbidity and non-drug abuse hospitalization cases.

Hypothesis 2: Drug abuse comorbidity hospitalization cases have a longer length of stay than non-drug abuse cases.

Null Hypothesis 2a: There is no difference in length of stay for drug abuse comorbidity and non-drug abuse hospitalization

Alternate Hypothesis 2b: There is a difference in length of stay for drug abuse comorbidity and non-drug abuse hospitalizations

Hypothesis 3: There are demographic differences for drug abuse comorbidity hospitalization and non-drug abuse

Null Hypothesis 3a: There are no demographic differences for drug abuse comorbidity and non-drug abuse hospitalization cases.

1.7 Significance of the study

The study is significant because it will bring an understanding of the hospitalizations outcomes for patients with drug abuse comorbidity. The analyses of the variables would assist in policy planning regarding resource allocation geared for combatting drug abuse related issues. The significance of this study increases as drug abuse-related cases have sky-rocketed over the past few years. The National Survey on Drug abuse and Health (NSDUH), estimated that 21.5 million Americans adults were battling a substance use disorder [10]. Drug users are expected to increase by 25% globally by 2050 [11]**.** Currently, at least one in 7 people in the U.S. is expected to develop a substance use disorder at some point in lives [1]. Analyzing the hospitalization outcome of drug abuse comorbidity will facilitate resources allocation and identify ways to reduce overall healthcare expenditure related to drug abuse. We need to measure actual health outcomes rather than relying solely on process measures; the only way to indeed contain costs in health care is to improve outcomes [11].

The search for quality healthcare outcomes has always been a significant public health concern such that the Center for Medicare and Medicaid Services has also implemented value-based healthcare delivery model in which healthcare providers, including hospitals and physicians, are paid based on patient hospitalization or outcomes. When paying providers based on the quality, rather than the quantity of care they give patients, it is essential to study the hospitalization outcome in order to put a measurable value to it. The "value" in value-based healthcare is derived from measuring health outcomes against the cost of delivering the outcomes. Value-based care incentive payments are part of the quality strategy to reform how health care is delivered and paid for. Value-based programs also support the goals: Better care for individuals, better health for the population, and lower cost [12]. Drug abuse comorbidity may aggravate existing conditions and contribute to patients failing to adhere to treatment. Therefore, analyzing the results will not only drive providers and health plans to improve outcomes and efficiency but also will help patients and health plans choose the best provider teams for their medical circumstances [13].

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter focuses on reviewing existing literature about health care hospitalization outcomes associated with drug abuse. The literature was searched using PubMed, GoogleScholar, MEDLINE, CINAHL, ProQuest using the Rutgers University library system. Key terms included comorbidity; substance-related disorders; costs and cost analysis, hospitalization outcomes, abuse, misuse, dependence, discharge, and disposition. The articles were reviewed for exclusion criteria.

2.2 Selection criteria

The Inclusion criteria for this review included research investigating hospitalization outcomes for a patient with drug abuse comorbidity. Articles that focused on hospitalization cost, length of stay, discharge disposition, and mortality were included. Articles that focused on evaluating the cost associated with specific drug abuse-related cases were also included. The literature search was performed on Medline, Google Scholar, and PubMed. The associated included the following phrases "drug abuse," "hospitalization cost," and "hospitalization outcome.” The outcome of these searches was

then evaluated based on the inclusion and exclusion criteria. The details of the study with regards to originality and aspects of evaluating the hospitalization outcomes as well as the time of publication were considered. Origin of data collection approaches as well as the country of origin was taken into account.

The inclusion and exclusion criteria were defined as follows:

Inclusion criteria:

1. Assess the cost of drug abuse/ substance abuse as it relates to hospitalization
2. United States of America drug abuse-related cost
3. Assess the length of stay as it relates to drug abuse hospitalization.

Exclusion criteria:

1. Any article that did not evaluate hospitalization cost or outcomes.
2. The year the article was published.

2.3 Types of drugs

Substance abuse has had a significant impact on America's health care system. The drug abuse problem is not just limited to prescription drugs but different categories of the drug, as shown in figure 1.

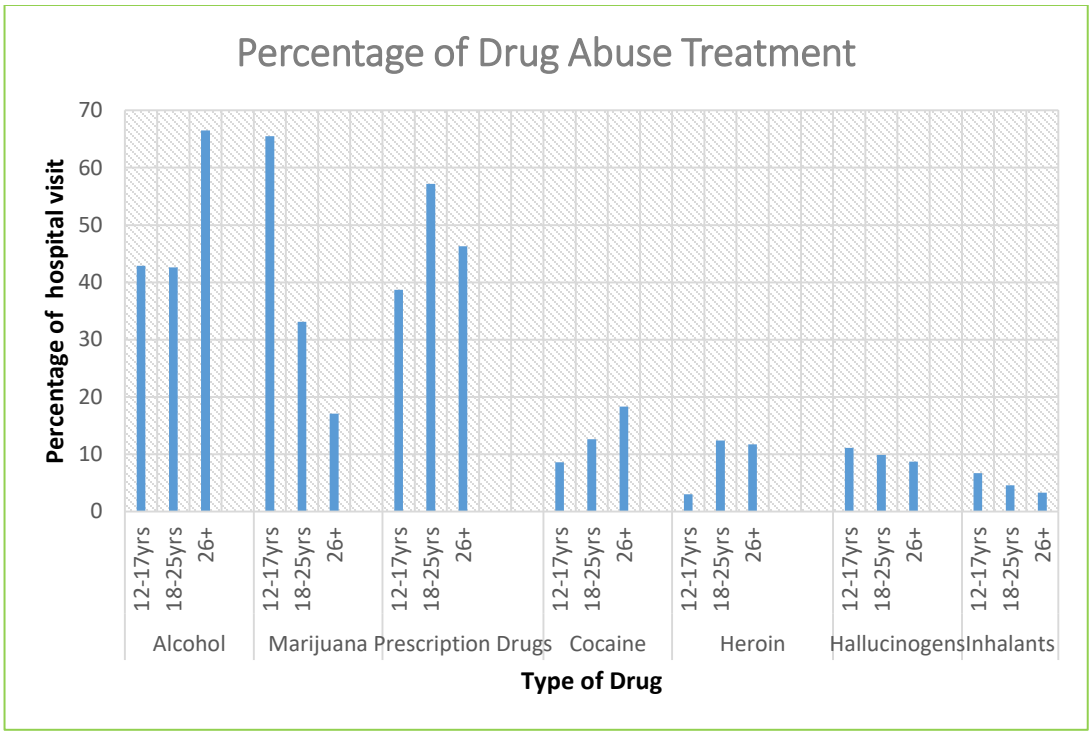


Figure 2 SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use

Marijuana

Marijuana refers to the dried leaves, flowers, stems, and seeds from the Cannabis sativa or Cannabis indicia plant. The plant contains the mind-altering chemical Tetrahydrocannabinol (THC) and other similar compounds. Extracts can also be made from the cannabis plant. These extracts can deliver substantial amounts of THC to the body. When a person smokes marijuana, THC quickly passes from the lungs into the bloodstream. The blood carries the chemical to the brain and other organs throughout the body. THC acts on specific brain cell receptors that ordinarily react to natural THC-like chemicals. Previous studies have found cannabis to impact hospital admissions [14] significantly.

According to the Substance Abuse Center for Behavioral Health Statistics and Quality, Marijuana is the most commonly used illicit drug in the United States. Its use is widespread among young people [15]. At least 11 million young adults ages 18 to 25 are estimated to have used marijuana in 2014 alone [6]. Several states have legalized marijuana, and there has been a push in several other states to focus on the legalization of marijuana for medical use or adult recreational use. This has likely pushed an increase in the number of people who believe that regular marijuana use does not have any effect. Marijuana over activates parts of the brain that contain the highest number of these receptors. This causes the "high" that people feel. Marijuana also affects brain development. The drug may impair learning functions, memory and affect how the brain builds connections between the areas necessary for these functions primarily when used during the early years. A marijuana overdose is believed to induce a panic attack and psychosis [16]. A study at Duke University showed that people who started smoking marijuana in their teenage years and continuously used marijuana lost an average of 8 IQ points between their teen and young adult years. Mental abilities of those who used the drug at a young age did not fully come back even after stopping marijuana later on in life [6]. The study also suggested that those who started smoking marijuana as adults had no notable IQ difference, possibly because the brain has already matured at the onset of use. Marijuana use has become popular such that in 2013, 4.2 million Americans met clinical criteria for dependence or abuse of marijuana in the past year [6].

Opioids

These are a class of drugs that include the illegal drug heroin, synthetic opioids such as fentanyl, and pain relievers available legally by prescription, for example, oxycodone, hydrocodone, morphine, and many others. They are often used as medicines because they contain chemicals that relax the body and can relieve pain. Opioid misuse can cause slowed breathing, which can result in hypoxia. Hypoxia is a condition that occurs when the brain receives less oxygen. Hypoxia can lead to long-term psychological and neurological effects, including coma, permanent brain damage, or death. Several studies have identified that long term use causes a risk of impairments [17].

An estimated 1.9 million people had an opioid use disorder related to prescription pain relievers in 2014 alone [15]. The Council of Economic Advisers (CEA) also reported that the economic cost of the opioid crisis in 2015 was $504 billion [18]. Overdose has also been the most significant concern as twenty thousand people are estimated to have died due to opioid overdose in 2011 [15]. Large cities are the ones who are likely to see the increase in opioid overdose than rural setting [12]. Another study from the found that there was an increase in drug overdose between 2009 and 2015, which was above 50% of admissions [19]. Patients admitted for opioid use were discharged with a DRG that shows a high prevalence of psychoses, which reflects the significance of opioid use among patients with mental disorders [20].

Prescription sedatives and tranquilizers

These are medications that act as central nervous system depressants and are medically prescribed for acute anxiety and sleep disorders. When misused these types of prescription medications also contribute to slowing brain function, which is likely to result in slurred speech, shallow breathing, disorientation, and even lack of coordination or dilated pupils. If taken in high doses, they can cause impaired memory, paranoia, and irritability. Combining these drugs with other substances can cause slow breathing, slow both the heart and respiration and possibly lead to death. The National Survey on Drug Use and Health showed that young adults were most likely to have used alprazolam, a drug used to treat anxiety for non-medical purposes. The rate of abuse for young adults was (10.3%) and (5.7%) for older adults [10].

Stimulants

These are medications that increase alertness, attention, energy, blood pressure, heart rate, and breathing rate. Prescription stimulants increase the activity of the brain chemicals dopamine and norepinephrine. Dopamine is involved in the reinforcement of rewarding behaviors. Norepinephrine affects blood vessels, blood pressure and heart rate, blood sugar, and breathing. When misused at high doses of prescription stimulants have been linked to high body temperature, an irregular heartbeat, heart failure, and seizures [21]. Even when stimulants are taken at low doses, repeated misuse can cause personality disorders or other behavioral issues such as psychosis, anger, or paranoia. Cocaine is an addictive stimulant drug that increases levels of the natural chemical

messenger dopamine in the brain. Continuous use is likely to cause irritability, aggressive and stereotyped behavior, and paranoid-like psychosis [22].

Steroids

Anabolic steroids are synthetic drug variations of the male sex hormone testosterone. They are usually commonly abused as drugs to boost performance or improve physical appearance by some athletes and bodybuilders. Steroids do not have short term effects on the brain, but long term use exposes the brain to different chemicals such as dopamine and serotonin, which usually triggers a significant effect on mood and behavior. More than a million Americans adult admitted to using anabolic steroids and the National Institute on Drug Abuse (NIDA) also estimates that at least half a million 8th and 10th-grade students are now using steroids, and they do not see them as a dangerous substance [6]. Table 2 shows the types of steroids that are commonly misused.

Table 1 Type of steroids

Oral Steroids	Injectable Steroids
Anadrol® (oxymetholone)	Deca-Durabolin (nandrolone decanoate)
Oxandrin® (oxandrolone)	Durabolin (nandrolone phenpropionate)
Dianabol® (methandrostenolone)	Depo-Testosterone
Winstrol® (stanozolol)	Equipoise)

Tobacco

Tobacco contains nicotine, the ingredient that leads to addiction. Hence so many people who use tobacco find it difficult to quit. The nicotine absorbs into the bloodstream when a person uses it. Upon entering the bloodstream, nicotine immediately stimulates the adrenal glands to release the hormone epinephrine. Epinephrine is known to stimulate the central nervous system and increases blood pressure and heart rate. The use of tobacco or nicotine products over time causes brain changes and result in addiction Tobacco smoking can lead to several diseases such as lung cancer, chronic bronchitis, and increases the risk of heart disease. CDC has estimated that more than 480,000 died of cigarette smoking related issues each year [15]. The total cost of combined abuse of tobacco, alcohol, or illicit drugs costs our country over $700 billion annually [23]

2.4 Clinical drug abuse symptoms and behaviors

- Use of the drug daily or even several times a day
- Intense urges for a drug
- Increased use of the drug to get the same effect
- Maintain a chain supply of the drug
- Spending money on the drug, even though you cannot afford it
- Lacking off in work or family responsibilities

- Continuous use of the drug, even though you know, it is causing problems in your life or causing you physical or psychological harm
- Risky behaviors when you're under the influence of the drug
- Withdrawal symptoms when you attempt to stop taking the drug

2.5 Substance abuse diagnosis and treatment

Diagnosis and Treatment for drug addiction are very complex and requires healthcare providers to perform a thorough evaluation in order to diagnose addiction. Diagnosis is usually better when it is a collaboration with other caregivers as other medical or non-medical disorders contribute to the overall health of the patient. Samples of blood, urine, or other lab test are assessed, other psychological or psychiatric evaluation used also be considered. Identifying the type of drug and contributing factors facilitate the treatment process. The type of drug and required level of care determines the type of treatment and type of program a patient can be enrolled into. It is possible that treatment from a general healthcare facility might be sufficient for those with mild to moderate drug abuse condition [1]. Below are some of the treatment options:

1. Detoxification or referred to as withdrawal - a physical process where the body is cleansed of toxins.
2. Behavior Therapy- this approach engages the patient in drug abuse treatment. They can provide incentives for behavior changes and provide life skills.

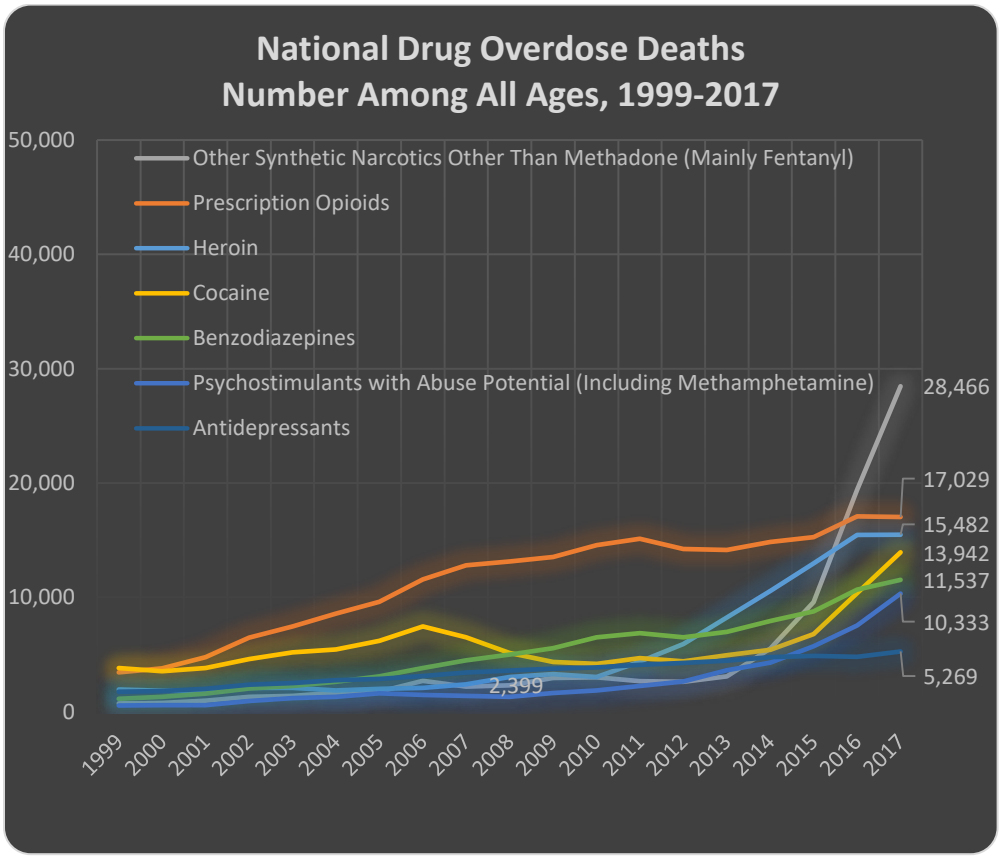
3. Self- Help groups- These are supportive environments for people facing similar challenges

It is essential to keep in mind that substance abuse treatment and recovery varies with each. The treatment process and risk factors differ by age, race, gender, ethnicity, geographical regions and other social factors [24]

2.6 Mortality

It is expected that drug overdose deaths will significantly rise over the years due to the number of people who have self-reported drug misuse. The National Institute on Drug Abuse noted that nearly one in every four deaths is due to drug use. In 2010, the death rate gradually increased from 12.3 per 100,000 population in 2010 to 16.3 in 2015 [8]. Figure 3 shows the national drug overdose deaths involving prescription and illicit drugs. Youth are known to be at a higher increase of death by suicide, homicide, accidents, or illness that are attributed to substance abuse [25]. The District of Columbia (DC) also reported on drug abuse mortality, suggesting that there were nearly 48,000 drug overdose deaths in 2014 [26].

Figure 3 National Drug overdose deaths



Centers for Disease Control and Prevention, National Center for Health Statistics. Multiple Cause of Death 1999-2017 on CDC WONDER Online Database released December 2018

2.7 Drug abuse and cost

A study to determine the Medicare hospital costs for treating substance-abuse-related illness reported that there were about 2.2 million tobacco-, alcohol- or drug-related Medicare admissions. Those admissions alone accounted for 20% of all Medicare hospitalizations. Medicare's allocated funds show that over $13 billion spent on inpatient short-stay hospital expenditures on substance-abuse-related care [27]. The Medicare data

report from the National Hospital Discharge Survey (NHDS) was used for this report. The study focused on Medicaid cost as it relates to drug abuse. Cost of care for substance abuse patient was categorized as it relates to several inpatient days. Medicaid patients who were admitted with a secondary diagnosis of substance abuse were likely to be hospitalized twice as long compared to those patients who had a similar primary diagnosis but no substance abuse history. The study also identified that young males admitted to the hospital for substance stayed longer than those with no primary or secondary diagnosis of abuse. Women in the same age group also likely to stay longer than those with no such diagnoses. For those drug abuse-related hospital visits at least one dollar in every fifth was spent on hospital care and Medicaid covered hospital days were attributable to substance abuse. Substance abuse-related hospitalization accounted for 19.2 % of total Medicaid inpatient costs and 20 % of total days [27].

In a cost comparison study that was initiated to calculate the excess burden of drug abuse, the drug abuse group had higher utilization rates for medical services and prescription drugs. The study identified patients with drug abuse using medical and pharmacy claims data. The results were compared with non-opioid abuse diagnosis using linear regression. Drugs abusers had eight times higher a cost than non-abusers. Hospital inpatient visits for opioid abusers were 12 times higher than non-abusers resulting in an estimated mean annual cost of at least $15, 884 compared to $1,830 [28]. Though this study focused only on insured patients, it shows how likely the cost is even higher when uninsured patients are included, and they are usually dependent on government assisted coverage. Treatment cost was totaled to be $126 million, and the excess medical cost was

about $2.48 billion. This study, opioid abuse represented a substantial and growing economic burden for society [28].

In an article that estimated the cost of substance abuse for Medicaid hospital programs, total substance abuse related care accounted for 20% of Medicaid inpatient stay [29]. The hospitalizations cost roughly 4 billion dollars, and treatment of substance abuse as a secondary diagnosis contributed more than 1.2 million inpatient days. Substance abuse patient who was admitted for also consumed more resources [29]. At least 1 in every five days was attributed to substance abuse stay, and 1.2 million days were used for direct treatment of substance abuse that is, treating diseases wholly attributable to substance abuse. The constant increase in medical costs, policies are focusing on reducing resource consumption by decreasing the number of inpatient days [30, 31].

Another research on the total economic burden for substance abuse estimated that as the prevalence of abuse and dependence increased significantly resulting in treatment cost of nearly $28.9 billion. With more people reporting prescription opioid and heroin dependence, the cost is increasing every year. The researcher also calculated cost estimates of prescription opioid overdose, abuse, and dependence related to overdose deaths and the prevalence of prescription opioid abuse and dependence in 2013 [32].

Marijuana studies also examined the Incremental inpatient costs of treatment that showed that marijuana comorbidity was associated with longer length of stays and higher charges [33]. Marijuana comorbidity increased treatment cost for patients with alcohol problems and mood disorder diagnoses, suggesting that there may be real health consequences associated with marijuana abuse and dependence. The patients with

marijuana comorbidity have lengths of stay that are longer than a day or more. The research also concluded there was a positive association between total charges and marijuana comorbidity, which remained consistent with findings for the length of stay. There is evidence that for alcohol problems, marijuana comorbidity is associated with an increase in the cost of care. On average, hospital charges for cases with a secondary marijuana diagnosis are between 7% and 19% higher depending on the model specification [33], but generally, marijuana dependence or abuse was statistically associated with longer length of stay.

Another study on inpatient drug abuse cost for Medicaid was $3,584 [34]. The total costs provider services, including prescription drug costs, suggest that almost more than half of the costs are from inpatients stays and the rest from physician services. They concluded that even though the cost varies with the payer, Substance abuse is indeed a significant cost of dollars to Medicaid.

In a study that used a cost-of-illness approach to document the costs of heroin addiction in the United States. To the patient and health care system, the medical care costs of heroin addiction are the third largest cost component (23.0%) and included medical complications (16.3%), direct treatment costs (5.7%), and health insurance administration (1.0%) [35]. The article also estimated that the administrative expenditures associated with the treatment of heroin addiction and its consequences were US$229 million [35].

Drug overdose deaths are estimated to have nearly tripled over the past decade. A common point regression analysis was used to analyze data from 50 states and the District of Columbia (DC) on drug abuse death, the drug overdose deaths trend increased 11.4%, similar to the same trend since 1991. Results show that there were 47,055 drug overdose deaths only in 2014; the data reflects that the drug overdose death rate increased each year significantly [8].

2.8 Substance abuse and gender

Substance Abuse and Mental Health Services Administration (SAMHSA) data set indicated that race was a significant factor in substance abuse. At least 19 percent of Hispanic women report opiates as their primary substance of abuse when admitted [15]. The treatment episode data also showed that African American women were 21 percent of admissions to substance abuse treatment facilities were in comparison to 12 percent of the non-Hispanic population. In African-American women, most admissions to treatment facilities were for cocaine abuse. The same study reflected that opioids, primarily heroin, accounted for 18 percent of substance-related admissions in the African –American women [10]. Asian and Pacific Americans represent 4 percent of the population and less than 1 percent of admissions to substance abuse treatment facilities in 1999 [10]. The rates of illicit drug use are relatively low among Asian- and Pacific-American women compared with other racial and ethnic groups. Women, in general, are known to have fewer years of regular use of particular drugs like opioids and marijuana at the onset of abuse [36]

2.9 Conclusion

Drug abuse cases have increased in the past decade and contributed to an increase in healthcare expenditure. Drug-related mortality rates have also been on the rise such that the United States has made it a priority to combat substance abuse. Current literature shows a trend of high cost and longer length of stay associated with drug abuse hospitalizations. It also shows that race had a significant influence on the number of cases each year. In all these efforts, current literature has not assessed the outcome of drug abuse comorbidity. Comorbidities are associated with a substantial increase in hospital cost and mortality; therefore, an understanding of the impact drug abuse comorbidity aids in determining utilization and resources allocations; including healthcare policy changes.

CHAPTER III

RESEARCH METHOD

3.1 National inpatient sample data

The aim of this study is to analyze the hospitalization outcome of drug abuse commodity. For this project, data was taken from the National Inpatient Sample (NIS), which is part of the Healthcare Cost and Utilization Project (HCUP). HCUP is associated with the Agency for Healthcare Research and Quality (AHRQ). HCUP combines both private and state organization data, including the Federal government. It is the most extensive collection of longitudinal hospital data. All-payer and encounter levels information is also provided. Researchers have been able to utilize this database for research on a broad range of healthcare policies, including qualities on the cost of services, access to healthcare and programs, and outcomes of treatment at all levels. The NIS is the most extensive hospital inpatient stay publicly available database. This database is used by researchers and policymakers to identify, track, and analyze national trends in health care utilization, access, charges, quality, and outcomes.

3.2 Data elements

The data was obtained by purchasing online from HCUP website. It was then downloaded using the instructions provided by HCUP into SPSS format. IBM-SPSS statistical analysis software and Microsoft Excel was used in the data analysis and presentation. Table 2 shows the data elements were utilized to analyze the hospitalization outcomes of drug abuse comorbidity. Based on the hypothesis for this study, total charges, length of stay and comorbidity drug abuse are dependent variables

Table 2 Study Data Elements

HCUP Data Element	**Descriptive Title**
AGE	Age in years at admission
MONTH	Admission month
APR-DRG	All Patient Refined DRG
APRDRG_Risk_Mortality	All Patient Refined DRG: Risk of Mortality Subclass
APRDRG_Severity	All Patient Refined DRG: Severity of Illness Subclass
CM_DRUG	AHRQ comorbidity measure for ICD-9-CM codes: drug abuse
DIED	Died during hospitalization
DISCWT	Weight to discharges in the universe
DISPUNIFORM	Disposition of patient, uniform coding
DRG	DRG in use on the discharge date
DXn	ICD-9-CM Diagnosis
ELECTIVE	Elective versus non-elective admission
FEMALE	Indicator of sex
H_CONTRL	Control/ownership of hospital
HOSP_BEDSIZE	Bedsize of hospital

HOSP_DIVISION	Census Division of hospital (STRATA)
HOSP_LOCTEACH	Location/teaching status of hospital
HOSP_REGION	Region of hospital
LOS	Length of stay, cleaned
N_HOSP_U	Number of hospitals in the universe for the stratum
CHRONIC	ICD-9-CM Number of chronic conditions
NDX	Number of ICD-9-CM diagnoses on this discharge
NIS_STRATUM	Stratum used to post-stratify hospital
NPR	Number of ICD-9-CM procedures on this discharge
ORPROC	Significant operating room ICD-9-CM procedure indicator
PAY1	Expected primary payer, uniform
PRN	ICD-9-CM Procedure
PRCCSn	Clinical Classifications Software (CCS) for ICD-9-CM Procedures
PRDAYn	Number of days from admission to procedure n
PRMCCSn	Multi-Level CCS for ICD-9-CM Procedures
PRVER	Procedure codes ICD version indicator
RACE	Race
S_DISC_U	Number of discharges in the sample for the stratum
S_HOSP_U	Number of hospitals in the sample for the stratum
TOTAL_DISC	Total hospital discharges
TOTCHG	Total charges, cleaned
TRAN_IN	Indicator of a transfer into the hospital

TRAN_OUT	Transfer out indicator
YEAR	The calendar year
ZIPINC_QRTL	Median household income for patient's ZIP Code (based on current year)

NIS Description of Data Elements. Healthcare Cost and Utilization Project (HCUP). August 2018

The variables of focus in this study consist of total charges or cost, and length of stay. Independent variables include discharge disposition, gender, race, primary diagnosis, and insurance type. The National Inpatient Sample database provides the total charges for each patient and all those without were eliminated from the study. The retrospective approach to this research focuses on the analysis of records of patients with drug abuse comorbidity. The data enables the analysis evaluation of the research questions. Moreover, it aids in exploring the dynamics between the dependent variables and independents variables as well as other covariates. HCUP-NIS data availability allows for such research to continually evaluate and improve health outcomes as well as healthcare policies.

The AHRQ comorbidity measures identify coexisting medical conditions that are not directly related to the principal diagnosis, or the main reason for admission, and are likely to have originated before the hospital stay. HCUP defines drug abuse comorbidity as including the following ICD-9-CM codes: 292.0, 292.82-292.89, 292.9, 304.00-304.93, 305.20-305.93, and 648.30-648.34 [37].

Table 3 Comorbidity drug abuse description

variable	Description	Value	Value Description
CM_DRUG	AHRQ comorbidity measure for ICD-9-CM codes: drug abuse	0	Comorbidity is not present
		1	Comorbidity is present

For comorbidity drug abuse, CM is used in the data set to distinguish the comorbidity measures from other HCUP data elements. You will notice that CM-Drug will be used more often in this study were CM=0 is not present, and CM=1 is present on the record.

3.3 Research design and rationale

The study is a retrospective analysis of NIS data from 2010- 2014. For justification for the sophisticated sampling data design in NIS, all data were weighted to reflect national estimates. The study will include comorbidity drug abuse cases from the 2010-2014 HCUP National Inpatient Sample Database. The design for this quantitative approach will include a thorough analysis hospitalization outcome for the selected years.

These datasets contain inpatient clinical and resource utilization discharge information. The database also includes information on patient age, sex, payment options, and patient's income status by zip code. Comorbidity drug abuse is already subcategorized in the National Inpatient Sample Database. The large sample size that is nationally representative of all states allows analyzing data at a large national scale. Though several

studies have focused on combating the drug abuse crisis, not enough has been published in hospitalization outcome of those admitted with drug abuse comorbidity. This study will aid the literature gap by providing the hospitalization outcome, not only for a specific drug but for all drug abuse comorbidity defined in the CM drug category. This study also identified the hospitalization outcome as it relates to the length of stay, total charges, and discharge disposition and mortality.

A retrospective analysis of hospitalizations with a drug abuse comorbidity diagnosis was conducted. Data were drawn from the Health Care Utilization Project National Inpatient Sample. Nonclinical related information is patient's demographics data that include age, gender, race and primary payer status, hospital characteristics, and total charges. Clinically related information includes principal diagnosis and procedure categories. There was also no need for the Institution Review Board as the data did not have any patient identifiers.

3.5 Data analysis plan

IBM SPSS Statistics 23, and Microsoft Excel will be utilized in the process of data analysis. The data will be recoded for all drug abuse comorbidity cases in a general category and then further subcategorized for detailed analysis. Descriptive statistics will be run for variables for missing values and outliers. Descriptive analysis will also be used to summarize SPSS results. Total charges were examined based evaluated, including the length of stay. The results of each analysis will be schemed separately to compare the outcome with a specified region, race, and gender. Longitudinal regression, each factor of the presentation was examined for a relationship with cost, the year, and several

procedures. The drug abuse comorbidity was derived from the comorbidity measure fields as defined by AHRQ. Outcomes such as cost and total charges are reported as mean values and other related outcomes as percentages. All results with a p-value of less than 0.05 were considered significant. Multiple linear regression was used to interpret total charges and length of stay. Multiple regression is the best fit to predict the value of a variable based on the value of two or more other variables. It also allows works in determining the overall fit of the model and the contribution of each of the predictors to the total variance. Logistic regression is used to describe data and to explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval, or ratio-level independent variables [38]. In this study, logistic regression was used to determine predictors of in-hospital mortality.

CHAPTER IV

RESULTS

4.1 Introduction

This chapter includes the detailed results of the descriptive and statistical analysis. A variety of statistical analysis was performed using different modeling techniques on the Nationwide Inpatient Sample (NIS) data for 2010-2014. The total sample consisted of 2,258,235 drug abuse comorbidity cases within the five years. The results from the descriptive statistical analysis provide overall summaries of the study. The number of individuals in this study constitutes 98.2%, as shown in Table 4 below. A total of 40292 are excluded cases from this study. All values with p values less than 0.05 were considered significant.

Table 4 Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Total charges (cleaned) * Indicator of sex * Calendar year	2217943	98.2%	40292	1.8%	2258235	100.0%

Table 5 shows the number of cases in this study yearly. The trend from 2010 -2014 shows that in 2010, 518372 cases are making 23%. The highest cases were in 2011 and

2013 with each having 569874 and 580678 respectively and making 50% of the cases combined. Lastly, 2012 and 2014 recorded low cases with 276451 and 312860, respectively.

Table 5 Comorbidity drug abuse case distribution

		Frequency	Percent	Cumulative Percent
Valid	2010	518372	23.0	23.0
	2011	569874	25.2	48.2
	2012	276451	12.2	60.4
	2013	580678	25.7	86.1
	2014	312860	13.9	100.0
			100.0	

Table 5 shows the percentages of admission type; 88 % of patients with drug abuse comorbidity were non-elective admissions, while 11% were elective. The total cases that were nonelective were 19998339, with only 253299 noted as elective.

Table 6 Comorbidity drug abuse Admission Type

Elective versus non-elective admission					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1998339	88.5	88.8	88.8
	1	253299	11.2	11.2	100.0
	Total	2251638	99.7	100.0	
Total		2258235	100.0		

4.2 Patient demographics characterictics

4.2.1 Age distribution

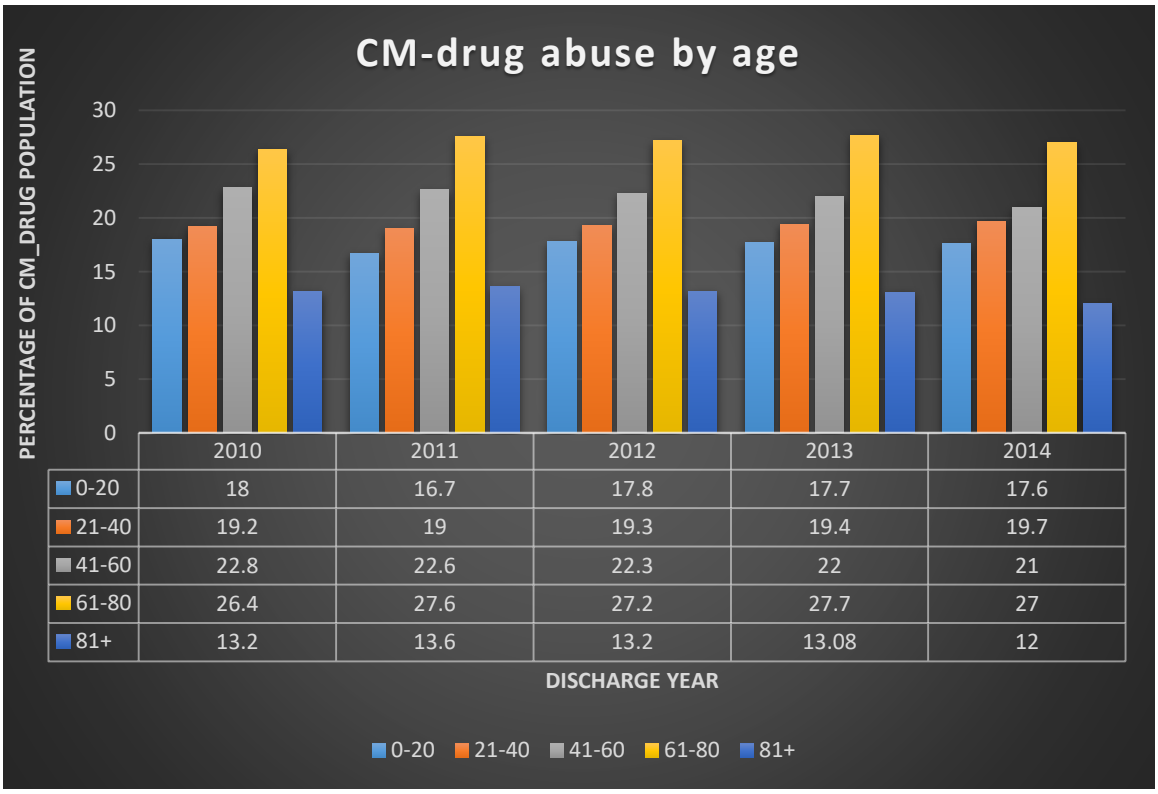
The age range for patients with CM Drug abuse ranged from zero to 111, as shown in Figure 3. The peak ages were between 30-33 and 54-57. In order to better understand the differences in age groups, the patient ages were divided into five groups

ranging from 0-81 and older. The trend for drug abuse comorbidity from 2010 to 2014 was distributed according to patient's age group, as shown in Figure 4.

Figure 4 Age distribution for CM Drug case

Figure 4 shows that more than 68% of patients with drug abuse comorbidity were in combined age groups of 21-80+ years. Less than 18% were under 20 years with the youngest less than one year, and the 81, and older age group had an average of 13%.

Figure 4 Trend of age groups



	2010	2011	2012	2013	2014
0-20	18	16.7	17.8	17.7	17.6
21-40	19.2	19	19.3	19.4	19.7
41-60	22.8	22.6	22.3	22	21
61-80	26.4	27.6	27.2	27.7	27
81+	13.2	13.6	13.2	13.08	12

4.2.2 Gender distribution

The trend in gender distribution for drug abuse commodity is shown in figure 5. There were 1261378 male cases while females were 995969. Eight hundred eighty-eight cases did not reflect gender type and were recorded as missing for analysis purposes.

Figure 5 Drug cases of abuse comorbidity cases by gender

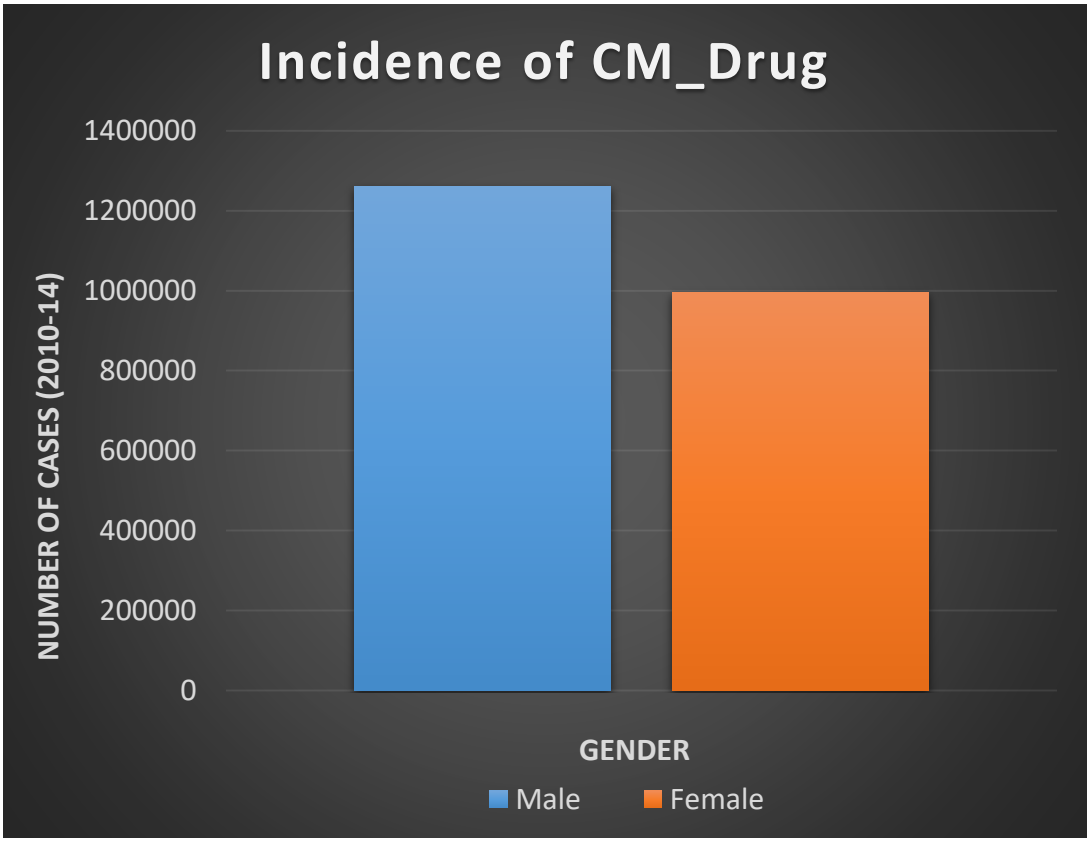
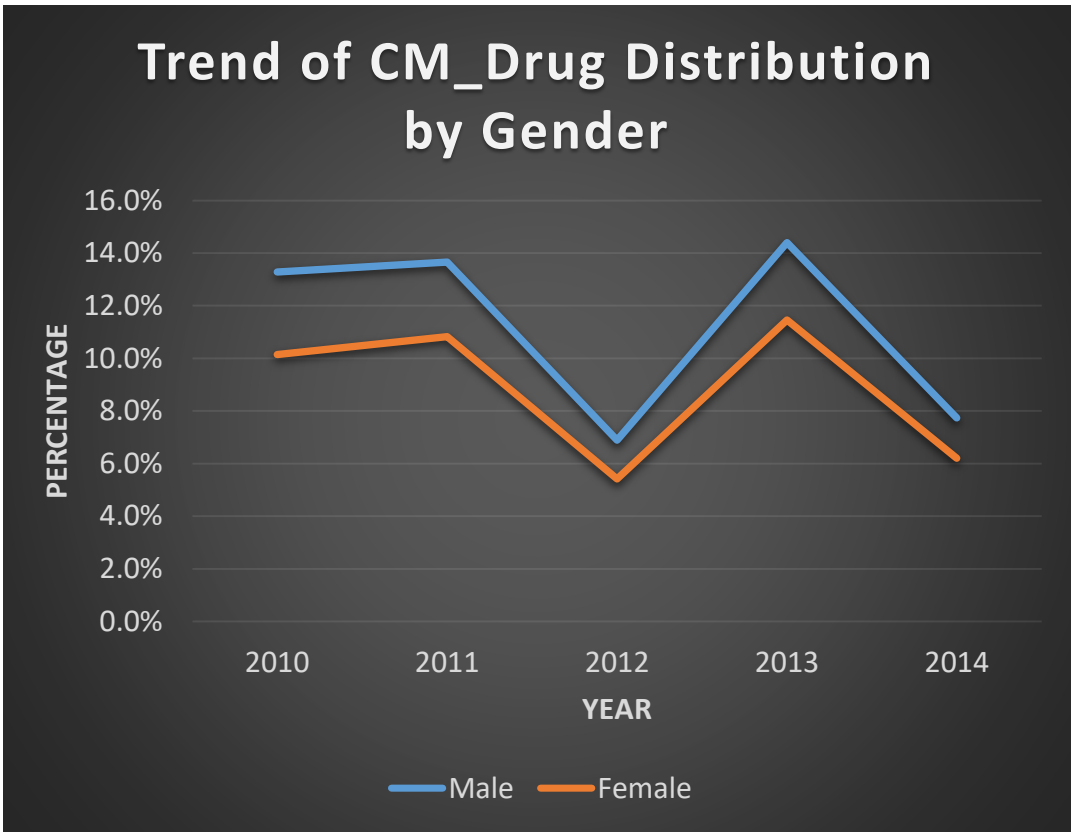


Figure 6 CM- Drug Gender Distribution



The drug abuse comorbidity gender distribution above shows the trend from 2010-2014 that for 2010, 13% of CM-Drug patients were male compared to 10.1 females. In 2011showed, 13.7% males and 10.8% females, 2012 showed 6.9 males and 5.4, 2013 had 14.5% male cases and 11.5% female cases. Lastly, 2014 had 7.7% of males and 6.2 female cases.

4.2.3 Race distribution

Within the five-year period, a total of 629608 drug abuse comorbidity patients were white, which comprises 54.9% of the total, followed by black with nearly half of the white population 24.3%, Hispanic 8.9%, other 2.5%, Asians and Native American were the lowest with only 0.8% as shown in table 7.

Table 7 Race Distribution

		Frequency	Percent	Valid Percent
Valid	White	629608	54.9	59.5
	Black	279256	24.3	26.4
	Hispanic	102471	8.9	9.7
	Asian or Pacific Islander	8607	.8	.8
	Native American	9173	.8	.9
	Other	29252	2.5	2.8
	Total	1058367	92.2	100.0
Total		1147326	100.0	

4.2.4 Type of payer

The primary expected payer table 8 shows that Medicaid was the main form of health insurance charged 36%. Medicare had 22.6% while private and self-pay had 18.2 and 15.1, respectively. Other not specified insurance types were charged 5.4% times and no charges reflected on 1.7% of the cases

Table 8 Primary expected payer

		Frequency	Percent
Valid	Medicare	510179	22.6
	Medicaid	827936	36.7
	Private	411272	18.2
	Self-Pay	341257	15.1
	No Charge	37369	1.7
	Other	122357	5.4
Total		2258235	100.0

4.2.5 Region of Hospital

The hospital region table below shows the distribution of hospitals throughout the United States. The Northeast has the lowest presentation of 13%; Midwest was 31.3 % while the South had 36.2% and west had 19.5%.

Table 9Region of the hospital (STRATA)

		Frequency	Valid Percent	Cumulative Percent
Valid	Northeast	2840	13.0	13.0
	Midwest	6850	31.3	44.3
	South	7930	36.2	80.5
	West	4270	19.5	100.0
	Total	21890	100.0	
Total		21890		

4.2.6 Principal diagnosis and comorbidity drug abuse

The figure below shows common conditions that are associated with drug abuse and were listed as the primary diagnosis for the cases that had drug abuse comorbidity on file. Although these conditions are not primarily the reason, people become addicted; it is beneficial for this study to analyze the pattern of association.

Figure 7 List of Principal Diagnosis

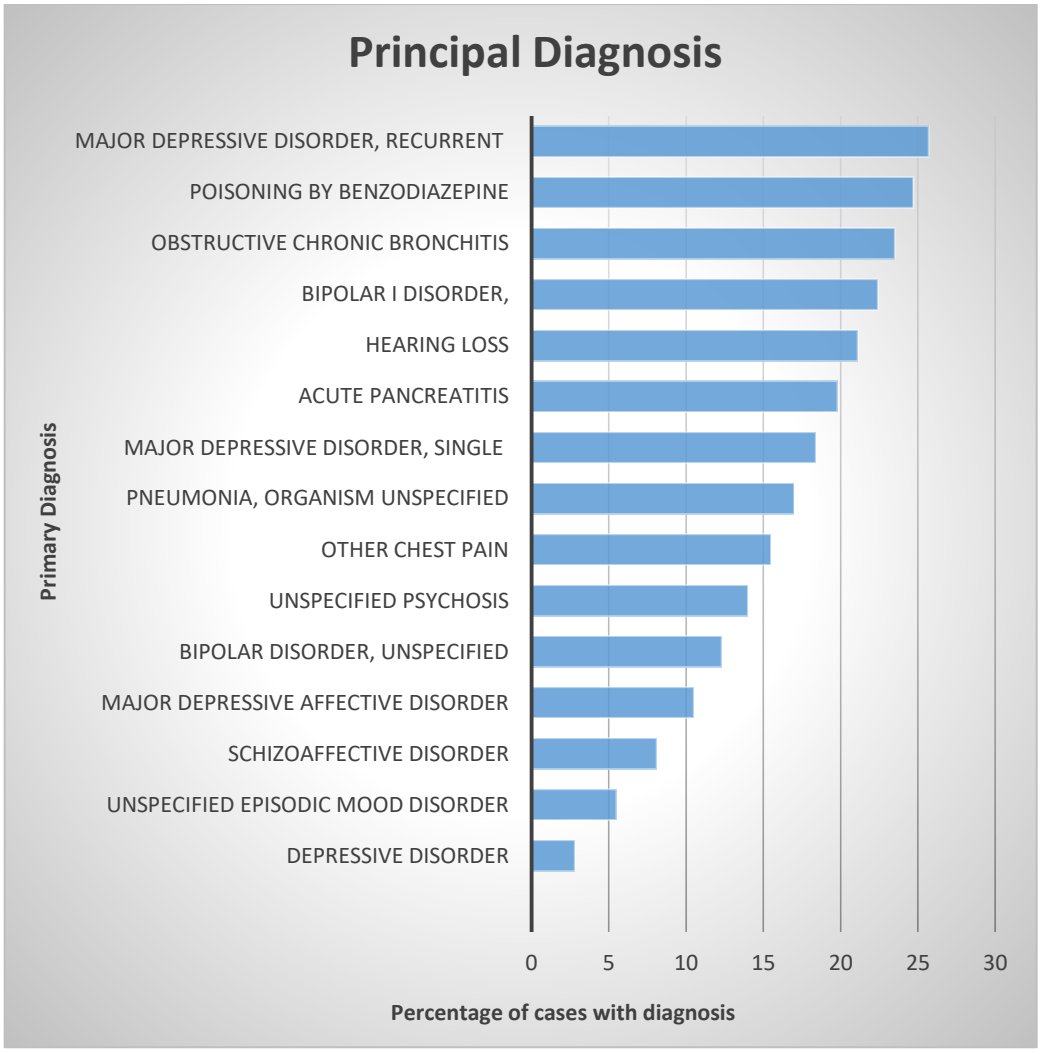


Figure 7 shows the most common principal diagnosis as a major depressive disorder with recurrent episodes accounting for 25.7%, poisoning by benzodiazepine was recorded in 24.7% cases. Bipolar depressive disorder had 12.3% by schizophrenia disorder and significant depression affective disorder with 8.1 and 10.5, respectively.

4.2.7 Number of procedures

Table 8 below shows the number of procedures that were associated with patients who had CM-DRUG on their record. At least 54% did not have any procedures, 19% had at least one procedure list, and 10.5% had two procedures during their hospital stay.

Table 10 Number of procedure on record

Number of procedures on this record	N	Sum	% of Total N
0	1218606	1218606	54.0%
1	430265	430265	19.1%
2	237793	237793	10.5%
3	143101	143101	6.3%
4	79734	79734	3.5%
5	45598	45598	2.0%
6	38546	38546	1.7%
7	19370	19370	.9%
8	13666	13666	.6%
9	9408	9408	.4%
10	6095	6095	.3%

4.2.8 Discharge disposition distribution

Figure 8 below shows the distribution of discharge disposition for each region according to race.

Figure 8 Discharge by race/white

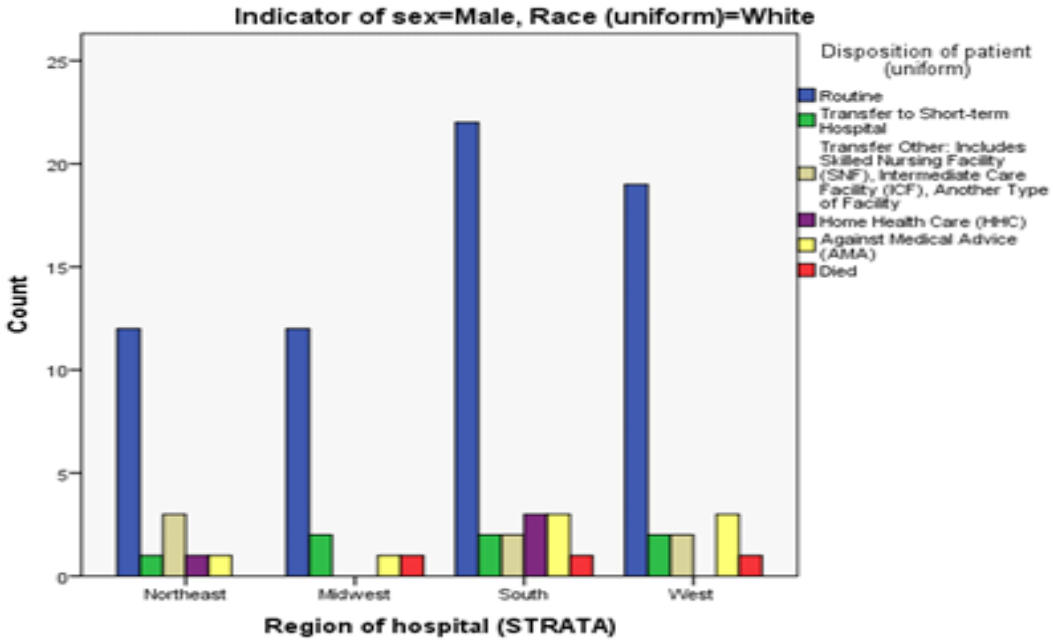
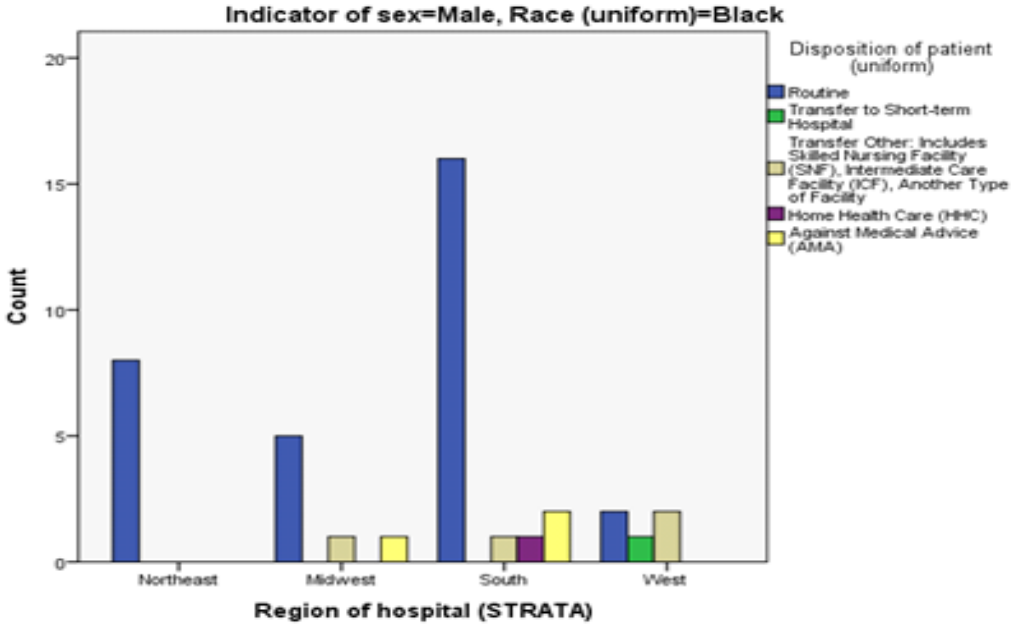


Figure 9 Discharge by race/black



Routine discharge counts for the majority of the discharges for both races in each region.

Figure 10 Discharge disposition for females

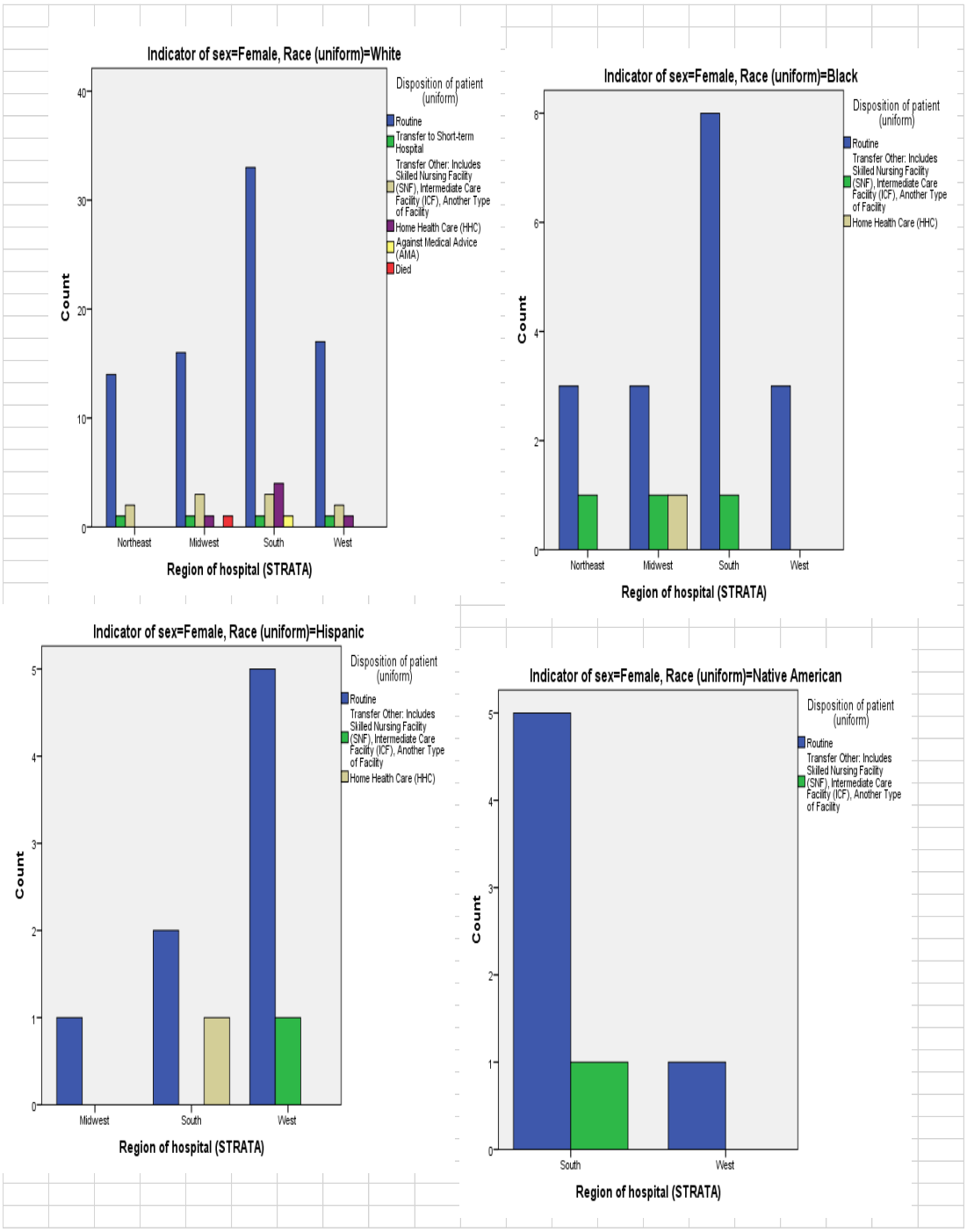


Figure 10 above also shows the discharge distribution for each region for female. Routine discharge is more familiar with other patients being discharged to skilled nursing

facilities or long term care.

4.3 Comparison of outcomes for patients with drug abuse comorbidity and non-drug abuse.

4.3.1 Comparison of length of stay (LOS)

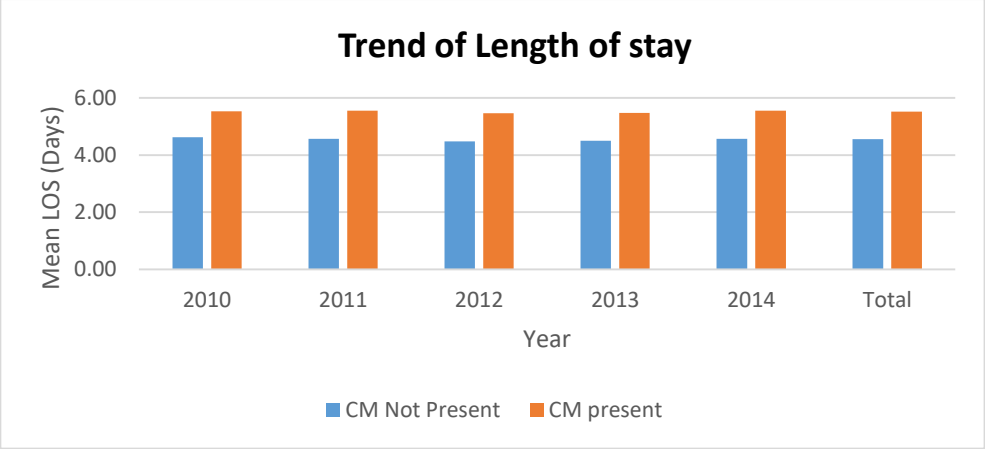
When comparing the length of stay for between drug abuse comorbidity patient and non-drug abuse, the average stay for a patient with drug abuse comorbidity was 5.52 compared to 4.56 for non-abuse.

Table 11 Length of stay

AHRQ comorbidity measure: Drug abuse	Mean	N	Std. Deviation
Not Present	4.56	286979236	6.768
CM Present	5.52	11211054	8.051
Total	4.59	298190290	6.823

Figure 9 shows the trend for the length of stay for drug abuse comorbidity and non-drug abuse. From 2010-2014 the drug abuse comorbidity cases have an average of 5 days while non-drug abuse has four days

Figure 11 Trend of Length of Stay



4.3.2 Admission type

Table 12 shows non-elective that do not have CM-drug have a 4.6-day stay while those cases with CM-drug have 5.46. Elective cases for non-drug abuse have 4.2 days while those with CM-drug have 5.9 days

Table 12 Admission type and length of stay

Length of stay Elective vs. Non-Elective		Mean	N	Std. Deviation	% of Total N
Not Present	0	4.64	219088606	6.748	73.7%
	1	4.28	66915661	6.798	22.5%
	Total	4.55	286004267	6.761	96.2%
CM Present	0	5.46	9924188	7.847	3.3%
	1	5.96	1254562	9.510	.4%
	Total	5.52	11178750	8.052	3.8%

The *p*-value is 0.0001. The result is significant at $p < .05$

4.3.3 Age and length of stay

Table 13 shows the length of stay for each age group. For age group, 1-20 patients that had no drug abuse had an average length of stay of 3.7 days while those with drug abuse had six days. The second age group 21-40 showed an average of 3.4 for non-drug abuse and five days for drug abuse comorbidity. The third age group 41-60 has an average of 4.7, and non-drug abuse comorbidity had 5.6 days. The fourth age group 61-80 had 5.3 days and 6.2 days for drug abuse comorbidity. Lastly, the 81 and older age group had an average of 5.3 compared to 6 days for drug abuse comorbidity.

Table 13 Age group and length of stay

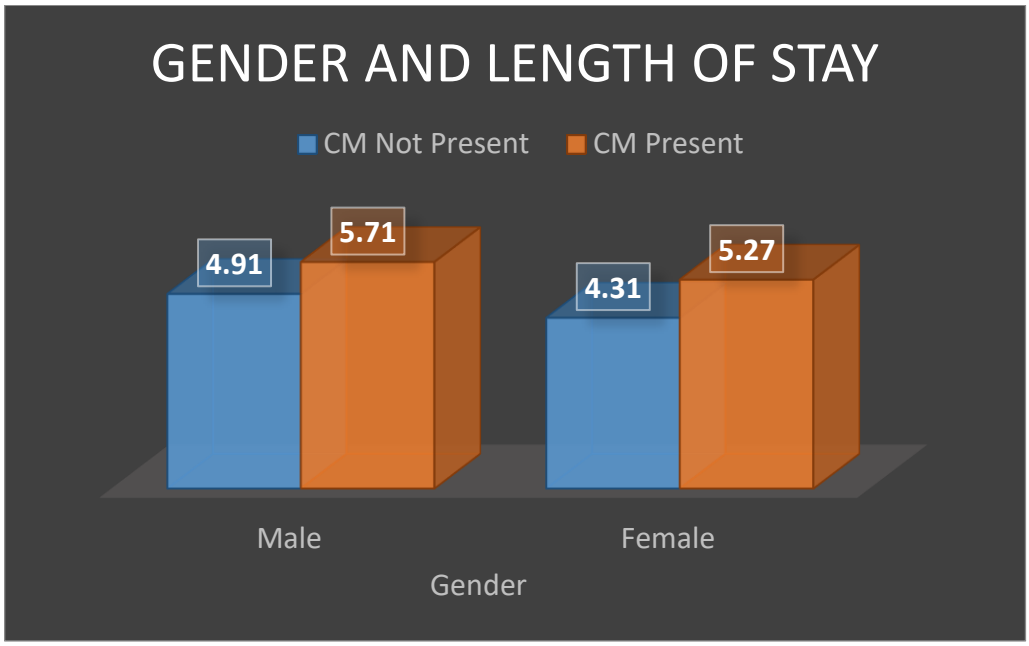
AHRQ comorbidity measure: Drug abuse		Mean	Std. Deviation	% of Total N
Not Present	1-20	3.79	8.457	17.3%
	21-40	3.44	5.141	17.8%
	41-60	4.76	6.927	20.8%
	61-80	5.25	6.609	27.0%
	81+	5.34	5.910	13.2%
	Total	4.56	6.768	96.2%
CM Present	1-20	6.02	11.474	.3%
	21-40	5.09	7.396	1.5%
	41-60	5.68	7.972	1.6%
	61-80	6.24	8.167	.3%
	81+	6.00	5.653	.0%
	Total	5.52	8.050	3.8%

The result is significant at $p < 0.001$.

4.3.4 Gender and length of stay

Length of stay comparison shown in Figure 12 reflects that males with drug abuse comorbidity had an average of 5.7 inpatient days while non-drug abuse patients stayed for 4.9 days. Females who had drug abuse comorbidity had an average of 5.2 days, while non-drug abuse patients had 4.3 inpatient days. The p-value was significant at $p< 0.001$.

Figure 12 Gender and length of stay



The result is significant at $p < 0.001$

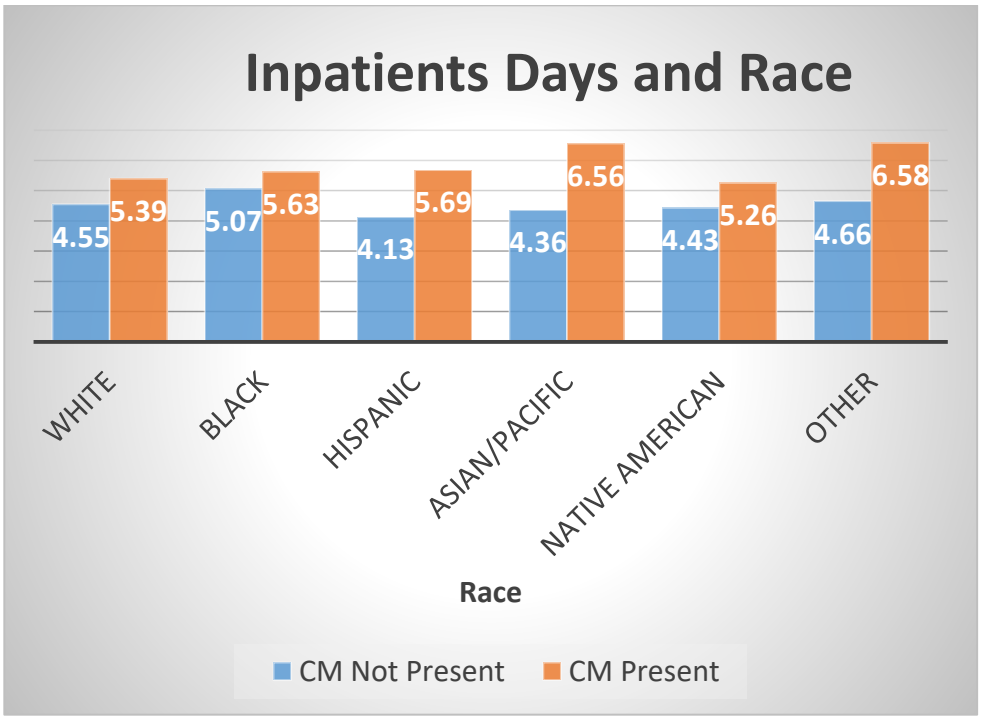
95% Confidence Interval

CM Present [5.49 to 5.52] CM Not Present [4.42 to 4.55]

4.3.5 Race and length of stay

Length of stay comparison between races showed a range of 4.1-4.6 days for non-drug abuse cases while drug abuse comorbidity ranged from 5.2-6.5 days, as shown in figure 13. The p-value for race and length of stay was significant at p<0.001

Figure 13 Inpatient days and Race



95% Confidence Interval

CM Present [5.51 to 5.54] CM Not Present [4.54 to 4.56]

4.3.6 CCS Diagnosis category and length of stay

Classification software diagnosis categories were used to identify the relationship between the length of stay and diagnosis categories. Table 14 shows that the lowest inpatient days were recorded for obstetrics non-drug abuse of 2.6 days and 3.1 for drug abuse comorbidity. The most extended stay for non-drug abuse was 7.6 days for infectious category while the highest for drug abuse was for a perinatal category that had a total inpatient stay of 43.2 days.

Table 14 CCS Diagnosis and length of stay

comorbidity measure: Drug abuse		Mean	N	Std. Deviation	% of Total N
Not Present	Infectious &Parasitic	7.62	10629576	9.059	3.6%
	neoplasms	5.90	13039692	7.505	4.4%
	Endocrine, Metabolic, Immune	4.08	10256701	5.532	3.4%
	Blood Disease	4.26	3532375	5.315	1.2%
	Mental Illness	7.18	13069073	10.405	4.4%
	Nervous system	4.05	6971913	6.597	2.3%
	Circulatory	4.37	43761556	5.568	14.7%
	Respiratory	5.06	25189088	6.620	8.5%
	Digestive	4.48	27220916	5.239	9.1%
	Genitourinary	3.92	13611383	4.518	4.6%
	OB	2.65	32893738	2.534	11.1%
	Skin	4.68	5271131	5.664	1.8%
	Musculoskeletal	3.43	16748584	3.752	5.6%
	Congenital	6.79	1038237	15.330	.3%
	Perinatal	3.71	31670636	8.993	10.6%
	Injury& poisoning	5.23	22740371	7.200	7.6%
	Other	6.91	8838465	8.639	3.0%
CM Present	Infectious &Parasitic	8.33	472964	10.628	.2%
	neoplasms	8.12	156564	9.994	.1%
	Endocrine, Metabolic, Immune	4.16	410136	6.146	.1%
	Blood Disease	5.01	111035	5.808	.0%
	Mental Illness	6.55	3657988	8.755	1.2%
	Nervous system	4.30	380123	7.678	.1%
	Circulatory	4.72	1180146	7.334	.4%
	Respiratory	5.25	787240	7.351	.3%
	Digestive	4.60	854650	5.848	.3%
	Genitourinary	4.28	292427	5.231	.1%
	OB	3.12	503597	3.747	.2%
	Skin	4.36	396249	5.546	.1%
	Musculoskeletal	5.54	293256	7.473	.1%
	Congenital	16.88	9589	33.548	.0%
	Perinatal	43.20	3226	54.698	.0%
	Injury& poisoning	5.01	1297307	7.989	.4%
	Other	5.91	300686	9.625	.1%

The result is significant at $p < 0.001$

95% Confidence Interval

CM Present [5.53 to 5.64] CM Not Present [4.54 to 4.55]

4.3.7 CCS procedure category and length of stay

Table 15 shows the clinical classification software procedure categories (CCS procedure) and length of stay was analyzed and shows that respiratory and hemic lymphatic procedures had the most extended length of stay. They were both above nine days for non-drug abuse and above 11 days when a patient had drug abuse comorbidity.

Table 15 Length of Stay and CCS procedure category

AHRQ comorbidity measure: Drug abuse		Mean	N	Std. Deviation	% of Total N
Not Present	Nervous System OP	5.66	5378469	8.759	2.9%
	Endocrine OP	3.06	645529	5.802	.3%
	Eye OP	4.76	180958	11.199	.1%
	Ear OP	4.21	106850	7.817	.1%
	Nose, Mouth	3.80	988123	6.110	.5%
	Respiratory OP	9.69	4907755	12.947	2.6%
	CVD	6.14	25683183	8.346	13.6%
	Hemic, Lymphatic	9.32	1108369	12.561	.6%
	Digestive	5.99	24573964	8.015	13.0%
	Urinary	4.91	4020494	5.930	2.1%
	Male DX	2.76	8568816	3.751	4.5%
	Female DX	2.60	4353390	3.136	2.3%
	OB	2.64	29664878	2.341	15.7%
	Musculoskeletal	4.41	22467799	5.181	11.9%
	Integumentary	6.17	5239428	9.372	2.8%
	Other	5.84	45339075	8.957	24.1%
CM Present	Nervous System OP	8.50	159804	12.265	.1%
	Endocrine OP	6.42	6153	8.880	.0%
	Eye OP	4.70	9528	7.802	.0%
	Ear OP	5.39	2854	7.538	.0%
	Nose, Mouth	6.07	27808	10.684	.0%
	Respiratory OP	12.30	152899	16.259	.1%
	CVD	6.95	761638	9.446	.4%
	Hemic, Lymphatic	11.59	25148	13.147	.0%
	Digestive	6.56	616544	8.765	.3%
	Urinary	5.69	70654	6.918	.0%
	Male DX	5.33	10985	7.025	.0%
	Female DX	3.92	42071	6.272	.0%
	OB	2.96	490992	3.360	.3%
	Musculoskeletal	7.15	437580	9.351	.2%
	Integumentary	6.31	330584	9.113	.2%
	Other	7.04	2016336	10.362	1.1%

The result is significant at $p < 0.001$

95% Confidence Interval

CM Present [6.71 to 6.72] CM Not Present [5.06 to 5.07]

4.4.1 Hospitalization charges

When comparing total charges for drug abuse comorbidity patient and non-drug abuse, the mean charges for 3.8% of patient with drug abuse comorbidity was $36,735.93 compared to $35,200.85 for 98% of non-abuse cases as shown in table 16.

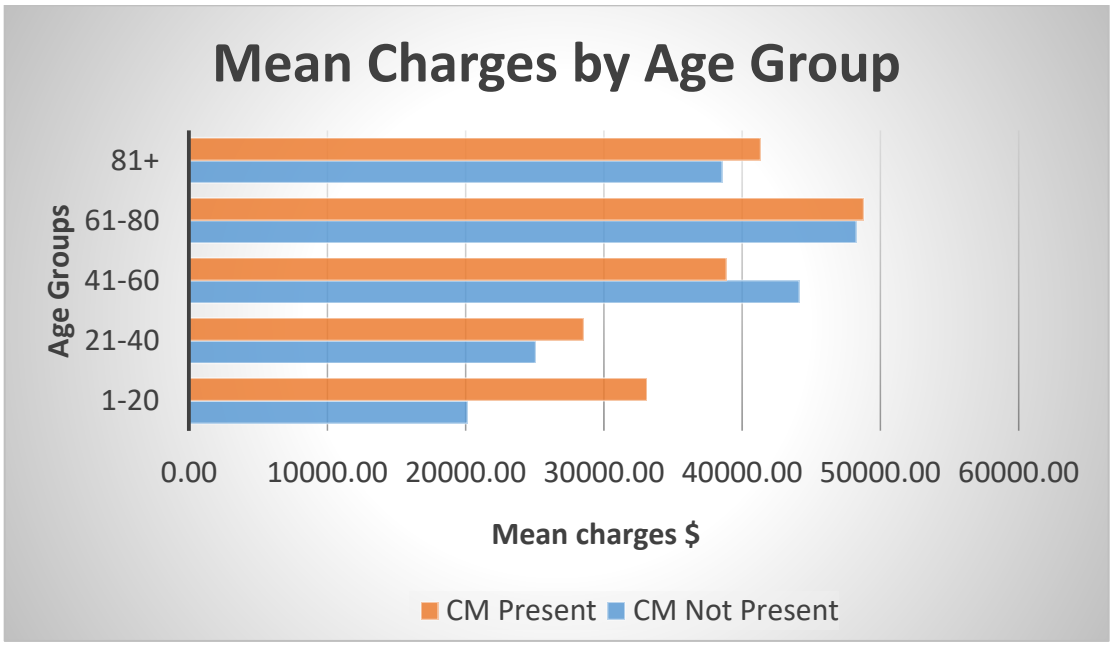
Table 16 Total charges and length of stay

AHRQ comorbidity measure: Drug abuse	Mean	N	Std. Deviation	% of Total N	% of the Total Sum
CM Present	36735.93	281068444	67717.829	96.2%	96.4%
NOT Present	35200.85	11013429	69321.442	3.8%	3.6%
Total	71936.78	292081873	67779.614	100.0%	100.0%

4.4.2 Age and mean charges

The mean charge for each age group shown in figure 14 reflects that for 0-20 age group non abuse cases had $20,000.00 charges, and cm-drug cases had $34,000.00. The 21-40 age group had $25,000.00 for non-drug abuse while cm-drug comorbidity had $28,000.00, 41-60 group had $44,000.00 for non-drug abuse while drug abuse had $38,000.00. Older adults 61-80 age group $48,000 for drug abuse comorbidity and non-drug abuse had $47,000. Lastly 81and above had $42,000 cm-drug and $38,000 for non-drug abuse cases. The results were significant at $p<0.001$.

Figure 14 Age group and mean charges



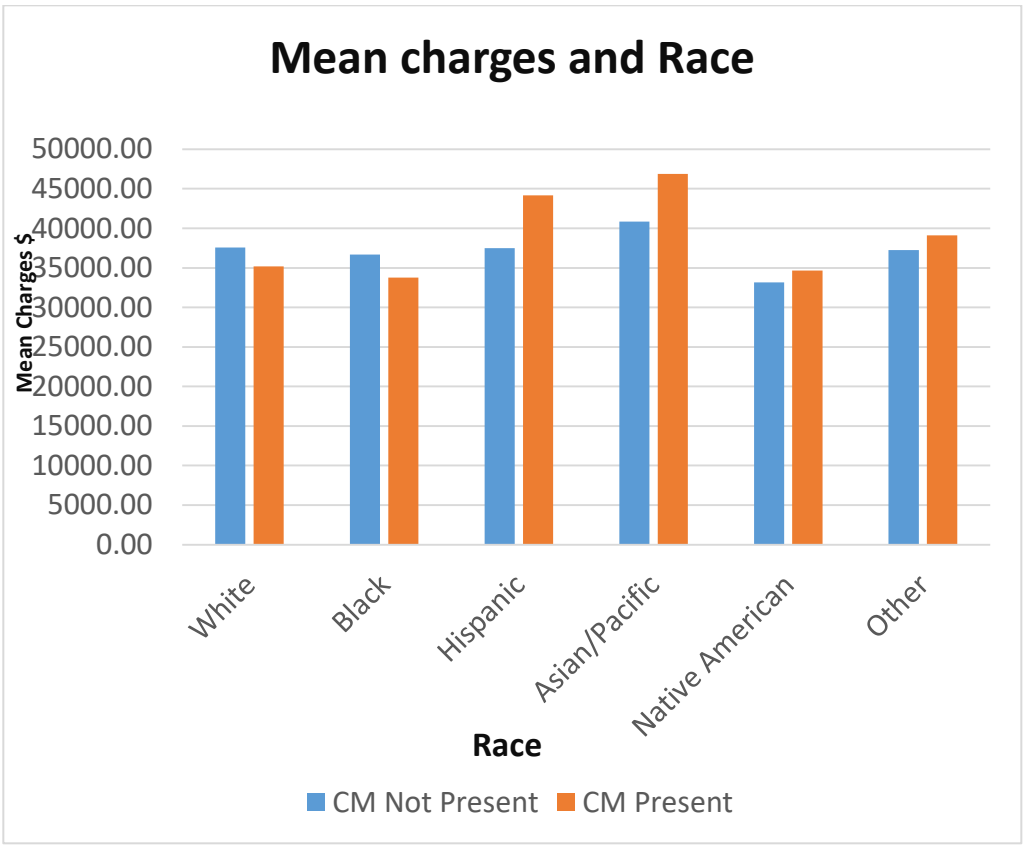
95% Confidence Interval

CM Present [$35,217 to $35,256] CM Not Present [$33,497 to $33,562]

4.4.3 Association of race and mean charges

Figure 15 above shows the relationship between race and mean charges. The mean charges for race showed that for non-drug abuse, Caucasian had $38,000 and $35,000 for drug abuse. Blacks had $36,000 for non-drug abuse, while cm-drug had $34,000. Hispanic showed $44,500 for cm-drug and less than $40,000 for non-drug abuse. Asian/Pacific showed higher charges at $47,000 for cm-drug and $41,000 for non-drug abuse. Native Americans and Other not specified had $34,000 and $39,000 for drug abuse and non-drug abuse $33,000 and $36,000 respectively. There was a significant P value of less than 0.001.

Figure 15 Race and mean charges



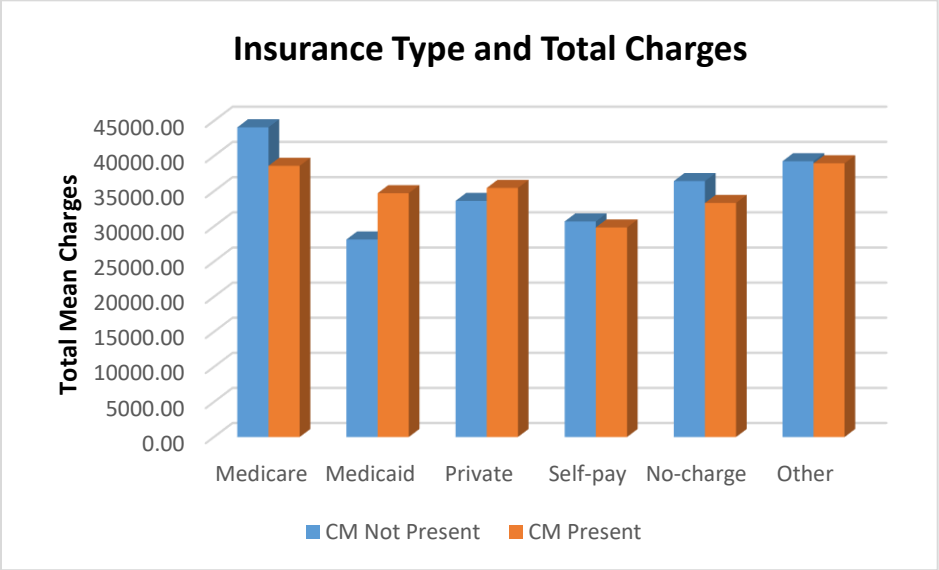
95% Confidence Interval

CM Present [$37,442 to $37,495] CM Not Present [$35,831 to $35,918]

4.4.4 Payer and mean charges

Figure 14 below shows variations in the total charges for each payer. Medicaid and Medicare have the highest reported for patients with drug abuse comorbidity at $38,000 and $34,000 for cm-drug cases while private and self-pay had $34,900 and $29,000 for drug abuse comorbidity cases. Medicaid and Private insurance paid more for drug abuse comorbidity than non-drug abuse cases. The P value remained significant at $p<0.001$.

Figure 16 Payer and mean charges



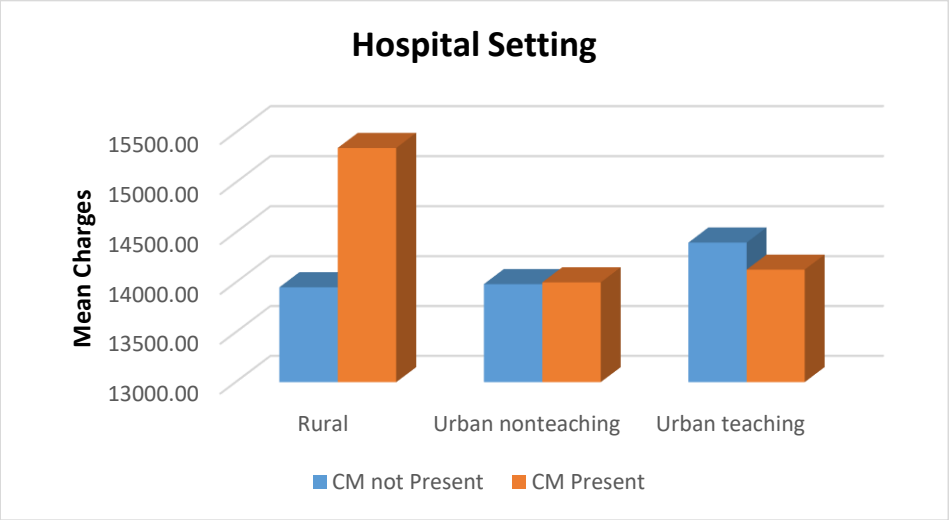
95% Confidence Interval

CM Present [$35,190 to $35,272] CM Not Present [$36,720 to $36,770]

4.4.5 Charges and geographical region

Charges were different for each hospital setting, as shown in figure 15. The rural setting had higher charges for cm-drug at $15,100.00 while non drug abuse was $13,800.00. Urban nonteaching did not show much difference between the two. Urban teaching hospitals had $14,000.00 for cm-drug abuse and $14,300.00 for non-drug abuse. P was significant at 0.001.

Figure 17 Hospital setting charges

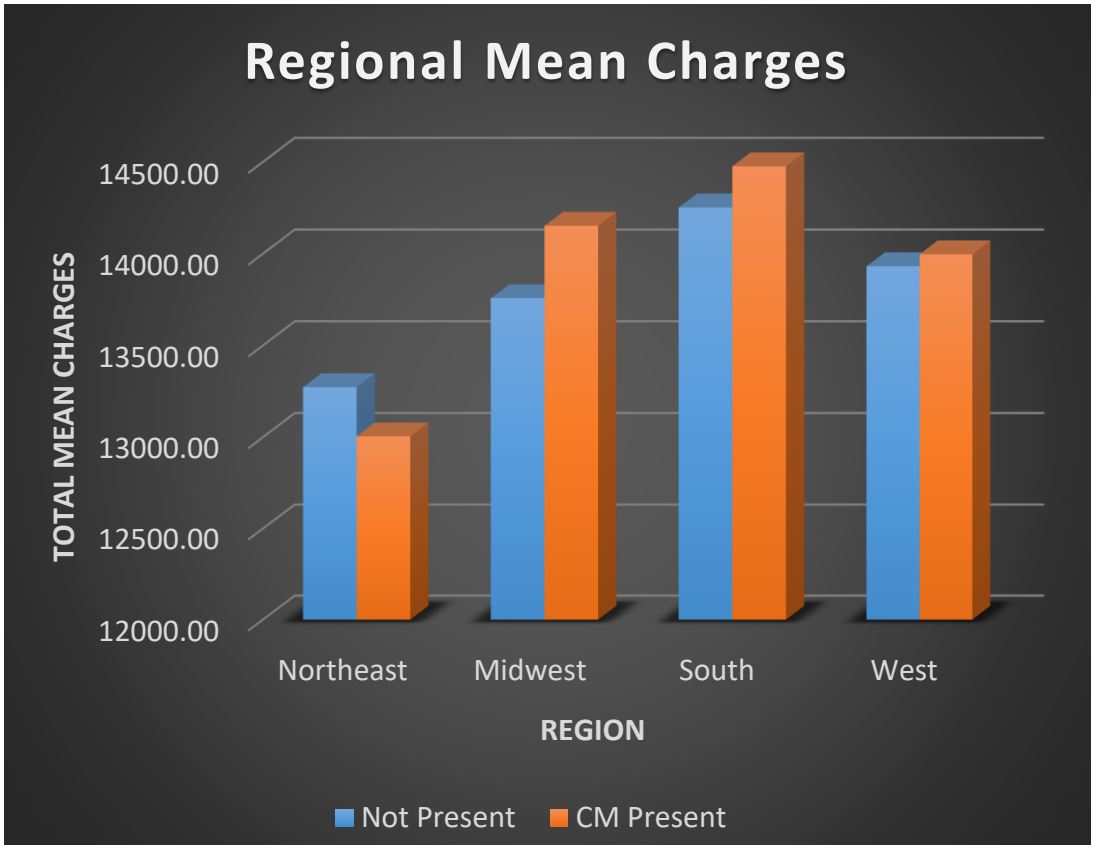


95% Confidence Interval

CM Present [$14,879 to $15,283] Not Present [$13,878 to $14,249]

Geographically the charges showed the variation of charges for each region. The northeast had the lowest charges for both cm-drug and non-drug abuse $12,900.00 and $13,300.00. The Midwest showed $13,650.00 for non-drug abuse and cm-drug $14,100.00. The South had $14,200.00 for non-drug abuse and $14,400.00 for drug abuse. Lastly, the West showed a slightly lower difference between drug abuse comorbidity and non-drug abuse. The p-value was 0.001

Figure 18 Geographical region and mean charges

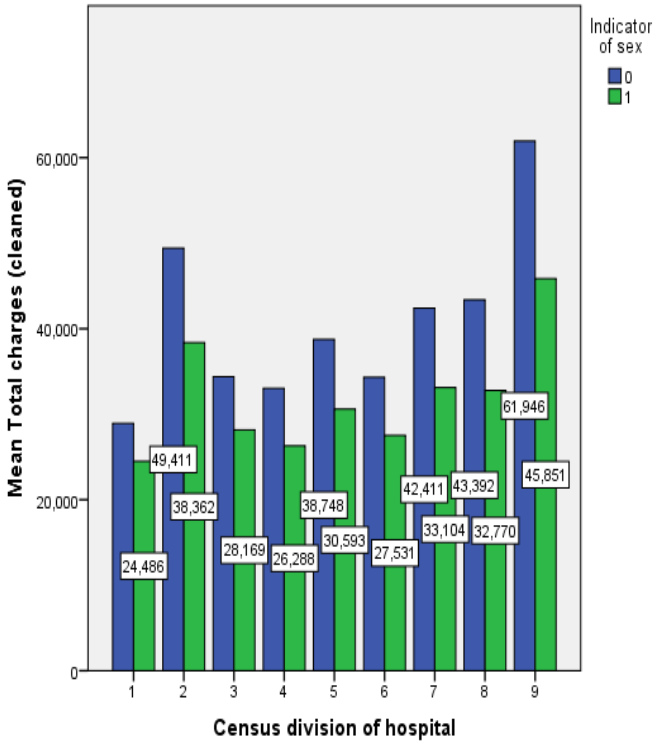


95% Confidence Interval

CM Present [$14,137 to $14,566] Not Present [$13,725 to $14,092]

Figure 19 below shows a breakdown of total mean charges by the census division 1-9.

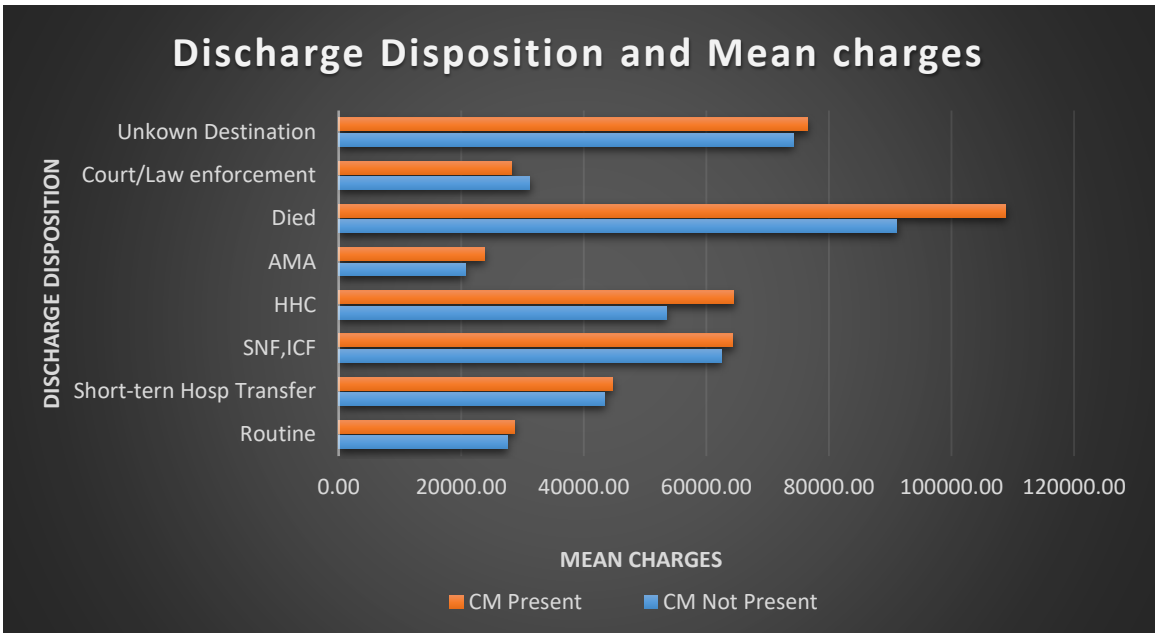
Figure 19 Hospital census division by gender



Region 1: Northeast	Division1: New England (Connecticut, Maine, Massachusetts New, Rhode Island, and Vermont) Division2: Mid-Atlantic (New Jersey, New York, and Pennsylvania
Region 2 Midwest	Division 3: East North Central (Illinois, Indiana, Michigan, Ohio, and Wisconsin) Division 4: West North Central (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota
Region 3 South	Division 5: South Atlantic (Delaware, Florida, Georgia, Maryland, North Carolina South Carolina, Virginia, District of Columbia, and West Virginia)Division 6: East South Central Alabama Kentucky, Mississippi and Tennessee Division 7: West South Central (Arkansas, Louisiana, Oklahoma, and Texas)
Region 4 West	Division8: Mountain (Arizona, Colorado, Idaho, Montana, Ne vada, New Mexico, Utah, and Wyoming) Division9: Pacific (Alaska, California, Hawaii, Oregon, and Washington)

4.4.6 Discharge disposition

Figure 20 Discharge disposition and mean charges



95% Confidence Interval

CM Present [$36,715 to $36,766] Not Present [$35,184 to $35,226]

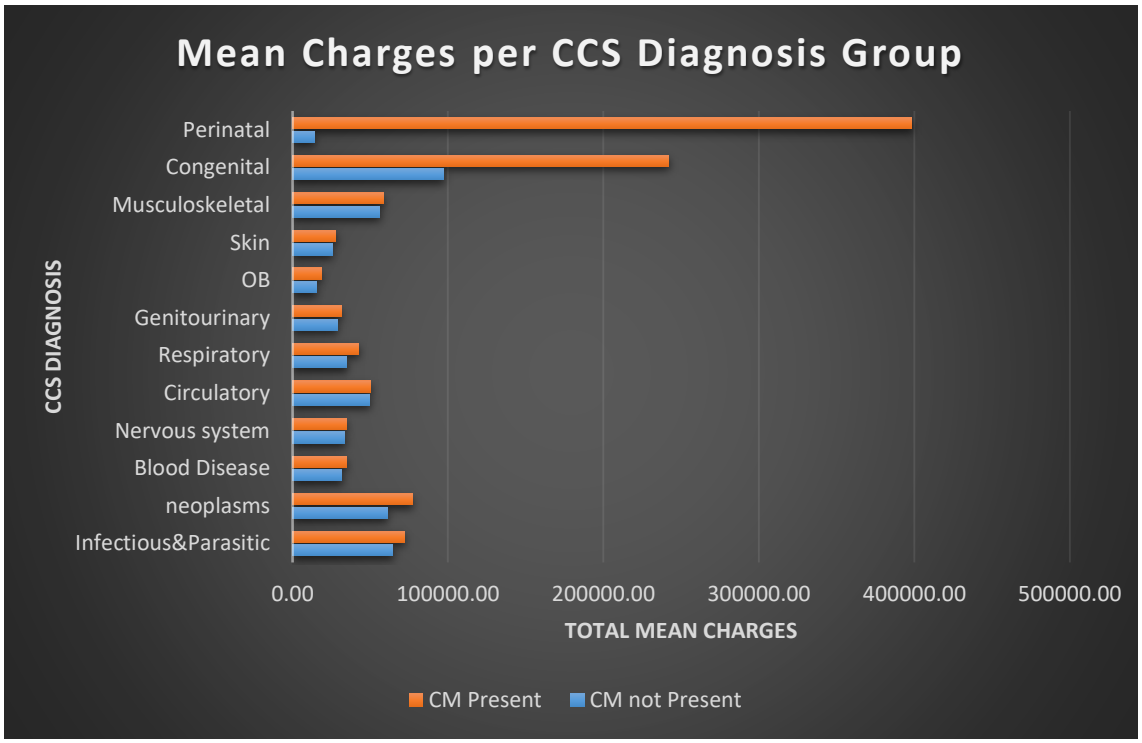
Figure 20 shows the discharge disposition and total mean charges association. Routine discharge, court/law enforcement, and those who left against medical advice had charges that were lower than $30,000.00 while other types of discharges resulted in charges above $40,000.00. P<0.001

4.4.7 CCS diagnosis and procedure categories

Figure 21 and 22 shows the total mean charges for CCS diagnosis categories and procedures. Figure 21 shows Perinatal and congenital diagnosis group showed higher charges of above $200,000.00 for drug abuse comorbidity while non-drug cases abuse was lower than $100,000.00.

Figure 22 shows the mean charges for procedure categories. Respiratory and hemic categories showed charges of over $100,000.00. Male-related diagnosis is significantly higher for drug abuse compared to non-drug abuse.

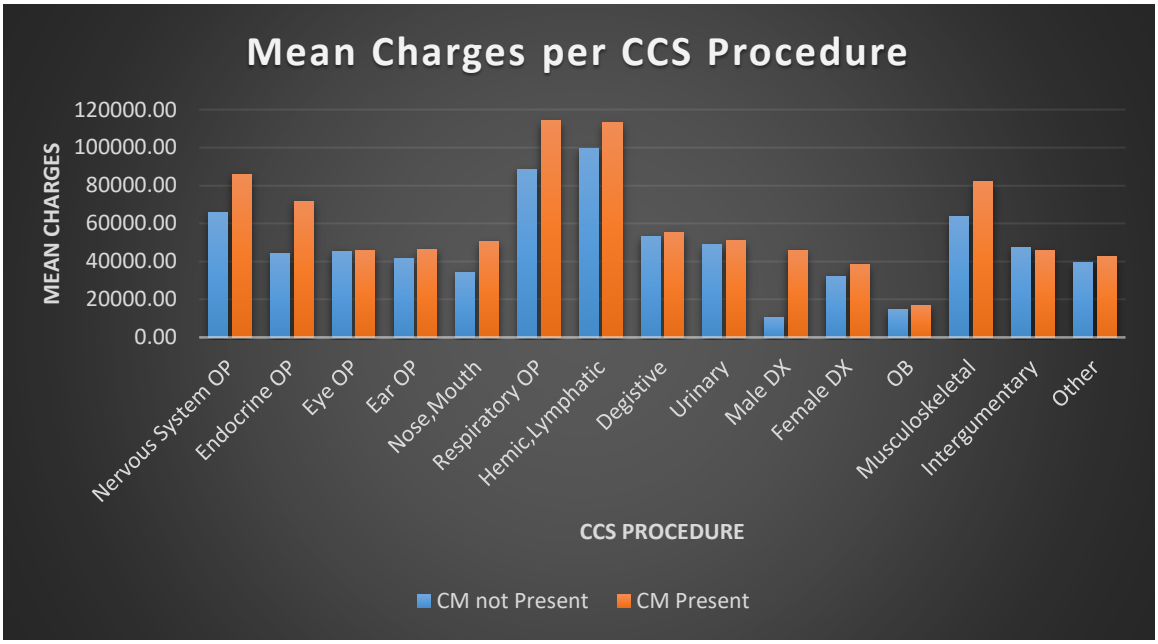
Figure 21 CCS diagnosis category



95% Confidence Interval

CM Present [$36,731 to $36,781] Not Present [$35,333 to $35,416]

Figure 22 CCS Procedure category



95% Confidence Interval

CM Present [$54,209 to $54,372] Not Present [$47,185 to $47,226]

4.4.8 Mortality

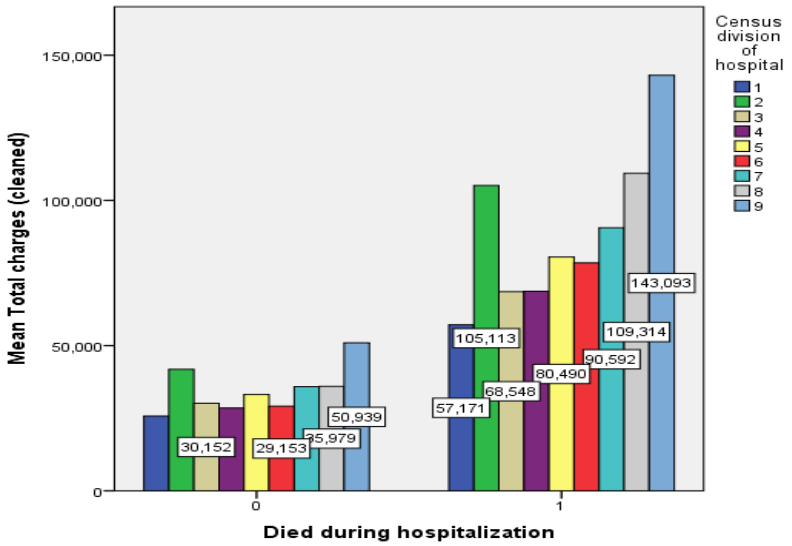
Table 17 above shows the total mean charges of those that died during hospitalization for both drug abuse comorbidity patient and non-drug abuse. The total mean charges for those with drug abuse comorbidity died was $108,808, and for non-drug abuse, it was lower at $91,089.45.

Table 17 Hospital Mortality

Died During Hospitalization		Mean	N	Std. Deviation	% of Total N
Not Present	0	35674.60	275443111	63581.994	94.4%
	1	91089.54	5410201	171072.636	1.9%
	Total	36742.08	280853312	67724.220	96.2%
CM Present	0	34502.37	10887672	67176.070	3.7%
	1	108808.81	107051	172556.356	.0%
	Total	35225.85	10994723	69367.379	3.8%

The figure below shows the total charges for each census region for those who died during hospitalization. Region 8 and nine which are both in the west, had the highest charges of $109,314.00 and $143, 093.00 respectively. The P value was significant at p<0.0001.

Figure 23 Mortality and census regions



4.5.1 Predictors of study outcomes

The following assumptions were taken into consideration for the predictors of outcome:

- The dependent variable must be continuous- total charges are continuous variables
- Two or more independent variable (numerical, ordinal or categorical)- variables involved matched the criteria
- Independent of observation or independence of residual- the value of the Durbin-Watson test for total charges 1.799. The acceptable value must range between 1-3, and closer to 2 to be accepted.
- The relation between the dependent and independent has to be linear- the result showed significant correlations

Table 18 Multivariate Regression for Total Charges

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate	R Square Change	F Change	df 1	df 2	Sig. F Change

1	.549[a]	.301	.288	11779.428	.301	22.421	20	1038	.000
2	.719[b]	.518	.506	9808.829	.216	115.850	4	1034	.000

a. Predictors: (Constant), Indicator of birth in this hospital, Region of hospital, All Patient Refined DRG: Risk of Mortality Subclass, Indicator of sex, Patient Location: NCHS Urban-Rural Code (V2006), Transfer in indicator, Major operating room procedure indicator, Bed size of hospital (STRATA), Control/ownership of hospital (STRATA), Disposition of patient (uniform), Median household income national quartile for patient ZIP Code, Admission day is a weekend, Discharge quarter, Primary expected payer (uniform), HCUP Emergency Department service indicator, Race (uniform), Elective versus non-elective admission, All Patient Refined DRG: Severity of Illness Subclass, Died during hospitalization, Admission month

b. Predictors: (Constant), Indicator of birth in this hospital, Region of hospital, All Patient Refined DRG: Risk of Mortality Subclass, Indicator of sex, Patient Location: NCHS Urban-Rural Code (V2006), Transfer in indicator, Major operating room procedure indicator, Comorbidity dfrug abuse, Bed size of hospital (STRATA), Control/ownership of hospital (STRATA), Disposition of patient (uniform), Median household income national quartile for patient ZIP Code, Admission day is a weekend, Discharge quarter, Primary expected payer (uniform), HCUP Emergency Department service indicator, Race (uniform), Elective versus non-elective admission, All Patient Refined DRG: Severity of Illness Subclass, Died during hospitalization, Admission month, Length of stay (cleaned), Number of chronic conditions, Age in years at admission, Number of diagnoses on this record

d. Dependent Variable: Total charges (cleaned)

The table above shows that adjusted coefficient determination is 0.50; therefore, 50% of the variance in total charges is explained by the independent variable shown above. It also reflects the indicator of the model goodness of fit. The P value of 0.0001 is observed, indicating statistical significance for the relationship. The predictors for the highest total charges were observed in CCS diagnosis and operating procedures. The number of chronic conditions and discharge status was observed o be contributing factors to charge model (beta=0.403 and o.357).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	10433.772	4245.823		2.457	.014	2102.408	18765.137
	Died during hospitalization	-21594.971	4581.494	-.211	-4.714	.000	-30585.008	-12604.935
	Disposition of patient (uniform)	1604.283	202.165	.357	7.936	.000	1207.584	2000.982
	Discharge quarter	3467.233	1306.041	.273	2.655	.008	904.453	6030.013
	Elective versus non-elective admission	-81.811	1690.656	-.002	-.048	.961	-3399.300	3235.679
	Indicator of sex	243.161	790.904	.009	.307	.759	-1308.790	1795.111
	HCUP Emergency Department service indicator	2392.986	892.308	.093	2.682	.007	642.055	4143.917
	Primary expected payer (uniform)	-438.213	349.124	-.035	-1.255	.210	-1123.282	246.856
	Major operating room procedure indicator	10655.113	1032.198	.317	10.323	.000	8629.683	12680.542
	Race (uniform)	-403.392	444.921	-.031	-.907	.365	-1276.438	469.655
	Transfer in indicator	7953.226	2542.577	.087	3.128	.002	2964.055	12942.397
	Median household income national quartile for patient ZIP Code	807.303	377.672	.070	2.138	.033	66.216	1548.390
	All Patient Refined DRG: Risk of Mortality Subclass	-1975.857	646.846	-.113	-3.055	.002	-3245.130	-706.584
	All Patient Refined DRG: Severity of Illness Subclass	2311.604	640.344	.133	3.610	.000	1055.090	3568.118
	Patient Location: NCHS Urban-Rural Code (V2006)	-3780.955	1475.154	-.069	-2.563	.011	-6675.575	-886.334
	Bed size of hospital (STRATA)	1322.990	438.884	.083	3.014	.003	461.790	2184.190
	Region of hospital	-196.865	395.059	-.014	-.498	.618	-972.070	578.340
	Control/ownership of hospital (STRATA)	627.968	687.666	.025	.913	.361	-721.405	1977.341
	Admission month	-1479.022	440.867	-.348	-3.355	.001	-2344.113	-613.931
	Admission day is a weekend	1452.713	974.280	.041	1.491	.136	-459.068	3364.493
	Indicator of birth in this hospital	-9451.143	1372.965	-.215	-6.884	.000	-12145.242	-6757.043
2	(Constant)	356.821	3891.097		.092	.927	-7278.509	7992.152
	Died during hospitalization	2795.226	4020.150	.027	.695	.487	-5093.339	10683.792
	Disposition of patient (uniform)	160.050	186.890	.036	.856	.392	-206.676	526.776
	Discharge quarter	2900.818	1108.216	.228	2.618	.009	726.214	5075.421
	Elective versus non-elective admission	1271.801	1428.941	.026	.890	.374	-1532.148	4075.750
	Indicator of sex	331.062	681.536	.012	.486	.627	-1006.285	1668.410
	HCUP Emergency Department service indicator	634.242	773.783	.025	.820	.413	-884.118	2152.602
	Primary expected payer (uniform)	-606.957	315.270	-.049	-1.925	.054	-1225.597	11.683
	Major operating room procedure indicator	10485.986	877.547	.312	11.949	.000	8764.013	12207.959
	Race (uniform)	470.493	378.916	.036	1.242	.215	-273.037	1214.024
	Transfer in indicator	-2432.408	2245.492	-.027	-1.083	.279	-6838.639	1973.823
	Median household income national quartile for patient ZIP Code	757.269	318.819	.066	2.375	.018	131.664	1382.873
	All Patient Refined DRG: Risk of Mortality Subclass	-1750.421	546.767	-.100	-3.201	.001	-2823.319	-677.524
	All Patient Refined DRG: Severity of Illness Subclass	1422.942	539.021	.082	2.640	.008	365.245	2480.640
	Patient Location: NCHS Urban-Rural Code (V2006)	-984.556	1252.690	-.018	-.786	.432	-3442.654	1473.543
	Bed size of hospital (STRATA)	1488.155	370.873	.093	4.013	.000	760.408	2215.903
	Region of hospital	277.979	343.368	.019	.810	.418	-395.797	951.755
	Control/ownership of hospital (STRATA)	235.035	576.119	.009	.408	.683	-895.458	1365.527
	Admission month	-1227.249	376.642	-.289	-3.258	.001	-1966.317	-488.181
	Admission day is a weekend	1489.616	815.503	.043	1.827	.068	-110.610	3089.843
	Indicator of birth in this hospital	-7579.235	1215.836	-.172	-6.234	.000	-9965.017	-5193.453
	Number of chronic conditions	1747.211	201.948	.403	8.652	.000	1350.938	2143.484
	Number of diagnoses on this record	-910.284	154.055	-.301	-5.909	.000	-1212.579	-607.988
	Length of stay (cleaned)	2390.000	126.513	.522	18.891	.000	2141.750	2638.250

a. Dependent Variable: Total charges (cleaned)

Table 19 Total Charges Coefficients

Table 20 Association of the clinical condition and mean charges

		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	-37304.465	56.854		-656.148	0.000	-37415.856	-37193.074
	Number of chronic conditions	-2662.195	6.558	-.118	-405.916	0.000	-2675.045	-2649.345
	Number of diagnoses on this record	2182.541	4.125	.163	529.114	0.000	2174.460	2190.623
	Number of E codes on this record	5462.562	16.857	.048	324.050	0.000	5429.535	5495.590
	Neonatal and/or maternal DX and/or PR	-4164.372	22.771	-.034	-182.878	0.000	-4208.987	-4119.757
	Number of procedures on this record	14166.227	5.720	.374	2476.439	0.000	14155.019	14177.434
	Major operating room procedure indicator	19906.511	24.648	.122	807.623	0.000	19858.219	19954.803
	All Patient Refined DRG: Risk of Mortality Subclass	9670.031	19.750	.113	489.618	0.000	9631.335	9708.726
	All Patient Refined DRG: Severity of Illness Subclass	8650.114	19.762	.103	437.723	0.000	8611.396	8688.832
	CCSPR	-345.538	3.059	-.016	-112.973	0.000	-351.530	-339.545
	CCSDX	47.406	3.050	.003	15.542	.000	41.430	53.383

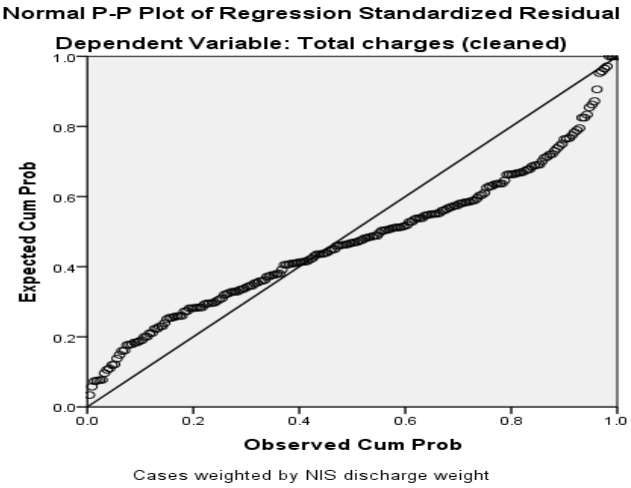
Multiple linear regression: R=0.670(adjusted R^2 =0.525), df (10), p<0.001

Table 20 shows that there is statistical significance between cost and the variables presented with procedure charges showing a relatively high average than all others.

Figure 24 shows the standard regression residual for total charges

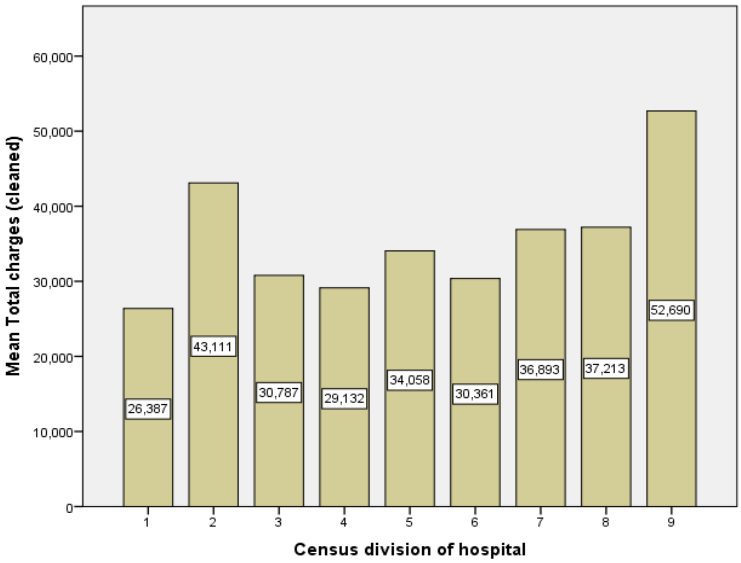
Figure 24 Regression residual

Figure 24 shows that the residual variable is approximately normally distributed.



When looking at census regions, figure 25 shows the total means charges are also shown reflecting region 9 in the west and region 2 in the northeast has the highest total charges per region at $52,690 and $43,111. These region are urban areas were healthcare cost and insurance premium are known to be expensive.

Figure 25 Mean Total Charges and Census region



4.5.2 Multivariate regression for the length of stay

- The dependent variable must be continuous- length of stay is continuous variables
- Two or more independent variable (numerical, ordinal or categorical- variables involved matched the criteria
- Independent of observation or independence of residual- the value of the Durbin-1.768 for the length of stay. The acceptable value must range between 1-3, and closer to 2 to be accepted. In this case values for the length of stay and total charges were acceptable
- The relation between the dependent and independent has to be linear- the result showed significant correlations

Table 21 Multivariate Regression for Length of Stay

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.571[a]	.326	.313	2.527	.326	25.119	20	1038	.000
2	.736[b]	.541	.531	2.087	.216	162.318	3	1035	.000

a. Predictors: (Constant), Indicator of birth in this hospital, Region of hospital, All Patient Refined DRG: Risk of Mortality Subclass, Indicator of sex, Patient Location: NCHS Urban-Rural Code (V2006), Transfer in indicator, Major operating room procedure indicator, Bed size of hospital (STRATA), Control/ownership of hospital (STRATA), Disposition of patient (uniform), Comobidity drug abuse,Median household income national quartile for patient ZIP Code, Admission day is a weekend, Discharge quarter, Primary expected payer (uniform), HCUP Emergency Department service indicator, Race (uniform), Elective versus non-elective admission, All Patient Refined DRG: Severity of Illness Subclass, Died during hospitalization, Admission month

b. Dependent Variable: Length of stay (cleaned)

The R squared reflects the proportion of the length of stay that is explained by the multiple independent variables. It shows that 54% of the variance in length of stay is explained by the independent variables.

The coefficient summary reflects a breakdown of each variable, allowing us to analyze each relationship. Table 21 shows that some variables do not show a significant connection to the dependent variable. Some of the variables are associated and also suggest there is an additive effect that is likely masking the relationship between variables. The constant shows a statistically significant value with all variables. The Durbin-Watson test for the length of stay was 1.76, which is considered an acceptable value.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	3.779	.911		4.148	.000	1.991	5.566
	Died during hospitalization	-9.940	.983	-.444	-10.113	.000	-11.869	-8.012
	Disposition of patient (uniform)	.628	.043	.640	14.477	.000	.543	.713
	Discharge quarter	.608	.280	.219	2.172	.030	.059	1.158
	Elective versus non-elective admission	-1.006	.363	-.094	-2.772	.006	-1.717	-.294
	Indicator of sex	.499	.170	.080	2.939	.003	.166	.832
	HCUP Emergency Department service indicator	.243	.191	.043	1.268	.205	-.133	.618
	Primary expected payer (uniform)	.212	.075	.079	2.829	.005	.065	.359
	Major operating room procedure indicator	.048	.221	.006	.215	.830	-.387	.482
	Race (uniform)	-.178	.095	-.062	-1.867	.062	-.366	.009
	Transfer in indicator	5.297	.546	.266	9.710	.000	4.227	6.368
	Median household income national quartile for patient ZIP Code	.151	.081	.060	1.860	.063	-.008	.310
	All Patient Refined DRG: Risk of Mortality Subclass	.158	.139	.041	1.140	.255	-.114	.431
	All Patient Refined DRG: Severity of Illness Subclass	.290	.137	.076	2.110	.035	.020	.559
	Patient Location: NCHS Urban-Rural Code (V2006)	-1.129	.316	-.095	-3.568	.000	-1.750	-.508
	Bed size of hospital (STRATA)	-.006	.094	-.002	-.063	.949	-.191	.179
	Region of hospital	-.342	.085	-.109	-4.033	.000	-.508	-.176
	Control/ownership of hospital (STRATA)	.073	.148	.013	.497	.619	-.216	.363
	Admission month	-.282	.095	-.304	-2.985	.003	-.468	-.097
	Admission day is a weekend	.056	.209	.007	.269	.788	-.354	.466
	Indicator of birth in this hospital	-.666	.295	-.069	-2.259	.024	-1.244	-.087
2	(Constant)	.016	.824		.020	.984	-1.601	1.634
	Died during hospitalization	-7.045	.823	-.315	-8.560	.000	-8.660	-5.430
	Disposition of patient (uniform)	.370	.038	.377	9.767	.000	.296	.444
	Discharge quarter	-.160	.235	-.058	-.678	.498	-.622	.302
	Elective versus non-elective admission	-.593	.302	-.056	-1.962	.050	-1.186	.000
	Indicator of sex	.343	.144	.055	2.379	.018	.060	.625
	HCUP Emergency Department service indicator	-.111	.164	-.020	-.678	.498	-.433	.210
	Primary expected payer (uniform)	.383	.066	.142	5.823	.000	.254	.512
	Major operating room procedure indicator	-.827	.197	-.113	-4.208	.000	-1.213	-.441
	Race (uniform)	-.116	.080	-.040	-1.451	.147	-.274	.041
	Transfer in indicator	4.190	.458	.210	9.155	.000	3.292	5.088
	Median household income national quartile for patient ZIP Code	.038	.068	.015	.564	.573	-.095	.171
	All Patient Refined DRG: Risk of Mortality Subclass	.329	.116	.086	2.835	.005	.101	.556
	All Patient Refined DRG: Severity of Illness Subclass	-.017	.115	-.004	-.146	.884	-.242	.208
	Patient Location: NCHS Urban-Rural Code (V2006)	-.392	.265	-.033	-1.477	.140	-.912	.129
	Bed size of hospital (STRATA)	-.086	.079	-.025	-1.088	.277	-.241	.069
	Region of hospital	-.125	.073	-.040	-1.722	.085	-.268	.017
	Control/ownership of hospital (STRATA)	.014	.122	.002	.113	.910	-.226	.253
	Admission month	.037	.080	.040	.465	.642	-.120	.195
	Admission day is a weekend	-.112	.173	-.015	-.649	.516	-.452	.227
	Indicator of birth in this hospital	1.005	.260	.105	3.861	.000	.494	1.516
	Number of chronic conditions	-.293	.043	-.310	-6.765	.000	-.378	-.208
	Number of diagnoses on this record	.321	.032	.486	10.143	.000	.259	.383
	Total charges (cleaned)	.000	.000	.491	18.891	.000	.000	.000

a. Dependent Variable: Length of stay (cleaned)

Table 22 Length of stay coefficients table

Table 23 Association of clinical condition and length of stay

		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	-3.558	.006		-645.600	0.000	-3.569	-3.547
	Number of chronic conditions	-.451	.001	-.214	-711.253	0.000	-.453	-.450
	Number of diagnoses on this record	.384	.000	.307	961.420	0.000	.383	.385
	Number of E codes on this record	.246	.002	.023	151.708	0.000	.243	.250
	Neonatal and/or maternal DX and/or PR	.658	.002	.058	299.207	0.000	.653	.662
	Number of procedures on this record	.917	.001	.259	1654.331	0.000	.916	.918
	Major operating room procedure indicator	.219	.002	.014	91.918	0.000	.215	.224
	All Patient Refined DRG: Risk of Mortality Subclass	.549	.002	.069	286.704	0.000	.545	.553
	All Patient Refined DRG: Severity of Illness Subclass	1.532	.002	.195	800.541	0.000	1.529	1.536
	CCSPR	.022	.000	.011	75.372	0.000	.022	.023
	CCSDX	-.006	.000	-.003	-20.418	.000	-.007	-.005

Multiple linear regression: R=0.510(adjusted R^2 =0.260), df (10), p<0.001

4.5.3 Logistic regression

Table 24 shows the association of hospital mortality, while most the variables show a significant outcome with the reference category, Hospital birth, NIS Stratum, and race and trans-Out did not show any significance

Table 24 Association of Hospital mortality

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
AgeGroups	.228	.004	3375.188	1	0.000	1.256	1.247	1.266
CCSPR	.017	.001	463.670	1	.000	1.017	1.015	1.019
Years	-.011	.002	23.188	1	.000	.989	.985	.994
CCSDX	-.054	.001	5934.390	1	0.000	.947	.946	.948
CM_DRUG	-.174	.019	83.933	1	.000	.840	.810	.872
TRAN_OUT	-11.437	10.917	1.098	1	.295	.000	.000	21159.544
TRAN_IN	.450	.008	3531.132	1	0.000	1.569	1.546	1.592
RACE	-.005	.003	2.715	1	.099	.995	.990	1.001
PAY1	-.016	.003	28.151	1	.000	.984	.978	.990
ORPROC	-.176	.008	509.298	1	.000	.839	.826	.852
NEOMAT	-.355	.016	512.662	1	.000	.701	.680	.723
HCUP_ED	-.069	.003	515.254	1	.000	.933	.927	.939
FEMALE	-.167	.006	691.390	1	.000	.846	.835	.856
HOSPBRTH	.535	.035	235.011	1	.000	1.708	1.595	1.829
ELECTIVE	-.823	.010	7258.965	1	0.000	.439	.431	.447
DQTR	-.039	.006	47.420	1	.000	.962	.952	.973
DISPUNIFORM	.497	.000	1450166.336	1	0.000	1.643	1.642	1.644
AWEEKEND	.112	.008	209.717	1	.000	1.119	1.102	1.136
AMONTH	.009	.002	24.051	1	.000	1.009	1.005	1.013
Constant	76.445	25.478	9.002	1	0.000	.000		

Logistic regression. Model fitting**:** x^2 =73.917, df (8) and the result is significant at $p < 0.001$.

CHAPTER V

DISCUSSION AND LIMITATIONS

5.1 Discussion

This study was conducted to understand the hospitalization outcome of the drug abuse comorbidity for patients that were admitted between 2010- 2014. The study aim was to analyze the difference in total charges and length of stay between patients with drug abuse comorbidity and non-drug abuse. The study shows the predictors of total charges, length of stay, and mortality. The study revealed several key points that need to be addressed to minimize the hospitalization cost, reduce the length of stay, and incidence of mortality.

The central inclusion for this study was drug abuse comorbidity patient. This retrospective study shows that 58 % of the drug abuse admitted patients were males compared to 42% females. These findings support the findings of other publications that have indicated that men are more likely than women to use almost all types of illicit drugs [39]. Men, in general, have a higher rate of drug and alcohol use compared to women [40]. We found substantial differences between races; Caucasians recorded the highest number of patients admitted with drug abuse comorbidity at 54% while Blacks and Hispanic had 24% and 9% respectively. All other races had less than 10 percent of the patients that were admitted with drug abuse comorbidity. In other studies that have looked at the different types of drugs in trauma settings, Caucasian and Hispanic patients

were more likely to be admitted [41, 42] and Blacks in rural areas were less likely to use methamphetamine compared to whites [43, 44] . This is probably because each race is likely susceptible to a different type of drugs, hence the need to expand the research on types of drugs affecting each race. The U.S population surveys and treatment studies also indicated that there is a racial and ethnic difference in the prevalence of substance use [45] There is also evidence that racial differences also result in minorities less likely to receive a variety of medical services. These disparities are significant even when looking at insurance status, income, age, and education level [46] and are more intensified when drug abuse and other mental disorders are present. [47].

The most significant percentages of drug abuse-related stays were for patients within the two age groups, 41-60 and 61-80, which had an average of 22% and 27%. Though older adults might not typically be considered drug seekers, it is likely that as their primary or secondary conditions become more clinically complicated, the continuous use of prescription medication might lead to addiction misuse or dependence. Older adults are also fragile and are susceptible to multiple factors. Other studies have also considered the potential of drug interactions associated with multiple conditions [48, 49, 50, 51]. Maternal drug use also contributed to cases of babies that were less than two years to be included in the drug abuse population. Drug abuse comorbidity for infants is more costly and complicated. Substantial progress for the baby that has been exposed to drugs is very complicated and is attributed to the longer length of stay [52, 53].

It is also necessary for healthcare providers to consider the complete medical and social factors contributing to healthcare as abuse intensify existing conditions [54, 55]. A higher proportion of patients with drug abuse comorbidity showed that the most prevalent

principal diagnosis was depression and mood disorders. Other forms of psychosis were also noted to be very common in patients with drug abuse comorbidity. This correlates with other previous studies that have identified a similar pattern of co-occurrence of substance-related disorders and personality or mood disorders [56, 57, 58].

The need for prophylactic vaccination was also another common diagnosis for a patient with drug abuse comorbidity compared to non-drug abuse. This is possible to prevent infections related to injection drug use. Injection site studies have identified the increase in drug use-related infections and attributed them to a significant mortality and morbidity rate and a substantial hospitalization cost [59, 60].

The mean length of stay was five days for both males and females, which correlates with previous studies on another specific drug-related length of stay. The longer the substance abuse patient was admitted, the more resources they were likely to use [29]. Previous studies have also found an association between specific drug abuse diagnoses with longer length of stay [61]. This study expanded on those findings to reflect all types of drugs as defined in HCUP drug abuse comorbidity. The mean hospital length of stay was at least a day longer in drug abuse comorbidity patients compared to non-drug abuse (4.56 vs. 5.52 days with $p< 0.001$; table 9). An additional day of inpatient increases resource utilization and add to the overall cost of hospitalization. A more comprehensive and intervention targeted for drug abuse-related diagnosis could potentially reduce the length of stay. There was a direct association of higher mean charges and length of stay. CCS diagnosis category analysis showed perinatal and congenital categories have an extremely higher length of stay when drug abuse comorbidity is present (43.2 days and 16.8 days) compared to (6.7 and 3.7 days) when

there is no drug use. Respiratory and hemic/lymphatic procedures also showed a longer length of stay when drug abuse comorbidity was present (12 and 11 days) compared to general non-abuse (9 days).

In this study, most of the discharged patients were a routine or primary residence, and there were inpatient deaths that had comorbidity of drug abuse. There were differences among regions in the type of facilities the patients were transferred to. At least three-quarters of the population was discharged routinely 75.9%. While there was a variable trend in the transfer to short term hospital reflected a 2.3%, Skilled nursing and intermediate facilities 10.2%, Home Health and those who left against medical advice were 5.6% and 5.0% respectively. Of the 2232371 cases, about 22105 died during hospitalization. Most patients with drug abuse comorbidity underwent discharges to rehabilitation centers, skilled nursing facilities, and long term care [62].

The study demonstrates the contribution of drug abuse comorbidity to the overall health service utilization. There was a significant difference in total charges for cases that reflected drug abuse comorbidity compared to non-drug abuse. Drug abuse cases only represented 3.6% of the total hospital admissions for the study period but had relatively significant total charges compared to non-drug abuse cases that were 96.4 %. The mean hospital charges for the study sample was $36, 735 for the non-drug abuse cases and $35,200 for those with drug abuse comorbidity on record — patients with drug abuse comorbidity. There were variations in total charges for each variable of interest. Total charges for1-20-year-old was high for drug abuse comorbidity cases ($33, 000) compared to non- drug abuse ($20,000). The young adults aged 21-40 showed higher charges for drug abuse comorbidity cases with $24,600 compared to $28,100 for non-drug abuse.

The older adults had mean charges of $38,000 compared to $42,000 for cm-drug.

The mean total charges, according to race, also showed that Hispanic and Asian/Pacific have higher hospital charges when they have a drug abuse comorbidity on record even though they have fewer cases of cm-drug admissions. This could be due to cultural differences and hesitation in seeking immediate treatment for their condition. However, when they do, treatment charges are likely to be higher because of being admitted through the emergency department, or treatment for intoxication and inpatient stays, resulting in additional hospitalization cost. Studies on insurance coverage have shown that limited access healthcare for minorities is also a significant concern, Hispanic, Blacks and some Asian populations appear to have lower levels of healthcare coverages compared to Caucasians [63, 64]

The primary health insurance for the sample admissions was mostly either Medicare ($38,000) or Medicaid ($34,000) and those without health insurance which probably could also be that the health insurance was not listed during the time of discharge ($36,000). Medicaid covered more than 36% of the total patients admitted with drug abuse, followed by Medicare 23% as shown in Table 8. This reflects that there is a significant burden to the government related health insurance benefits. This also possibly indicate the socio-economy background of drug abuse patients. Medicare charges are the highest for drug abuse cases compared to general hospitalizations, which is in correlation with other Medicare and Medicaid cost studies [29, 65].

Total charges also varied depending on the hospital setting; rural hospitals had at least $2,000 more for patients with drug abuse comorbidity compared to both urban teaching and non-teaching hospitals. This is possible because there are variations in

healthcare cost between rural and urban centers [66, 67]. The geographical variations in charges show that the South ($14,300), Mid-west ($14,100) and West (13,900) had higher charges for drug abuse-related cases compared to the Northeast ($12,900), perhaps because of the easily accessible drug recovery program that are available that patient is likely to use than hospital visits. There was a $700 charge difference in the Midwest for drug abuse comorbidity and the general admissions. Discharge disposition analysis also showed that patients that had cm-drug has higher charges in each discharge category and are most likely to be transferred to a skilled nursing facility. Patients who expired consumed more hospital resources and accounted for higher charges above $100,000 compared to all other discharges and including non-drug related discharges.

To effectively provide information on charges and length of stay for CM-Drug, The Clinical Classifications Software (CCS) for ICD-9-CM a diagnosis and procedure categorization scheme was used. CCS categories have over 14,000 diagnosis codes and 3,900 procedure codes – which are collapsed into a smaller number of clinically meaningful categories that are more useful for presenting descriptive statistics than are individual ICD-9-CM codes. The Clinical Classifications Software (CCS) for ICD-9-CM a diagnosis and procedure categorization analysis of charges shows that certain conditions such as perinatal and congenital diagnosis will increase charges significantly when associated with drug abuse comorbidity compared to non-drug abuse cases. All CCS procedure categories also reflected an increase in charges when drug abuse comorbidity is present — suggesting a need for innovative interventions that are focused on addressing diagnosis and procedures that are coexisting with drug abuse comorbidity. Drug abuse comorbidity contributes to higher charges, therefore linking the diagnosis

directly related can provide a care plan that will reduce resource utilization and cost and improve patient clinical outcome [65, 66, 67].

5.2 Limitations

Our results depend on the coding of diagnosis using the International Classification of disease and procedure codes 9th Revision. Therefore we cannot verify the accuracy of the codes. The administrative database is an excellent resource to healthcare research, but as with any data, they are subjected to coding inaccuracies and deficiencies. The use of only administrative database also limits the researcher from obtaining an adequate understanding of some aspects of hospital utilization and protocols for treatment. The lack of detailed information on patient progress during inpatient care limits understanding of the length of stay causes, including readmission rates.

The lack of cost breakdown on proportionality on total charge or cost limits the ability to stratify cost further. Also, an understanding of all cost broken down for procedures, laboratory services, and physician charges will assist further in understanding the factors that impact healthcare cost.

Despite these limitations, the use of H-CUP, a large and nationally representative database allows information to be captured from a majority of admissions and discharges in the U.S. The data includes all regions and covers a significant number of factors that allows a generalizable analysis to all hospitalizations in the United States.

CHAPTER VI

SUMMARY AND CONCLUSION

6.1 Study summary

This study is designed to analyze and understand the hospitalization outcomes of patients with drug abuse comorbidity compared to non-drug abuse. The study analyzed the outcomes of total charges, length of stay, and mortality related to drug abuse comorbidity in the United States from 2010-2014. The study also analyzed the socio-demographic; age, gender, race, discharge disposition, and insurance type to better understand the hospitalization outcomes of this study sample. Descriptive analysis shows that the highest incidence of patients admitted with a drug abuse comorbidity is male patients with an average age on admissions being 42 years. Medicaid and Medicare were the highest paying payer for this study sample. Logistic and multiple linear regression were used to determine predictor's of the length of stay, total charge, and mortality rate. CCS procedure and diagnosis categories were the leading influencers of mean charges and length of stay. Age and number of procedures were common predictors for mortality.

Healthcare cost related to drug abuse comorbidity admissions is significantly high in the United States. Our findings suggest that patients with drug abuse comorbidity are more susceptible to other conditions such as psychiatry and are likely benefit from

interventions targeted at treating the co-existing diagnosis early to reduce the number of inpatient days and another hospital resource. The rising drug abuse hospitalizations and length of stay burden may threaten the hospital resources and possibly affect the delivery of care.

6.2 Conclusion and future research

This study brings a better understanding of the hospitalization outcomes of drug abuse comorbidity patients. From this data, it appears that; charges are significantly higher for drug abuse comorbidity than general admissions, drug abuse comorbidity hospitalization cases have a longer length of stay than non-drug abuse cases, and there are variations in age, race, and insurance payer for drug abuse comorbidity and non-drug abuse hospitalizations

Patients with drug abuse comorbidity have been noted to have other conditions that have resulted in a costlier inpatient stay, suggesting a more targeted approach to patient care for those who fall under the CCS diagnosis category of perinatal, congenital and mood and personality disorders, or those undergoing certain types of procedures such as respiratory. Early coordination of care for these conditions is likely to result in less utilization. Finding of charges for government-related insurances is also of the importance of policymakers that can evaluate potential cost and estimate budgets. There is also a need for policymakers to evaluate the legalization of recreational drugs that have the potential to increase other types of drug abuse. Continuous research is needed to understand substance abuse comorbidity hospitalization in a more comprehensive

approach that analyzes the clinical components that are not captured in administrative data sources.

Further research is needed for alternative and innovative interventions for conditions that are identified to be coexisting with drug abuse comorbidity. This will likely lower the number of inpatient days and reduce hospitalization cost. The identified regional differences should also be significant for policymakers to address regional health disparities and also evaluate the legalization of recreational drugs that have the potential to increase other types of drug use and abuse.

References

[1] "Surgeongeneral.gov," *Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health,* pp. 19-23, 20 November 2016

[2] "www.CDC.gov," 18 December 2015. [Online]. Available: https://www.cdc.gov/media/releases/2015/p1218-drug-overdose.html. [Accessed 17 June 2018]

[3] Anne B. Martin, Micah Hartman, Joseph Benson, Aaron Catlin, "National Health Spending In 2014: Faster Growth Driven By Coverage Expansion And Prescription Drug Spending," *Health Affairs,* pp. 13-14, 15 January 2016

[4] McGeary KA, French MT., "Illicit drug use and emergency room utilization.," *Health Service Res,* pp. 14-15, 2013

[5] Carmen LMassona, James LSorensena, Steven LBatkic, RobertOkina, Kevin LDelucchi, David CPerlmand, "Medical service use and financial charges among opioid users at a public hospital," *Drug and Alcohol Dependence,* pp. 85-99, 2012

[6] "National Institute on Drug Abuse," 26 September 2010. [Online]. Available: https://www.drugabuse.gov/sites/default/files/rrcomorbidity.pdf. [Accessed 25 October 2018]

[7] Lisa Dixon, Yael Holoshitz and IIana Nossel, "Treatment engagement of individuals experiencing mental illness: review and update," *World Psychiatry,* pp. 13-20, 2016

[8] Rudd RA, Seth, David, Scholl,, "Increases in Drug and Opioid-Involved Overdose Deaths — United States, 2010–2015," MMWR Morb Mortal Wkly Rep , 30 December 2016. [Online]. Available: https://www.cdc.gov/mmwr/volumes/65/wr/mm655051e1.htm#suggestedcitation. [Accessed 12 June 2018]

[9] Katz NP, Adams EH, Chilcoat H, "Challenges in the development of prescription opioid abuse-deterrent formulations," *Clin J Pain,* pp. 648-80, 2007

[10] "Substance Abuse and Mental Health Services Administration," 22 April 2014. [Online].

Available: https://www.samhsa.gov/atod/marijuana. [Accessed 15 May 2018]

[11] Porte, Michael E., "A Strategy for Health Care Reform — Toward a Value-Based System," *The NEW ENGLAND JOURNAL of MEDICINE,* vol. 361, pp. 109-112, 2009

[12] "Centers for Medicare and Medicaid Services," 25 July 2018. [Online]. Available: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/Value-Based-Programs.html. [Accessed 5 November 2018]

[13] Brown MM1, Brown GC, Sharma S, Landy J., "Health care economic analyses and value-based medicine.," *Survey of Opthalmology,* pp. 61-63, 2015

[14] Paris Charilaou et al, "Trends of Cannabis Use Disorder in the Inpatient:2002 to 2011," *American Journal Of Medicine,* pp. 678-687, 2017

[15] "Substance Use Disorder," 27 October 2015. [Online]. Available: https://www.samhsa.gov/disorders/substance-use

[16] Hall W, Solowij N., "Adverse effects of cannabis.," *Lancet,* pp. 1611-1616, 1998.

[17] Gonzalez G, Oliveto A, Kosten TR., "Treatment of heroin (diamorphine) addiction: current approaches and future prospects. Drugs," 2002

[18] "Council of Economic Advisers Report: the Underestimated Cost of the Opioid Crisis," 20 November 2017. [Online]. Available: https://www.whitehouse.gov/briefings-statements/cea-report-underestimated-cost-opioid-crisis/

[19] Nordqvist, Christian, "Everything you need to know about cocaine," 15 May 2017. [Online]. Available: https://www.medicalnewstoday.com/articles/234239.php

[20] ora Petersonlow asterisk,'Correspondence information aboCora Peterson, Likang Xu, Christina A. Mikosz, Curtis Florence, Karin A. Mack, "US hospital discharges documenting patient opioid use disorder without opioid overdose or treatment services, 2011–2015," *Journal of Substance Abuse Treatment,* pp. 35-39, 2018

[21] Sarnyai Z, Shaham Y, Heinrichs SC, "The role of corticotropin-releasing factor in drug

addiction," *Pharmacol Rev,* pp. 209-243, 2001

[22] Eric Nestler, "The Neurobiologyof Cocaine Addiction," *Addiction Science Practise ,* pp. 4-10, 2005

[23] "Trends and Statistics," 14 April 2017. [Online]. Available: https://www.drugabuse.gov/related-topics/trends-statistics

[24] "Substance Abuse Treatment: Addressing the Specific Needs of Women," SMA, Rockville, 2009

[25] Robin E. Clark, Ph.D., Elizabeth O'Connell, M.S., and Mihail Samnaliev, Ph.D, "Overview of Substance Abuse and Healthacre Costs," March 2010. [Online]. Available: http://saprp.org/knowledgeassets/knowledge_detail.cfm?KAID=21

[26] Andreas, Muller, "Education, income inequality, and mortality: a multiple regression analysis," *British Medical Journal,* pp. 61-64, 2002

[27] Alana M et al, "Vital Signs: Trends in Emergency Department Visits for Suspected Opioid Overdoses — United States, July 2016–September 2017," 6-10 March 2018. [Online]. Available: https://www.cdc.gov/mmwr/volumes/67/wr/mm6709e1.htm. [Accessed 15 June 2018]

[28] Howard G. Birnbaum, Alan G. White,, "Societal Costs of Prescription Opioid Abuse,," *Pain Medicine 2011,* pp. 657-667, December 2011

[29] Kimberley Fox, MPA, Jeffrey C. Memll, MPH, Han-hua Chang, MA,, "Estimating the Costs of Substance Abuse to the Medicaid Hospital Care Program," *American Journal of Public Health,* vol. 85, pp. 76-78, 2017

[30] Fulop, George , "Impact of Psychiatric Comorbidity on Lenth of Hospital stay: A Preliminary Report," *Psychiatry,* pp. 878-882

[31] Gryczynski J, Schwartz RP, O'Grady KE, Restivo L, Mitchell SG, Jaffe JH., "Understanding Patterns Of High-Cost Health Care Use Across Different Substance User Groups.," *PMCID:*

PMC4936480, pp. 42-45, 2016

[32] Curtis Florence, PhD, Feijun Luo, PhD, Likang Xu, MD, and Chao Zhou, PhD, "The Economic Burden of Prescription Opioid Overdose, Abuse and Dependence in the United States, 2013," *PMC,* pp. 901-906, 2018

[33] Rosalie Liccardo Pacula, Jeanne Ringel, Carlos Dobkin, Khoa Truonga, "he Incremental Inpatient Costs Associated with Marijuana Comorbidity," pp. 78-82, 2008

[34] Lowell W. Gerson, James Boex,Keding Hua,Robert A. Liebelt, Donna Bush,Carolyn Givens, "Medical Care Use by Treated and Untreated Substance Abusing Medicaid Patients," 1991

[35] Tami L Mark , "The economic costs of heroin addiction in the United States," *Drug and Alcohol Dependence,* pp. 195-206

[36] Hernandez-Avila, B. Rounsaville and H. Kranzler, "OPiod, Cannabis and Alcohol Dependent women show more rapid progression to substance treatment," *Drug And Alcohol Dependence,* pp. 265-272, 2004

[37] "Comorbidity Software Documentation," HCUP Method Series, 2006

[38] "Logistic Regression | SPSS Annotated Output," UCLA , 2006. [Online]. Available: https://stats.idre.ucla.edu/spss/output/logistic-regression/. [Accessed 18 February 2018

[39] "Center for Behavioral Health Statistics and Quality.," 4 July 2017. [Online]. Available: https://www.samhsa.gov/data/sites/default/files/NSDUH-DetTabs-2016/NSDUH-DetTabs-2016.pdf

[40] "Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality.," 2016. [Online]. Available: https://wwwdasis.samhsa.gov/dasis2/teds_pubs/2014_teds_rpt_natl.pdf

[41] Schermer CR, Wisner DH., "Methamphetamine use in trauma patients: a population-based study.," pp. 442-9, 1999

[42] Hsu DJ, McCarthy EP, Stevens JP, Mukamal KJ, "Hospitalizations, costs and outcomes associated with heroin and prescription opioid overdoses in the United States 2001-12.,"

PMC, 2017

[43] Borders TF, Booth BM, Han X, Wright P, Leukefeld C, Falck RS, Carlson RG., "Longitudinal changes in methamphetamine and cocaine use in untreated rural stimulant users: racial differences and the impact of methamphetamine legislation.," pp. 12-17, 19 August 2008

[44] Sean Esteban McCabe, PhD, MA, MSW, Michele Morales, PhD, MA, MSW, James A. Cranford, PhD, Jorge Delva, PhD, MSW, Melnee D. McPherson, PhD, MA, MSW, and Carol J. Boyd, PhD, MSN, FAAN, "Race/Ethnicity and Gender Differences in Drug Use and Abuse Among College Students," *J Ethn Subst Abuse. ,* vol. 6, no. 2, pp. 75-95, 2008

[45] Laura Schmidt., Thomas Greenfield, and Nina Mulia,, "Unequal Treatment Racial and Ethnic Disparities in Alcoholism Treatment Services," 11 February 2016. [Online]. Available: https://pubs.niaaa.nih.gov/publications/arh291/49-54.htm

[46] David R. Williams, Selina A. Mohammed, P Jacinta Leavell, and Chiquita Collins, "Race, Socioeconomic Status and Health: Complexities, Ongoing Challenges and Research Opportunities," pp. 69-101, 2012

[47] Druss BG, Von Esenwein SA, "Improving general medical care for persons with mental and addictive disorders: systematic review.," *Gen Hosp Psychiatry,* pp. 145-53, 2006

[48] Marya T. Schulte, and Yih-Ing Hser, "Substance Use and Associated Health Conditions throughout the Lifespan," *Public Health Rev.,* pp. 68-70, 2017

[49] Holly Hedegaard, M.D., Arialdi M. Miniño, M.P.H., and Margaret Warner, Ph.D, "Drug Overdose Deaths in the United States, 1999–2017," *NCHS Data Brief,* pp. 34-39, November 2018

[50] "National Center for Health Statistics. Public-use data files:," 12 December 2017. [Online]. Available: : https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm#Mortality

[51] Audrey J. Weiss, Ph.D., Kevin C. Heslin, Ph.D, Marguerite L. Barrett, M.S., Rwaida Izar, M.P.H., and Arlene S. Bierman, M.D., M.S, "Opioid-Related Inpatient Stays and Emergency Department Visits Among Patients Aged 65 Years and Older,," *H-CUP STATISTICAL BRIEF #244,* pp. 50-56, September 2018

[52] Creanga, Andreea A. MD, PhD; Sabel, Jennifer C. PhD; Ko, Jean Y. PhD; Wasserman, Cathy

R. PhD; Shapiro-Mendoza, Carrie K. PhD, MPH; Taylor, Polly MPH; Barfield, Wanda MD, MPH; Cawthon, Laurie MD, MPH; Paulozzi, Leonard J. MD, "Maternal Drug Use and Its Effect on Neonates: A Population-Based Study in Washington State," *Obstetrics & Gynecology,* pp. 924-933, 2012

[53] Valerie E. Whiteman, Jason L. Salemi, Mulubrhan F. Mogos, Mary Ashley Cain, Muktar H. Aliyu,and Hamisu M. Salihu, "Maternal Opioid Drug Use during Pregnancy and Its Impact on Perinatal Morbidity, Mortality, and the Costs of Medical Care in the United States," *Journal of Pregnancy,* pp. 66-70, 2014

[54] Shei, Amie et al, "Characteristics of High-Cost Patients Diagnosed with Opioid Abuse," *JMCP,* pp. 902-912, 2015.

[55] Samet, Friedman P, Saitz R, "Benefits of linking primary medical care and substance abuse services," *Arch. Intern. Med,* pp. 17-23, 2001

[56] Quan H, Li Bing et al, "Updating and validating the Charlson comorbidity index and score for risk adjustment in hospital discharge abstracts using data from 6 countries.," *American Journal of Epidemiology,* pp. 676-682, 2011

[57] Heslin KC , "Hospitalizations Involving Mental and Substance Use Disorders Among Adults," June 2015. [Online]. Available: https://www.hcup-us.ahrq.gov/reports/statbriefs/sb191-Hospitalization-Mental-Substance-Use-Disorders-2012.pdf

[58] P. Robert K. Brooner, M. Van L. King, P. Michael Kidorf and e. al, "Psychiatric and Substance Use Comorbidity Among Treatment-Seeking Opioid Abusers," *Arch Gen Psychiatry,* pp. 71-80

[59] H, Tookes; C, Diaz; Li, Hua; R, Khalid; S, Doblecki-Lewis, "A cost Analysis of Hospitalization for Infections Related to Injection Drug Use at a County safety -Net Hospital in Miami, Florida," *PLOS ONE,* 2015

[60] Sukanya Mitra and M. P. Raymond S. Sinatra, "Perioperative Management of Acute Pain in the Opioid-dependent Patient," *Anesthesiology ,* pp. 212-227

[61] Atul Gupta, M.D.; Junaid Nizamuddin, M.D.; Dalia Elmofty, M.D.; Sarah L. Nizamuddin, M.D.; Avery Tung, M.D., "Opioid Abuse or Dependence Increases 30-day Readmission

Rates after Major Operating Room Procedures: A National Readmissions Database Study," *Anesthesiology ,* vol. 128, pp. 880-890, 2018

[62] Alexander Y. Walley, MD, MSc, Michael Paasche-Orlow, MD, MA, MPH, Eugene C. Lee, BA, Shaula Forsythe, AM, MPH, Veerappa K. Chetty, PhD, Suzanne Mitchell, MD, and Brian W. Jack, MD, "Acute Care Hospital Utilization Among Medical Inpatients Discharged With a Substance Use Disorder Diagnosis," *Journal of Addiction Medicine,* pp. 50-56, 2012

[63] Escarce J, Kapur K, "Access to and quality of health Care," in *Hispanics and the Future of America*, Washington, National Academies Press, 2006, pp. 135-40

[64] Heeju Sohn, "Racial and Ethnic Disparities in Health Insurance Coverage: Dynamics of Gaining and Losing Coverage over the Life-Course," *Popul Res Policy Rev,* pp. 181-201, 2017.

[65] Cathy A. Cowan, Patricia A. McDonnell, Katharine R. Levit, and Mark A. Zezza, "Burden of Health Care Costs: Businesses, Households, and Governments," *Health Care Financ Rev,* pp. 131-159, 2002

[66] Holmes, Mark, "Rural Health Care Costs Are They Higher and Why Might They Differ from Urban Health Care Costs?," *Journal of Health Policy analysis and dabate,* pp. 51-55, 2018

[67] Jane van Dis, "Where We Live:health Care in Rural vs Urban America," *Medical Student JAMA,* vol. 287, p. 108, 2002

[68] French MT, McGeary KA, Chitwood DD, McCoy CB., "Chronic illicit drug use, health services utilization and the cost of medical care.," *Social Science Med,* pp. 81-84, 2000

[69] Aaron M. White, Ralph W. Hingson, I-jen Pan, Ph.D.,and Hsiao-ye yi, "Hospitalizations for Alcohol and Drug Overdoses in Young Adults Ages 18–24 in the United States, 1999–2008: Results From the Nationwide Inpatient Sample," *Journal os studies of alcohol and srugs,* pp. 88-94, 2011

[70] Cheryl A Kassed, Katharine R Levit, and Megan M Hambrick,, "Hospitalizations Related to Drug Abuse, 2005," 2007. [Online]. Available: https://www.ncbi.nlm.nih.gov/books/NBK61972/

[71] N. D. Documentation, "NIS Database Documentation," 18 October 2018. [Online]. Available: http://www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp