

ABSTRACT
FACTORS ASSOCIATED WITH HIGHER EMERGENCY DEPARTMENT
UTILIZATION

By

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The purpose of this study was to analyze the factors associated with higher number of Emergency Department (ED) visits in the United States. Higher ED utilization contributes in a major way to costs in the healthcare industry. Unnecessary utilization of ED causes medication errors, poor patient satisfaction, lower quality and higher cost. This study analyzed the data from National Hospital Ambulatory Medical Care Survey (NHAMCS) collected in 2010, which involved a sample size of 34,936 ED visits nationwide. The variables in this study included age, ethnicity, type of coverage and gender differences. The result showed that Medicaid population has a higher number of ED visits than other types of insurance coverage; White population shows maximum ED visits than other race types; males visit ED more than females and infants have higher ED rate than other age groups. More research is needed to develop health policies to limit the non-urgent ED visits.

FACTORS ASSOCIATED WITH HIGHER EMERGENCY DEPARTMENT
UTILIZATION

A PROJECT REPORT

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LIST OF ABBREVIATIONS

CDC	Centers for Disease Control and Prevention
DEA	Drug Enforcement Agency
ED	Emergency Department
IHI	Institute of Healthcare Improvement
NHAMCS	National Hospital Ambulatory Medical Care Survey
PCP	Primary Care Provider
PSU	Primary Sampling Units
SPSS	Statistical Package for Social Services

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

Emergency Departments (EDs) provide health services to all patients regardless of insurance and ability to pay. EDs are considered the healthcare provider of last resort for many patients, who could not get access to care from community provider. From 1990, visits to emergency departments have increased significantly and the total number of EDs has declined. Recent studies show that the uninsured population has higher ED utilization. The number of uninsured population has increased from 38.8 million to 46.3 million between 1999-2008 (Tang, Stein, Hsia, Maselli & Gonzales, 2010). The major problem associated with higher ED utilization is overcrowding of patients in ED, which creates pressure on physicians and nurses to serve more patients in a short period of time, which results in errors, long patient wait times, higher mortality, lower patient satisfaction and higher costs. To avoid these adverse outcomes in the United States, reducing ED visits is our nation's first priority (Sun et al., 2012).

ED visits could be urgent or non-urgent based on the severity of illness or injury. The health policy and service researchers focus on non-urgent ED visits to reduce ED utilization and costs because as per a recent study at New York University, most of the non-urgent visits in EDs are from the patients who do not see primary care providers (PCP) on a regular basis or at least once a year. Some barriers to PCP access are busy schedule of the patients, limited hours of operation of primary care physicians, long wait

time, uninsured patients, cost and lack of knowledge (Resar & Griffin, 2010). An electronic search was conducted by three researchers using PubMed and the Cochrane Library starting from January 1985 to February 2012 with a sample size of 2,787 patients using a Quasi experimental method to analyze the effectiveness of organizational interventions in order to reduce ED utilization. The findings from the study showed that the increase in primary care accessibility and education to the patients have reduced ED visits significantly. Patient's non-urgent visits to ED instead of primary care lead to unnecessary tests, treatment, overload on healthcare staff, increase in cost and loss of opportunity to build up primary care physician-patient relationships. Some hospitals are developing strategies to reduce ED utilization by denying the coverage of non-urgent ED visits to improve the quality of care and reduce the cost of the services (Flores, Violan, Carrillo, Peiro & Agimon, 2012). The costs of ED visits continued to increase in past years and patients also ask for transparency in healthcare pricing with better care; that is why the variation in ED visits charges is an issue for healthcare policy makers. A recent study by researchers in California hospitals shows that there is a wide variation in the charges of level 1 to level 5 outpatient ED visits. This variation depends on the type of the hospital, location and population served. Another important factor for higher ED utilization is patient's poor knowledge about health and medications (Hsia & Akosa, 2014). The study was conducted in an ED of a hospital in Texas, where researchers asked a series of important medical questions to 309 patients and the results showed that 70% of patients could not answer the questions about the allergies, medication history, past surgery, physician's name and other health conditions. This study encouraged the researchers to provide basic health education to patients to prepare them in case of

emergency and to reduce readmissions. As per the new policy, the hospital gets penalized for a readmission within 30 days, which significantly increases the cost for the hospital (Davis, 2012)

The purpose of this project is to analyze the factors that contribute to higher ED utilization using statistical analysis methods, which help identify the key factors and targeted groups. Further research on targeted factors would improve the healthcare outcomes that reduce ED visits. The factors responsible for more ED visits are lack of primary care physician availability, demographic, lack of insurance, injury, illness and lack of knowledge of patients.

Emergency Department utilization for different reasons

Statistics of Centers for Disease Control and Prevention (CDC, 2006) reported 129.8 million ED visits in 2006 in the United States. Patients visit ED for different reasons such as illness, injury, depression, substance abuse, alcohol use, tobacco use, anxiety and adverse reactions. The leading causes of ED visits are injury, heart diseases, mental illness, modifiable behavior pattern and adverse outcomes of the medications. Twenty nine million ED visits were reported due to unintentional or intentional injuries. Among these injuries, 2.48 million were intentional and 2.16 million involved use of drugs or alcohol. Modifiable behaviors include use of tobacco, alcohol and substance abuse. Alcohol accounted for 7.9% and tobacco use accounted for 4.9% of all ED visits. Substance abuse accounted for 1.74 million ED visits, which involved illicit drugs and prescription medications. Mental health disorders represented 3.6% of all ED visits in 2006. The prevalence of ED visits for sexually transmitted infections was higher in urban area (Bernstein, 2009).

From the statistics of CDC survey for ED visits, modifiable health behavior is one factor that could be controlled with healthcare laws and policies to reduce ED utilization. For example, on October 7, 2014 the Drug Enforcement Agency (DEA) changed the schedule of hydrocodone medications from schedule-III to schedule II to control substance abuse of prescription medications. Alcohol and Tobacco use could also be controlled with some strict policies, which could help reduce ED visits and improve patients' health. Providing education to patients nationwide and encouraging more interaction between physicians and patients could control modifiable behavior and reduce ED visits significantly. Sexually transmitted infections are also responsible for ED visits, which could be prevented by patient education. Another approach to reduce ED utilization is case management, which includes planning, assessment, and evaluation of care to meet patient's needs. Case management strategies were used on 960 frequent ED users in the United States, which reduced ED utilization and improved clinical outcomes (Kumar & Klein, 2013).

Skin conditions, skipped medications, respiratory problems, priapism and concussion account for lower number of ED visits. Patients visit ED for skin conditions such as eczema, inflammation, rash, hives and conjunctivitis. Ozone levels, sunburn, pollution and allergies to medications are the main causes of skin reactions (Szyszkowicz, Porada, Searles & Rowe, 2012). As per the CDC statistics from 2006 to 2009, 8,738 priapism visits were reported and 62 per 10,000 ED visits accounted for meningitis (Stein, Flum, Cashy, Zhao & McVary, 2013). In children and adults, skipped medications for asthma, diabetes and heart diseases cause frequent hospitalization and ED visits (Walker, 2013).

Researchers studied the data from the California office of Statewide Health Planning and Development from January 1, 2002 to December 31, 2009 to analyze the ED visits characteristics in California. The study results showed that the total ED visits increased by 25 % from 2002 to 2009. Total ED visits were 9 million in 2002; in 2009, 11.3 million ED visits were reported. The number of EDs remained unchanged from 2002-2009, which suggests that either there is a reduction in primary care services or patients replaced primary care with ED visits. White and Hispanic populations showed more visits from 2002-2009. Patients with Medicaid and private insurance are significantly increasing in ED. The trend in California is towards the ED based care because people visit physicians only in case of emergency. Some options to avoid this situation are to promote primary care services, availability of primary care providers on weekend, patient education and free clinics for uninsured patients. Free clinics provide primary care services to the uninsured low income population without any charges, which encourage patients to see the physician every 6 months. The government should promote free clinics as many uninsured patients are not aware about the availability of free clinics (Herring et al., 2013).

Influential Factors for Emergency Department Visits

Age

The CDC statistics of 2007 shows that older population above 75 years have highest ED utilization with ED visits at least once in 12 month period. The age group 45-64 shows lower ED utilization compare to age groups 0-17, 18-44, 65-74 and above 75. In the age group 0-17, most of the ED visits were reported due to injury, asthma attacks and skipped medications (CDC, 2007).

Race

Non-Hispanic Black population shows more ED visits than Hispanic, White and Asians. Non-Hispanic White population shows higher ED utilization than Hispanic and Asians. The lowest ED use is represented by Asians (CDC, 2007).

Gender

The statistics shows more female visits to emergency department than male. Females in the age group 18-45 show more ED visits for pregnancy related complications and sexually transmitted infections (CDC, 2007).

Income

Population with federal poverty level below 100% shows highest emergency department visits than federal poverty level above 400%, which shows that poverty is related to higher ED utilization (Uscher, Pines, Kellermann, Gillen & Mehrotra, 2013).

Insurance

Patients with Medicaid insurance make more visits to emergency department than those with private insurance or uninsured. Older population with dual insurance (Medicare and Medicaid) are more likely to visit emergency department than population with Medicare insurance (CDC, 2007).

Social Support

One study was conducted by researchers to analyze the data from 2002-2009 for ED visits. The statistics showed no association between marital status and ED visits (Uscher-Pines et al., 2013).

Cost, Convenience and Perceived Severity

The above study also compared association between ED visits and cost. About 42% patients choose ED due to payment flexibility because it is not necessary to pay at the time of care. About 80% of patients feel that their condition was urgent and 60% patients use ED because of convenience. Primary care physician's office hours are usually on weekdays and offices are closed on weekends. This inconvenience encourages patients to visit urgent care on weekend or at night during weekdays due to busy schedule (Uscher-Pines et al., 2013).

Education and Patient's Knowledge

Individuals with high level of education and knowledge are less likely to visit ED. Some researchers have proposed that redesigning the EDs in such a way that physicians and nurses spend more time interacting with patients would help reduce readmission and ED visits in future. The cost associated with frequent ED visits could also be avoided (Ledue, 2009).

Alcohol, Tobacco and Drug Abuse

Smokers are more likely to use EDs than non-smokers. There is a strong relation between alcohol and drug abuse with ED visits. In the United States, more than 20 million people use illicit drugs. Prescription Drug Abuse is a complex issue in the United States. There are many social, genetic, environmental and cultural factors associated with it. Many laws have been implemented already for future prevention and certain new health policies are coming up in near future to protect the health of people. Education and counselling sessions are also provided to help people with physical dependence on drugs. Non-Hispanic White population shows highest mortality rate and American

Indians/Alaska Natives show highest drug abuse. More men are involved in drug abuse than women. Low socioeconomic status is a risk factor for drug abuse behavior. These people often have mental health disorders and drug overdose adverse outcomes, which lead to ED visits (Paulozzi, 2012).

Role of Technology, Care Coordination and PCP to reduce ED Visits

Reduction in ED utilization brings three major benefits: Reduction in cost, Improvement in the quality and Improvement in the patient experience of health care. Technology has positively affected ED utilization. Telemedicine is now becoming popular, where patients can interact with physicians through video. This technological advancement can save many lives in rural area and also reduce ED visits. There is an application on cell phones called “Doctor on Demand,” which patients could use to interact with doctors and doctors can call in new prescriptions to the pharmacy immediately to save time for their patients. This application could reduce ED visits significantly for the patients who use ED for non-urgent matters. In some hospitals, nurses are available on the phone to help patients with the questions about illness, which could reduce unnecessary crowding in ED (Resar & Griffin, 2010).

Care coordination programs are used to reduce ED visits from frequent ED users. The hospital assigns the health worker, who communicates with patients on a regular basis about the medications, illnesses, adverse reactions and other clinical outcomes to reduce ED visits. Some patients use EDs to get narcotics, which is alarming and hospitals should keep track of these patients. Narcotic prescribing guidelines should be established to reduce ED visits. Some common narcotic medications that the drug users seek are Tramadol, Norco, Soma and Xanax and the hospitals should monitor physicians

who prescribe these medications. Each emergency department should establish a program to reduce ED visits based on the area of utilization (Kumar & Klein, 2013).

Connecting patients to primary care providers is an effective strategy to decrease ED utilization. Every year 20 million children visit pediatric ED for non-urgent complaints. These unnecessary visits result in long patient wait time, more cost, unnecessary tests and burden on the staff. Researchers conducted a randomized trial in tertiary care children's hospital for 4 months starting from February 2010 to May 2010 on 332 patients. The majority of the population was African American in the age group 3 months to 16 years. Among 332 patients, 164 patients were randomly assigned to PCP and 168 patients to control. All participants had public insurance and the level of satisfaction for PCP service was measured after 4 months. About 74% of patients decided to use PCP instead of ED for non-urgent conditions. The result of this study shows that reconnecting the patients from ED to PCP could decrease future ED visits. Frequent flyers to PCP or working with PCP and expand hours could reduce ED utilization. Sometimes PCP is connected with schools to provide health services to children; this activity promotes PCP in the community and decrease ED visits. Some other reasons for patients to choose ED over PCP are long wait time and lack of timely appointment in PCP service. It is hard for patients to get appointment on time for the illness; sometimes the appointment period is of 1-2 weeks and in that case it is better for patients to go to ED to get quick care. Steps need to be taken to improve the quality of care in PCP to increase the patient visits (Sturm, Hirsh, Weselman & Simon, 2014).

The Institute of Healthcare Improvement (IHI) constructed a framework in October 2007 to reduce ED visits. The researchers conducted extensive literature review

and health care experts were interviewed to test the framework. The key concepts of IHI study includes: (1) Start with the community organizations, who are interested in addressing the issue related to ED over use. (2) Identify the high volume of patients that could benefit from the efforts to reduce ED utilization. (3) Design the interventions after interviewing patient streams. (4) Add the member, who can provide specific interventions for patient streams. (5) Test the strategies for improvement. This IHI initiative was implemented and reduction in ED visits was observed. Alternative therapy is also useful to reduce ED visits due to muscle pain, headache, back pain and other conditions. Some incentives of using alternative treatments such as physiotherapy, chiropractor treatment are reduction in prescription medications, reduction in patient wait time, decrease in the cost of therapy, higher patient satisfaction, more physician-patient interaction and more focus on patient centered care that help improve healthcare outcomes (Resar & Griffin, 2010).

More interaction between physician and patient gives opportunity to patient to gain knowledge about specific procedure or illness. Many patients are knowledgeable and ask questions to healthcare provider about medications, but there are still some patients who do not have basic information about the treatment. Some patients have language barriers and feel shy to ask the questions (Sinreich, Jabali & Dellaert, 2012). The descriptive study was conducted in an academic medical center from May 2011 to August 2012 to measure the duration of patient-provider conversation in ED. This study involved 102 patients with mean age of 41 years, which included 50% proportion of males. The results showed improvement in patient satisfaction and more time was spent

providing knowledge to the patients. The conversation of patient and provider was recorded in audio, which produced Hawthorne effect in the study (McCarthy et al., 2014).

Retail clinics provide care to the patients for simple or acute medical condition without any appointment. The cost at retail clinic is one-fifth of the ED cost to help uninsured population. This service could reduce ED visits as well as primary care visits. The community should focus on homeless people and provide special services to this vulnerable population to decrease ED utilization. PCP services should be promoted in the colleges and schools for young population to take advantage of the services and stay healthy. For old populations who have transportation issues, minivan or buses should be provided to PCP from home to improve health outcomes in the community and to reduce ED visits. Higher ED utilization is a community concern; all necessary steps should be taken to avoid unnecessary visits to ED. The survey should be conducted in the community every year to measure the proportion of the population using PCP and ED. Patient counselling sessions should also be provided for frequent ED visits. The key to reduce ED utilization is to target the factors responsible for more visits, which include lack of PCP timely appointment, longer wait time in PCP, lack of knowledge, cost, and lack of insurance, demographic factors, income and inconvenience (Smith & Jeffery, 2010).

CHAPTER 2

METHOD

Hypothesis and Study Design

The research approach of this project is to determine the factors associated with frequent ED visits (patients with no ED visits are excluded) to improve healthcare outcomes and patient centered care by focusing on targeted groups. The hypotheses for this project include: (1) Patients with PCP show lower ED utilization compared to other patients; (2) Medicaid populations report higher ED visits than population with other type of coverage; (3) Non- Hispanic Black population shows more ED visits and lack of insurance than Hispanics, Whites and Asians; (4) Females in the United States show more ED visits than males; (5) There is a positive relationship between numeric variables age and ED visits. To test these hypotheses, National Hospital Ambulatory Medical Care Survey (NHAMCS) was conducted in 2010 for ED visits by U.S. Department of Commerce and U.S. Census Bureau, which act as data collection agents for CDC and U.S. department of Health and Human Service. The study type is cross-sectional design, which includes sample size of 40,000 patients nationwide. The relevant policy issues in this study are health disparities and factors that contribute to health disparities.

NHAMCS uses multistage probability design, which includes samples of geographic primary sampling units (PSUs), hospitals within PSUs, and patient visits within EDs.

Each year approximately 480 nonfederal, general and short stay hospitals are selected for NHAMCS data collection (NHAMCS, 2010).

Overview of NHAMCS Data Collection

The emergency department patient record form was used for the survey, which provides demographic information about patient, patient's residence, date and time of visit, mode of transportation to emergency department, expected source of payment, reason for visit, initial vital signs, provider's diagnosis, injury/poisoning/adverse event, diagnostic services, procedures, medications/immunization record, service level, visit disposition, hospital admission and information about observation unit stay. Census Headquarters staff takes responsibility to monitor the data collection process, training the Census Regional Office staff, and writing the field manual. Regional Office staff provides training to the field representatives and monitors hospital data collection activities. Field representatives provide guidance to hospital staff for collection and sampling of Patient Record forms. Hospital staff keeps record of patient record forms for 4 weeks in case of missing information or any need to clarify information with patients. All information is verified during central data processing and hospitals are contacted to retrieve any missing patient information. The data collected for ED utilization is then categorized in various categories for further analysis (CDC, 2010). SPSS statistical package was used for data collection and all records of patients were held confidential.

Study Variables for Analysis

The dependent variable for this study is ED visits and independent variables are demographic, PCP availability, type of coverage, reason for visit and income. The

demographic variable includes the age, gender, ethnicity and race, which was analyzed in this project to determine the specific group that shows more ED visits with compare to other groups. For example, one particular race, ethnicity, gender or age group that represents maximum number of ED visits; if such group can be identified from the study, more research could be done for the reason for frequent ED visits and other parameters could be analyzed to reduce ED utilization among the group. Type of coverage is also important variable in this study that relates to income of patients and primary care provider visits. Uninsured populations are more likely to visit ED because they do not spend money to see PCP, which result in ED visits when health situation becomes severe. Comparison of reasons for visit with ED utilization gives indication about the disease or injury that is prevalent among patients for ED visits.

Dependent and independent variables of the study can be categorized into numeric or categorical types. Numeric variable contains numbers and categorical variable contains various categories of the objects. In this study, numeric variables are age, death and ED visits, while categorical variables are gender, race, ethnicity, reasons for visit, type of coverage and PCP availability. Based on the numeric or categorical type, statistical tests could be performed for analysis.

Statistical Techniques for NHAMCS Data

Chi-Square is used to test frequencies to make decision about the hypothesis; therefore it is appropriate if both variables under analysis are categorical. The null hypothesis states that the number of frequencies in the sample does not differ significantly from distribution. The significance (P value) of less than or equal to 0.05 means researchers reject null hypothesis and the frequencies differ significantly from the

distribution in population. Correlation shows positive or negative relationship between two numeric variables, which could be strong, moderate or small correlation based on the value of correlation coefficient R . If the value of R is between 0.00-0.29, correlation is weak; if value is between 0.30-0.69, correlation is moderate and value between 0.70-1.00 shows strong correlation. The t -test is used to test the mean of sample group with hypothetical mean, when one variable is numeric and other variable is categorical. There are three types of t -test: (1) Dependent sample t -test, which measures the difference in the means of two groups where each case is same (2) Independent sample t -test that tests the difference in the means of two groups where each case is not same (3) Single sample t -test tests the sample mean with hypothetical mean. The P value of less than 0.05 shows that the value is significant and null hypothesis is rejected based on the mean values. The P value of above 0.05 is not significant that means researchers fail to reject null hypothesis (Cowan, 2006).

The t -test is used on the categorical variables such as PCP availability, gender, race, type of coverage to test hypotheses when numerical variable is ED visits. Correlation test should be performed on both numeric variables age and ED visits to test positive or negative relationship for hypothesis. Chi-Square could be performed on categorical variables, race and type of coverage to test study hypothesis.

Table1. Hypothesis and Variables

Hypothesis	Dependent Variable	Independent variable	Statistical test
1) Medicaid population reports higher ED visits than population with other type of coverage	Past ED visits	Population with and without Medicaid	<i>t</i> -test
2) Non- Hispanic black population shows more ED visits than Hispanic, white and Asians	Past ED visits	Race	Anova
3) Females in the United States show more ED visits than males	Past ED visits	Sex	<i>t</i> -test
4) There is a positive relationship between age and ED visits	Past ED visits	Age	Correlation

CHAPTER 3

RESULT

Descriptive Statistics

The data was collected by NAMHCS in 2010, which includes the sample size of 34,936 patients in ED. Patients who did not visit ED are excluded in this data. There are 12,384 males and 10,259 females in the sample (see Figure 1 below). The analysis of the data shows 11,434 patients with Medicaid and 23,502 patients from other payment types including Medicare, private insurance, Tri-care, worker's compensation or uninsured population (see Figure 2 below). The race distribution shows 22,576 patients from Hispanic origin, 7,312 White patients, 820 Black patients, 238 Native Americans, 197 Asians, 101 Hawaiians and 3,692 patients from unknown race (see Figure 3 below). Frequency distribution in data analysis shows maximum sample size from infants less than 1 year of age, which constitutes 23% of total sample size (see Figure 4 below).

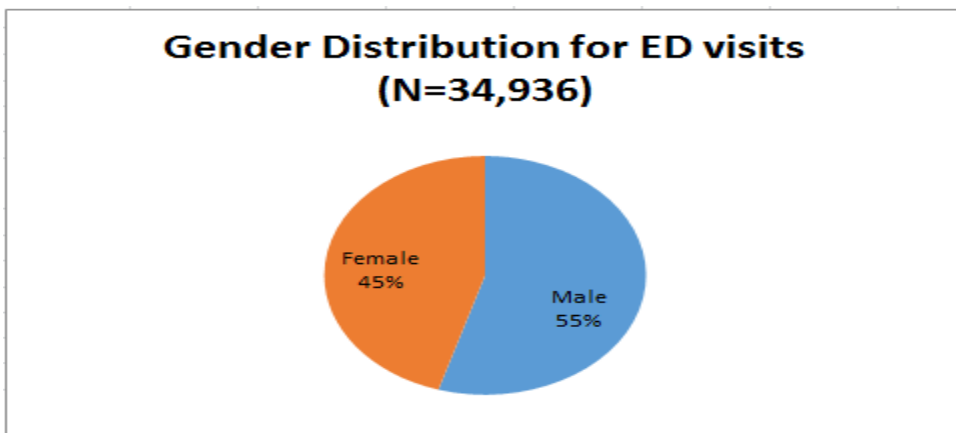


Figure 1 Gender distribution.

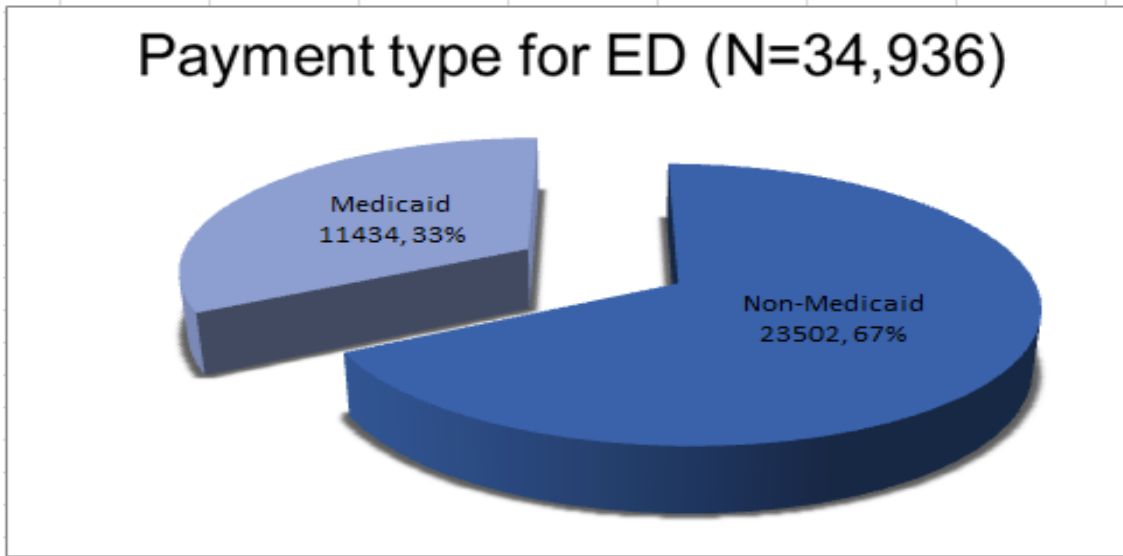


Figure 2 Payment types for ED visits.

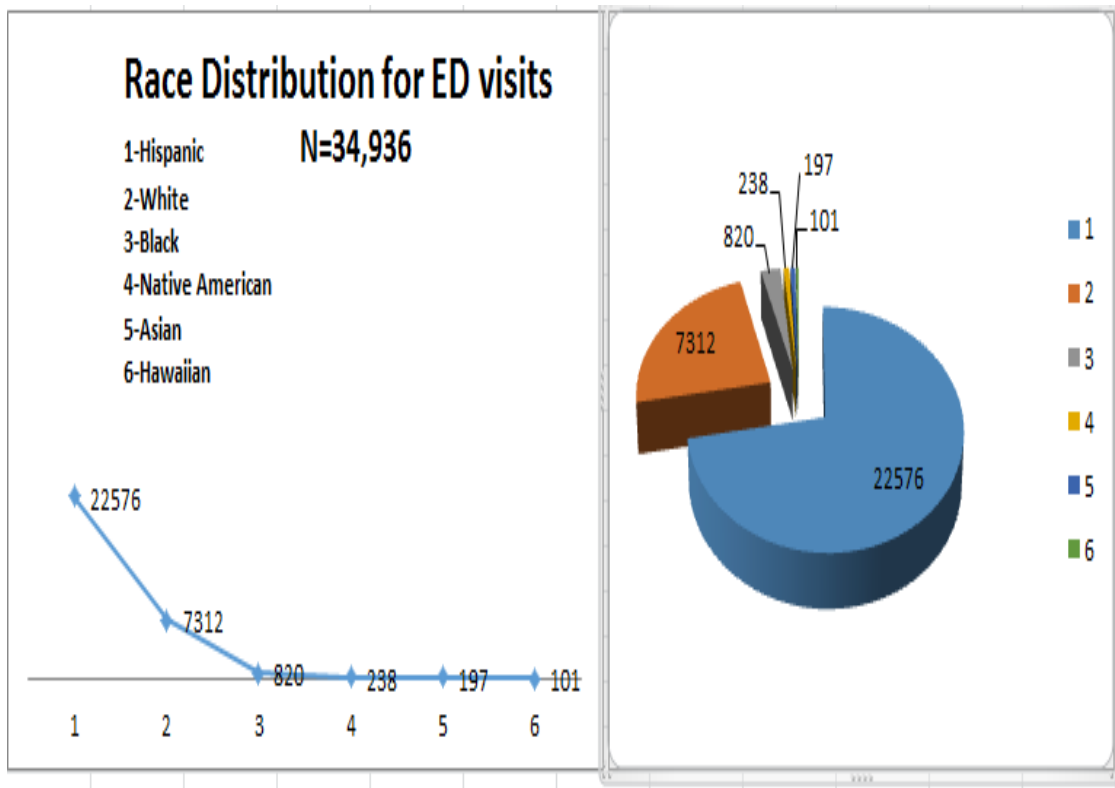


Figure 3 Race distribution.

Hypothesis Testing

Hypothesis 1: The first hypothesis in this research focuses on the Medicaid population to observe the pattern of ED visits based on the type of coverage. It states that “Medicaid population reports higher ED visits than population with other types of coverage.” To analyze this hypothesis, past ED visits variable called “pastvis” in the data was selected as the dependent variable and population with or without Medicaid called “paymcaid” was chosen as an independent variable. The *t*-test was used to test this hypothesis due to numeric dependent variable and categorical independent variable. The result of the *t*-test shows that “There was a significant difference in average ED visits from Medicaid population ($M = 2.23$, $SD = 4.92$) and non-Medicaid population ($M = 1.34$, $SD = 3.45$); $t(22641) = -15.692$, $P = 0.000$.” The null hypothesis was rejected due to significant *P* value and research hypothesis is accepted based on the higher mean value for Medicaid population with compare to population with other type of coverages such as private insurance, Tri-care, Worker’s compensation, Medicare or uninsured population.

Hypothesis 2: This hypothesis analyzes the relationship between the race and ED visits. It states that “Non- Hispanic Black population shows more ED visits than Hispanics, Whites and Asians”. Independent variable in this hypothesis is race variable called “Raceun” and dependent variable is past visits called “Pastvis” in the data. Statistical test ANOVA was used in this research to analyze this hypothesis due to more than two categories in race variable and numeric past visits variable.

In NAMHCS data, six different numbers were assigned to race variable to run the statistical tests. In race variable, number 1 was assigned to Hispanic patients, 2 for White population, 3 was assigned to Black patients, 4 for Native American, 5 to Asians and 6 for Hawaiians. The result of the ANOVA shows that “There is a significant relationship

between ED visits and race due to the values $[F(5, 20463) = 4.274, p = 0.001]$. The null hypothesis is rejected in this analysis due to significant p value and higher mean in white population than other population, which indicates that White population shows more ED visits than other populations. The result of ANOVA shows mean plot in figure 4 below.

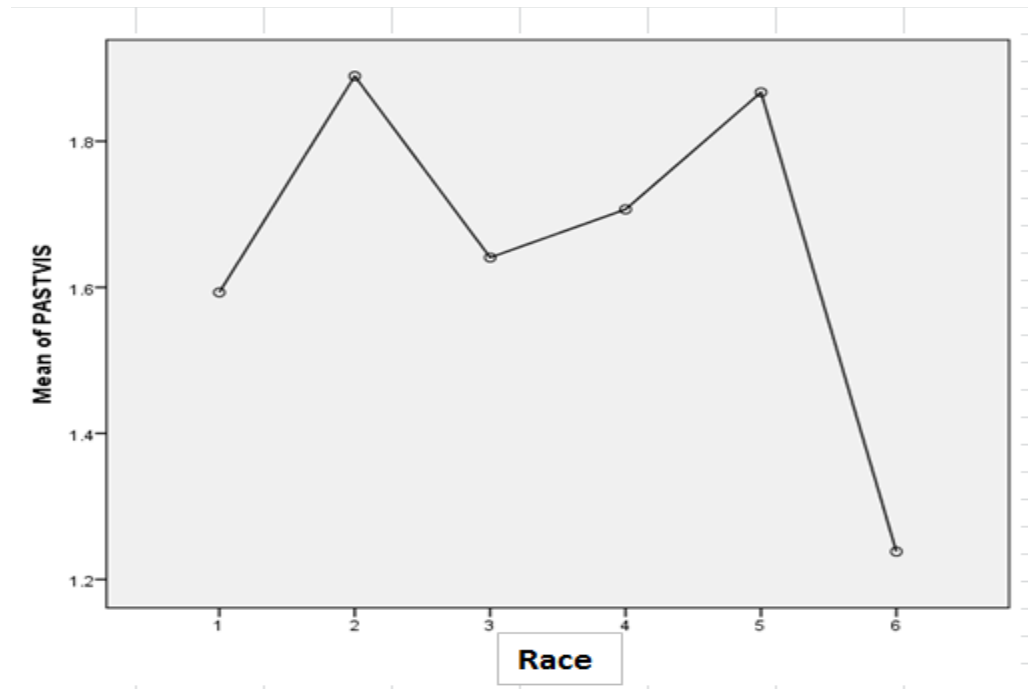


Figure 4 Mean of past visits based on Race of sample size (N=34,936).

1-Hispanic, 2-White, 3-Black, 4-Native American, 5-Asian, 6-Hawaiian

Hypothesis 3: This hypothesis shows relationship between gender and ED utilization. The dependent variable is past visits and independent variable is sex. The *t*-test was used in this hypothesis testing, which includes numeric dependent variable and categorical independent variable. Sex variable in NHAMCS data has two values; 1 indicates male and 2 indicates female. The result of *t*-test shows that “There is a significant difference in average number of ED visits for males ($M = 1.69, SD = 3.79$) and females ($M = 1.57, SD = 4.28$); $t(22641) = 2.27, P = 0.023$ ”. Null hypothesis is rejected

due to significant P value and higher mean for males than females, which suggested that males have higher average ED visits than females. (See figure 6 below).

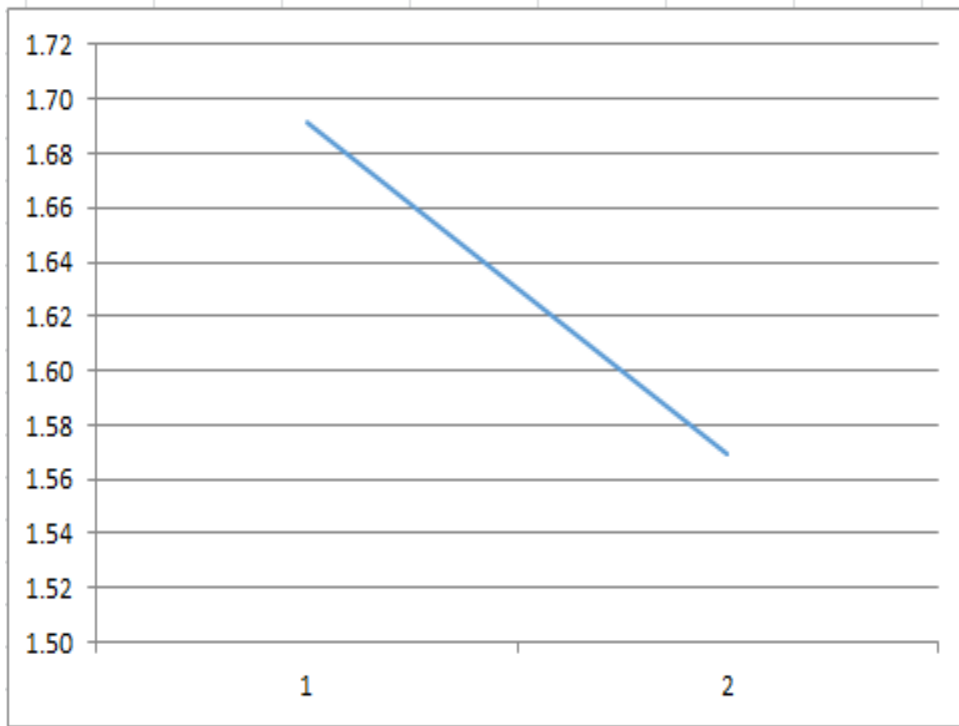


Figure 5 comparison of mean between 1-males and 2-females.

Hypothesis 4: In this hypothesis, analysis focuses on the correlation between age and ED utilization. The research states that “There is a positive relationship between age and ED visits”. To test this hypothesis, correlation statistical test was performed on dependent variable past visits and independent variable age. Both variables are numeric and therefore correlation test was used for analysis. The result of correlation shows that “There is weak correlation between the two variables, $r = 0.048$, $n=22643$, $p=0.000$ ”. The null hypothesis was rejected due to significant p value. The results suggested weak significant positive correlation between age and average number of ED visits by patients. The table below shows the result table for the research.

Table2. Result for the Hypotheses

Hypothesis	Dependent Variable	Independent variable	Statistical test	<i>P</i> value	<i>R</i> value or <i>T</i> or <i>F</i> value	Accept or Reject Hypothesis
1) Medicaid population reports higher ED visits than population with other type of coverage	Past ED visits (Pastvis)	Population with and without Medicaid (Paymcaid)	<i>t</i> -test	0.000	<i>T</i> = -15.692	Null hypothesis is rejected because <i>P</i> value is significant. Past visits Medicaid mean=2.23; non Medicaid mean = 1.34
2) Non-Hispanic black population shows more ED visits than Hispanic, white and Asians	Past ED visits (Pastvis)	Race (Raceun)	Anova	0.001	<i>F</i> =4.274	Null Hypothesis is rejected for the overall <i>F</i> test. There is a higher average number of visits to ED among Whites.
3) Females in the United States show more ED visits than males	Past ED visits (Pastvis)	Sex	<i>t</i> -test	0.023	<i>T</i> =2.270	Reject null hypothesis due to significant <i>p</i> value. There is a higher average number of ED visits by males than females.

Table2. Continued Result for the Hypotheses

4) There is a positive relationship between age and ED visits	Past ED visits (Pastvis)	Age	Correlation	0.000	R=0.048	Reject null hypothesis due to significant p value. It is a positive weak correlation R=0.048
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The null hypothesis in all four hypotheses is rejected because of significant p value greater than 0.05 in each hypothesis. This research performed two *t*-tests, one correlation test and one ANOVA test in the statistical analysis. Based on the statistical test results, White population shows frequent ED visits than other population; more males visit Emergency Department than females and there is a weak relationship between age and ED utilization. The dependent variable tested was past visits, which was compared with sex, race, type of coverage and age.

ANOVA was used in second hypothesis for race variable with six different categories to determine whether any difference in means between different groups. SPSS software was used to run all statistical tests and figures were generated in Microsoft excel.

CHAPTER 4

DISCUSSION

In the United States, higher utilization of Emergency department is a key issue for healthcare industry because of the cost associated with ED, work overload on ED staff to serve the patients and long patient wait time, which affects the healthcare quality and patient service. The primary objective of this research is to perform analysis of NHAMCS data collected in 2010 to test the research hypotheses and identify the factors that contribute to higher ED visits. In this research, four hypotheses were suggested to observe the characteristics of the population that shows frequent ED visits. These research hypotheses were based on the type of coverage, gender, age and race of the patients, who show frequent visits to ED. The first hypothesis in this research that states “Medicaid patients show higher ED utilization with compare to other coverage type” was accepted by performing *t*-test on the data that shows higher mean for Medicaid population. Emergency Department charges are extremely high for patient services, which is the main reason why patients with other types of coverage except Medicaid show less visits because Medicaid patients do not need to pay anything. Many Non-urgent ED visits could be avoided from Medicaid population, if they are required to see primary care physician at least once in a year. Patient education and awareness about healthy life style, availability of primary care physician on holidays and weekends, quick appointment for PCP and management in hospital staff to avoid longer patient wait time

are some possible suggestions to improve patient's access to PCP and reduce unnecessary visits to Emergency Department.

Hypothesis 2 in this research stated that "Black population shows more ED visits than other race groups", which was rejected in the analysis using ANOVA statistical test due to the highest mean represented from White population. The mean plot shows higher mean from White and Asians and significantly low mean from Black and Hawaiian populations. A detail analysis of the data is needed to determine the type of ED visits (urgent or non-urgent) from White population and the specific cause of frequent ED visits. The analysis of specific state or location, where patients show frequent ED visits would also help reduce ED utilization. Some patients visit ED more often to get narcotic prescriptions. These patients usually visit different ED locations to easily get prescriptions from the prescriber. The hospital staff needs to monitor these patients and keep track of their narcotic purchases through the centralized system that shows on which date and from which pharmacy, patients have picked up narcotic drugs. The Emergency Department could establish strict policies to stop the ED visits from these patients.

Statistical test *t*-test was performed for hypothesis 3 that states that "Females visit emergency department more than males." The result of the *t*-test shows that more males visit ED than females. The hypothesis 3 was proposed based on the assumption that females need medical assistance more often due to pregnancy, menstruation and menopause issues. The result of the statistical analysis rejected hypothesis 3 because males have higher mean for ED visits than females, which might be due to life style, alcohol consumption, smoking, drug abuse, stress, injuries or diseases. Correlation test was used for the hypothesis 4 to analyze the positive relation between age and ED visits.

As per this hypothesis, old population shows frequent visits than young population, but the result of the correlation shows weak relation between age and ED visits. Hypothesis 4 cannot be accepted due to weak correlation. The frequency distribution shows more ED visits from infants, adults between age 18-25 and 40-50.

Strengths of the Research Study

This study involves large sample size of 40,000 patients, which provides opportunity for researchers to thoroughly analyze the data for more accuracy and efficiency. The samples may be representative of the target populations because of the large sample size. The data include patient details about age, gender, race, diagnosis, reason for visit, death, type of coverage and other information. The sample is collected nationwide, which helps analyze the factors associated with higher ED utilization at national level.

Limitations of the Research Study

The NHAMCS data collection is a cross-sectional study, which is mostly one time survey that does not involve follow up. The major weakness of this study is that it does not determine the exposure-outcome relationship. For example, if patient visits ED due to black lung disease that occurs due to inhaling coal dust for several years, NHAMCS data reports diagnosis or the reason for the ED visits without focusing on the exposure coal dust. This limitation makes difficult for the researchers to identify the actual cause of the problem. This study focuses more on the prevalence than incidence. The data of NHAMCS does not include the name of the ED location or city that shows higher ED visits. The data does not include the information about income, PCP coverage and poverty level to analyze ED visits based on socio economic status or PCP availability.

The patient occupation details and education information are not provided in the data, which could help understand the ED visits related to different occupations.

Opportunities for Future Research

The secondary data analysis of NHAMCS data using statistical tests suggests that higher ED visits are reported from Medicaid population with compare to other types of coverages, White patients than other race groups, more males than females and infants, young adults and population between 40-50 years. These results provide opportunities to the researchers to explore the reasons why targeted population shows non-urgent ED visits and come up with healthcare policies to reduce ED utilization for non-urgent matters. For example, the comparisons of access to primary care for Medicaid patients in Emergency departments. The researchers could focus on the specific locations where very few primary care providers are available, which force patients to visit ED for illness. Another key point for the thorough analysis is the reasons for ED visits by White populations and the geographical regions where these populations show higher ED visits. Age groups of males and females for frequent ED visits need to analyze to understand the patterns of ED utilization. The researchers could also focus on ED visits distribution based on the income and socio-economic status data of the patients collected from other sources. The analysis of the factors and solutions to reduce non-urgent ED visits could reduce mortality rate, work overload on staff and save time for the patients who actually need immediate care.

Conclusion

Higher Emergency Department utilization is one of the biggest issues in healthcare industry. The possible solutions are to analyze the data that is collected every year,

evaluate the primary causes for frequent ED visits to identify the targeted group and establish the protocols to reduce utilization. Most of the non-urgent ED visits are reported due to lack of patient awareness, injuries, unavailability of primary care providers, allergies and flu like symptoms. These non-urgent visits from patients create unnecessary burden on healthcare staff to serve large volume, which result in poor health care outcomes, errors, higher mortality and low quality. These non-urgent ED visits are avoidable with patient education, promotion of healthy life style, physician-patient interactions, easy access to PCP and with use of new technologies like telemedicine and video chat with physicians.

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