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## Association between Opioid-Related Emergency Department Visits and Financial Liability of Hospitals

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# Walden University

College of Health Professions

This is to certify that the doctoral study by

Mary-Zitta Muabe

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Walden University  
2022

Abstract

Association between Opioid-Related Emergency Department Visits and Financial

Liability of Hospitals

By

Mary-Zitta E. Muabe

Doctoral Study Submitted in Partial Fulfillment

Of the Requirements for the Degree of

Doctor of Healthcare Administration

Walden University

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## Abstract

Emergency departments (EDs) are experiencing an influx of patients with opioid-related which result in increased opioid misuse, abuse, and overdoses. The purpose of this study was to examine the relationship between opioid-related ED visits and financial liability of hospitals by evaluating if an increase in opioid-related ED visits leads to an increase in average ED visit costs. The framework used for this study was Reason's theory of failures, which involves improving healthcare maturity in terms of risk management, achieved through enhanced efficiency. The analyzed research questions included analysis between the number of opioid-related ED visits and financial liability of hospitals in the US, an analysis of the correlation between hospital location and hospital bed capacity and the number of opioid related ED visits, and aggregate visit cost. Secondary data for this quantitative study came from the Nationwide Inpatient Sample and Nationwide Emergency Department Sample databases contained in the United States Healthcare Cost and Utilization Project. Data analysis included a correlational analysis and regression model to examine the relationship the variables. Results indicated that there was a weak positive relationship between total average charges for ED visits and total number of opioid-related ED visits and the relationship did not change when evaluating the hospital bed capacity and the hospital location. Recommendations to healthcare administrators are to develop enhanced data sharing among healthcare facilities to improve detection and response of ED spikes to help care for opioid-related cases, which will lead to better patient outcomes and reduced costs, demonstrating positive social change with better care and reduced costs.

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## Section 1: Foundation of the Study and Literature Review

### **Introduction**

Hospital emergency departments (EDs) are experiencing an influx of patients with opioid-related issues against a backdrop of limited resources. More ED visits, preventable or otherwise, are associated with higher healthcare costs (Greene et al., 2019). Such expenses inflate hospitals' financial liability, consequently affecting financial viability and profitability. The implication is the need for efficient management of EDs in terms of cost minimization and capacity optimization. An ED is an open system affected by its surrounding community as well as the population demographics concerning location. The rate of drug use and opioid use disorder (OUD) is higher in urban areas than rural areas. However, the rural fatal overdose rate has been significantly higher than the urban rate since 2006 (Centers for Disease Control and Prevention [CDC], 2021). Section 1 of this research proposal contains a detailed discussion of the background of the study, problem statement, purpose of the study, research questions, theoretical and conceptual framework, literature search strategies, literature review related to key variables and concepts, definitions of terms, assumptions, scope and delimitations, limitations of the proposed study, and its significance.

### **Background**

Public demand for medical emergency services in the U.S has been increasing, driven by the growing human population and the increasing variety of diseases that affect it. Consequently, outpatient services have become a critical component of healthcare systems, necessitating effective and efficient service delivery and continuous

improvement of EDs (Pandit & Kulkarni, 2017). EDs, whether hospital-based or freestanding, are critical in terms of the service delivery of healthcare systems in the United States (US). EDs are the source of 50% hospital admissions and cater to 25% of acute care visits and 11% of ambulatory visits (Schuur et al., 2016).

Use of EDs has been growing in the U.S due to their focal role as a point of delivery for unscheduled primary care as well as treatment of non-emergent and treatable conditions (Moore & Liang, 2020). Increasing ED use justifies the need for reliable performance and accessibility of delivery systems (DeLia, 2007). ED care and administration decisions are influenced by community needs based on where they are located and preferences of patients (DeLia, 2007). ED systems and capacity are thus expected to match or reflect immediate community needs.

Several problems manifest in terms of the administration of EDs, including but not limited to overcrowding, capacity surges, and rising costs of healthcare services, which undermine quality of care. The persistent opioid epidemic is also a factor that is exerting pressure on EDs across the nation. Efficiency is, therefore, integral for sustainable quality healthcare considering rising costs of these services.

Several empirical studies have been undertaken concerning costs associated with the opioid epidemic but lack information regarding the impact on specific hospital facilities. The growing ED visit rate which has increased from 37 per 100 people in 2009 to 41 per 100 people 2018-2019 drove the need for the proposed study amid increasing cases of OUD and the need for efficient ED administration, as well as the research gap regarding opioid-related financial liabilities incurred by specific medical facilities.

## **Problem Statement**

Opioid analgesics and other synthetic opioid misuse, abuse, and overdose continue to contribute to high mortality rates in the US with fatality cases due opioids increasing from 3.1 to 17.8 deaths per 100,000 people between 2015 and 2020 (World Health Organization [WHO], 2020). The problem is so severe that it has been labelled a national epidemic in the U.S. (CDC, 2018). Due to this high prevalence of opioid misuse, opioid-related emergency department visits have increased from 19 to 63 person per 100,000 ED visits. This increase has subsequently made hospitals incur substantial financial expenses due to associated costs of OUD management and treatment (Gallagher, 2020). OUD management within Health Service Organizations (HSOs) is estimated to be an economic burden in the US, amounting to \$78.5 billion annually, including healthcare, addiction treatment, lost productivity, and criminal justice involvement (CDC, 2018). Preventable adverse drug events (ADEs), such as opioid addiction, overdose, and associated deaths are as a result of underlying system failures that can be prevented and rectified. Some of these failures are poor ED management. In addition, these system failures have inflated financial liability costs of medical facilities, with increases ranging between \$2061 in 2010 to 3516 in 2016. These increases are detrimental to the profitability and financial viability of medical institutions (Hospital Industry Data Institute [HIDI], 2018; Moore & Liang, 2020). Existing system failures or inadequacies can be viewed as an opportunity to develop efficient OUD management and treatment regimens with adequate risk management in terms of financial liability costs, as

well as implement standard opioid therapy protocols (SOTPs) to mitigate such systemic failures.

A comparative analysis of financial liabilities associated with opioid abuse in hospitals located in metropolitan areas as compared to hospitals in suburban areas has not been exhaustively evaluated. A research gap exists that the proposed study seeks to address involving the relationship between opioid-related ED visits and financial liability.

### **Purpose of the Study**

The purpose of this quantitative study was to examine the relationship between opioid-related ED visits and financial liability of hospitals in the US. This will reveal nature of the relationship between the independent variable (opioid-related ED visits) and the dependent variable (financial liability). The dependent variable was operationalized in terms of aggregate ED costs. The study also incorporated an intervening variable (bed capacity) and moderating variable (location). Comparative analysis between hospitals located in metropolitan and suburban areas will be done to examine the differences in financial costs associated with OUD management and treatment between metropolitan and suburban communities.

### **Research Questions and Hypothesis**

I used the following research questions and hypotheses:

*RQ1*: Is there a correlation between number of opioid-related ED visits and financial liability of hospitals in the US?

*H<sub>01</sub>*: There is no correlation between number of opioid-related ED visits and financial liability of hospitals in the US.

*H<sub>a1</sub>*: There is a positive correlation between number of opioid-related ED visits and financial liability of hospitals in the US.

*RQ2*: Does hospital bed capacity mediate the relationship between number of opioid-related ED visits and aggregate ED visit costs?

*H<sub>02</sub>*: Hospital bed capacity does mediate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

*H<sub>a2</sub>*: Hospital bed capacity does mediate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

*RQ3*: Does hospital location moderate the relationship between number of opioid-related ED visits and aggregate ED visit costs?

*H<sub>03</sub>*: Hospital location does moderate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

*H<sub>a3</sub>*: Hospital location does not moderate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

### **Theoretical and Conceptual Framework**

The proposed study involved using Reason's theory of failures as incorporated into risk management within the healthcare sector and ED three factor crowding model. Reason's theory of failures involves improving healthcare organizations' maturity in terms of risk management, which is achieved through enhanced efficiency (Cagliano et al., 2011). Hospitals' financial liability decisions, specifically regarding OUD management, involve the facility's financial risk management.

The ED crowding conceptual model involves effective management of ED's: input, throughput, and output. ED input comprises any systemic characteristic, event, or condition which generates demand for ED services such as emergency care, unscheduled urgent care, or safety net care. ED throughput refers to the duration of time spent by a patient in the ED dictated in terms of efficiency and capacity of the ED, whereas ED output represents the discharge of patients to subsequent phases of care: admission, transfer to another facility, or discharge (Asplin et al., 2003). The input is represented in terms of opioid-related ER visits, and they fall under any of three stages of ED crowding conceptual model, where a patient will visit an ED as the input, receive medical assistance in form of throughput and get discharged under the output stage. Reason's theory resonates with this study based on his idea of risk management that stated a need to evaluate various stage of the process, input, throughput and output, and with any mistakes, a need to terminate the process may exist and it cannot continue to the next stage. For example, if a patient does not visit the ED, they will not be treated and, if a mistake happens when they are in the process of treatment, they will not be discharged.

### **Nature of the Study**

The methodology adopted for the proposed study was quantitative. Secondary data measuring ED visits and associated costs in the US from the Nationwide Inpatient Sample (NIS?) and Nationwide Emergency Department Sample (NEDS) databases, contained in the Healthcare Cost and Utilization Project (HCUP) was the requisite dataset for the proposed study. The independent variable is opioid-related ED visits. The dependent variable is financial liability, measured in terms of aggregate ED costs. The



study also incorporates an intervening variable (bed capacity) and moderating variable (location). To address research questions, multivariable regression was used to assess and model the relationship between opioid-related ED visits, aggregate ED costs, hospital location, and bed capacity. All variables under consideration in the regression model were then linearly correlated. Regression and correlation analyses not only indicated the direction and strength of the relationship between the predictor and dependent variable, but also illustrated the relationship between intervening and moderating variables and the dependent variable.

### **Literature Search Strategy**

A literature search was conducted with an emphasis on sources published between 2016 and 2020. Databases searched were: SAGE Journals, JSTOR, and ProQuest Dissertations and Theses Global. Keywords used in the search were: *opioid crisis*, *standard opioid therapy protocol (SOTP)*, *opioid misuse and over-prescription*, *opioid management*, *risk management in Health Service Organizations*, *ED administration*, *opioid-related ED visits*, and *opioid-related financial costs*.

### **Literature Review Related to Key Variables and Concepts**

The predictor variable is opioid-related ED visits, and the dependent variable is financial liability as measured in terms of aggregate ED costs. Bed capacity and location are also addressed as mediation and moderator variables.

### **Financial Implications of the Opioid Crisis**

The financial impact of the opioid crisis in terms of litigation costs and policymaking was assessed to quantify the costs incurred by the local government in

2019. Through unstructured qualitative interviews with local government departmental heads, Weeks and Sanford (2019), identified the following costs: the cost of naloxone- its procurement, storage, and training on its usage; costs associated with court administration; toxicology report costs and other costs associated with the coroner; select medical care costs; emergency medical services (EMS) costs; indigent care costs and other opioid treatment costs; lost productivity; lost economic development; opportunity costs arising from the local government's attention to controlling the opioid crisis; as well as decreased quality of life.

Florence et al., (2016) carried out a qualitative study to estimate the economic burden of prescription opioid overdose, dependence, and abuse from a societal perspective, specifically, lost productivity from the workforce, criminal justice costs, and the healthcare and treatment costs in the year 2013. Using secondary data from the 2013 National Survey on Drug Use and Health (NSDUH), obtained from the Centers for Disease Control and Prevention (CDC) WONDER database, Florence et al. found that in 2013 the total economic burden of the opioid epidemic amounted to approximately \$78.5 billion, with more than a third of the amount (\$28.9 billion) being attributed to increased health care and substance abuse treatment costs.

An example of the economic cost of the opioid epidemic can be proved by the state of Missouri in 2016, was assessed by the HIDI (2018). Using the cost-effectiveness analysis (CEA) on secondary data obtained from the CDC WONDER database, it was found that the total cost of the epidemic, economically, in Missouri was \$12.6 billion, translating to 4.2% of the state's GDP (HIDI, 2018). In comparison to the activity

generated by each sector of the economy, the opioid epidemic cost was 1.3 times Missouri's total economic activity from the mining, agriculture, and utility sectors combined (HIDI, 2018). When broken down further, the state of Missouri in 2016, incurred a total daily cost of \$34.5 million; an hourly cost of \$1.4 million; \$24 thousand every minute; and \$399 every second (HIDI, 2018).

### **Emergency Department Administration Costs**

To link health literacy and healthcare costs specific to hospitalizations and emergency room services, Greene et al. (2019), conducted a web-based patient-doctor aligned-incentive information therapy program in an employee health plan with 1800 members: the MedEncentive Mutual Accountability and Information Therapy (MAIT) Program. The MAIT program is a web-based system aimed at improving healthcare and reducing costs by aligning patient-doctor financial incentives and incorporating information therapy in bilateral reporting (Greene et al., 2019). Using a mixed-methods approach, quantitative data was analyzed using pre-post mean utilization and cost differences, and then summarized using descriptive statistics and further analyzed through thematic content analysis. It was found that there were reduced hospitalizations and ED visits, consequently, reduced ED healthcare costs as a result of the program under study. Hospitalizations per 1000 reduced by 32%; ED visits decreased by 14%; while annual per capita expenditures reduced by 10.8% post-program implementation.

The Center for American Progress (CAP, 2019) analyzed the administrative costs incurred by the U.S health care system. Secondary data on billing and insurance-related costs between the years 2010 and 2019 were obtained from Medicare and Organization

for Economic Co-operation and Development (OECD). In comparison to hospital utilization rates and costs in other high-income countries, it was found that the U.S spent double the amount of per capita income spent by others. The double expenditure of per capita income was attributed to high administrative costs, which amount to an annual excess of \$248 billion. The main components of these costs are billing and insurance-related (50%); hospital administration (25%); physician practice administration (20%). However, these components vary in proportion to the overall cost based on the type of visit. Thus, relative to professional revenue associated with each hospital visit, the emergency department visit has the highest billing costs equating to 25.2% of revenue (CAP, 2019).

The increasing rate of ED utilization is generally one of the factors that cause higher costs in healthcare. Shah, (2015) assessed the factors associated with higher ED visits in the U.S using data collected in 2010 by the National Hospital Ambulatory Medical Care Survey (NHAMCS). The data was based on a sample size of 34,936 ED visits. It was observed that higher ED utilization, moreover, unnecessary utilization of the ED results in higher costs and poor patient satisfaction, medication errors, and lower quality. Priest (2019) echoed the same observation in a study concerning hospital-based services for opioid use disorder. A mixed-methods approach was adopted in quantitatively and qualitatively analysing data collected from 17 interviews with medicine physicians; 25 policy documents from 10 non-federal hospitals; and data from the Veterans Health Administration (VHA) health system pertaining 12,407 OUD-related

hospital admissions. It was observed that hospitals are incurring significant costs as a result of the increase in OUD-related hospitalizations.

### **Opioid-Related ED Visits**

Vivolo-Kantor, et al. (2018) An analyzed of the trends in the U.S. of ED visits for suspected opioid overdoses in the period July 2016- September 2017 was conducted using hospital billing data and ED syndromic data from 45 states. It was found that the suspected opioid-involved OD cases increased at an average rate of 5.6% per quarter. In addition, large central metropolitan areas were found to experience significant linear increases of 54.1% in ED overdose visits, with a quarterly percentage change (QPC) of 11.7, compared to 20.6% increment in non-core areas, with a QPC of 6.4 (Vivolo-Kantor et al., 2018).

In 2018, an analysis of the trends and direct medical costs associated with non-heroin opioid and heroin OD treatment in hospital EDs was conducted. Secondary data from the 2010-2014 Nationwide Emergency Department Sample (NEDS) revealed a downward trend in non-heroin opioid overdose ED visits with an annual per cent change rate of -1.6. On the contrary, heroin OD ED visits had an APC of 33.3, indicating an upward trajectory of such ED visits. The direct medical costs associated with the 147,654 opioid overdose ED visits in 2014, amounted to \$152.8 million, over 50% of which was borne by the public sector (Guy et al., 2018). The economic burden of the opioid crisis is evident even though the medical costs utilized in this study were an underestimation of the actual cost due to the exclusion of physician and professional fees.

Hsu et al. (2017) conducted a retrospective cohort study of hospital admissions using data from the National Inpatient Sample (NIS), to analyse how prescription opioid (POD) and heroin overdose (HOD)-associated admission, outcomes, costs, and patient characteristics had changed between 2001 to 2012. Using a study sample of 138,610 admissions, it was found that HOD related admissions increased by 0.11 per 100000 people annually while POD related admissions increased 1.25 per 100000 per year. The outcome translated to an increase in total in-patient costs by \$4.1 million per year for HOD admissions, and the POD admissions increased the in-patient total cost by \$46 million. The associated increase in hospitalization costs during the period under study totalled an annual figure of \$700 million (Hsu et al., 2017). It was concluded that the continuous rise in opioid-related hospital admissions and their costs poses a threat to hospitals' finances and infrastructure in the U.S.

A study was conducted in the U.S in an urban setting to assess the cost-effectiveness of an ED-initiated treatment program for opioid addiction, by Busch et al. (2017). Data was obtained with respect to opioid-dependent patients who were 18 years and above, over a 30-day assessment period. From a healthcare system perspective, measured healthcare use was converted to dollar values; cost-effectiveness acceptability curves were then constructed. It was found that the ED-based treatment program was more cost-effective, preferred, and had better adherence in comparison to community-based treatment programs. Therefore, ED-initiated opioid addiction treatment (buprenorphine intervention) yields a higher value compared to other treatment interventions.

## **Hospital Location**

Empirical studies on opioid abuse in rural and urban setups have been conducted. The use of hospital location as a moderating variable is based on the findings on the disparity in opioid abuse across setups. Whether suburban or metropolitan, this moderating variable affects the relationship between opioid-related ED visits and the associated financial liability. The specificity of its effect will be determined in the proposed study.

Schuur et al. (2016) sought to link the location and number of free-standing EDs with the population characteristics of those areas, more so, income level, Medicaid, private insurance and number of Hispanics. The secondary data was sourced from the 2013 American Community Survey and the 2013 American Hospital Association data. Location was operationalized using area ZIP codes. Out of the 30 states, the focus was narrowed down to three states with the leading number of freestanding EDs. Using univariate regression with weights, 187 freestanding EDs were linked to health services data, insurance and demography. Multivariable logistic regression analysis was also performed to assess the concerted contribution of demographic, state, and health services variables to the location of the freestanding EDs. It was found that the strongest association was between freestanding ED presence and locations with higher rates of population growth and high proportions of private insurance (Schuur et al., 2016).

Mosher et al. (2017) compared trends in opioid overdose hospitalization trends among residents of rural setups and residents in urban areas in the U.S, between the year 2007 to 2014. Data from the National Inpatient Sample and from the US Census

American Community Survey was used. Hospitalization rates for heroin overdose were higher among urban residents at 5.5 per 100,000 than rural residents at 2.1 per 100,000. However, with respect to prescription opioid overdose, hospitalization rates were higher in rural populations by 20% to 30%.

Mallow et al. (2018 ) identified a research gap in opioid-related healthcare utilization. A retrospective study was carried out to derive estimates of mean adjusted hospital costs, payments, and the duration of stay for opioid-related visits. Using data from Vizient health system database, regression models were generated for both inpatient and outpatient visits concerning the three variables: adjusted cost, payments and duration of stay. It was found that opioid-related hospital costs, and the other two variables, varied across the country based on geographical locations, hence the need for hospitals to geographically benchmark their services for effective management of the diverse population.

In acknowledging the strain placed on emergency departments by the opioid crisis, Patel et al. (2020) conducted a study to establish an efficient way of distributing the thinly stretched rehabilitation and mental wellness efforts among the most susceptible to opioid abuse. The result would ease the economic burden on the healthcare system and enhance successful treatment of opioid addiction. The targeted lot would be delineated based on homogeneity of environments and population characteristics for opioid-related issues. Using data on the rates of ED admission, obtained from HCUP, State Emergency Department Database (SEDD) and NEDS, traits of the population at risk of opioid addiction were identified. Analysis of the data revealed that inhabitants of large



metropolitan areas, those earning incomes below the 25<sup>th</sup> percentile , and those in the age bracket of 25 to 44 years were most likely to develop opioid-use disorders and visit EDs with opioid-related issues.

### **Hospital Bed Capacity**

Capacity planning is one of the key components of hospital administration such that there is efficient utilization of the ED and no overcrowding. Poor capacity planning results in unnecessary costs that are avoidable.

Schwierz (2016) considered the rising healthcare expenditure and sought to find a way of containing costs while ensuring high access and quality of service. Bed capacity was not only identified as a cost factor but was also found to have an impact on the quality of care. Similarly, Sitepu et al. (2018) aimed to solve the dual administrative problem faced by hospitals: increasing demand for services and rising costs. An integrated bed allocation planning and staff capacity management strategy was developed using a direct neighborhood search approach.

Basu (2020) studied the association between socioeconomic traits of individual patients, the communities, and the readmission risks of opioid use disorder (OUD) in the U.S. Hospital characteristics. Based on five states, the 2014 discharge data from HCUP, was analysed using a multilevel logistic regression model. It was found that higher primary care access is associated with reduced readmission risk. Medicare, Medicaid, and urban patients were associated with an elevated risk of readmission due to OUD. The study findings varied based on geographic location and availability of primary care providers.

## Definition of Terms

*Aggregate ED Cost:* the summation of costs arising from opioid-related cases that were treated and released from the ED as well as opioid-related admissions through the ED.

*Bed capacity:* hospital characteristic that describes the total number of beds available for inpatient admissions.

*Financial liability* refers to the expenses or costs incurred by hospitals due to their operations or contingent occurrences such as lawsuit damages, which affects their profitability and financial viability.

*Hospital location:* the geographical classification of a hospital as either suburban or metropolitan based on the patients' residence according to the rural-urban classification scheme.

*Opioid abuse:* the CDC (2021) defines it as a problematic pattern of opioid use which causes significant impairment or distress, diagnosed based on unsuccessful efforts to control use, use resulting in social problems and failure to fulfill obligations. It is also referred to as opioid use disorder (OUD).

*Opioid-related emergency department visit:* the definition adopted for this study is Opioid-related visits are confirmed by a patient's history or current use of opioids regardless of the reason for its usage, and opioids effects in pregnancy (Jackson et al., 2020).

### **Assumptions**

Three underlying assumptions were proposed for this study. First, the secondary data obtained from HCUP is assumed to be reliable and appropriate for addressing the research questions. Second, there is a linear relationship between the predictor and response variables using the multiple linear regression model in its methodology. Third, it is assumed that there might be randomly occurring missing data from the secondary source. The randomness of this occurrence is not expected to introduce any bias to the study's analysis and conclusions. The mentioned assumptions are necessitated using the available secondary data, whose original intended purpose was different from the proposed study's research purpose.

### **Scope and Delimitations**

The proposed study will focus on the financial liability costs incurred by EDs due to OUD management and treatment. Interest in this is driven by the increasing use of EDs across the country and the need for enhanced efficiency in their management.

By using secondary data, the generalizability of the proposed study's findings will be limited to only the participating states and hospitals in the surveys conducted by the Nationwide Inpatient Sample (NIS) and the Nationwide Emergency Department Sample (NEDS). The study will also be limited to 5 years, that is, 2013 to 2017 due to restrictions on data availability. The proposed study's findings will be generalizable to all EDs across the U.S. due to the rigor, the representativeness of the study sample, and lack of information bias due to the use of secondary data.

### **Limitations**

The proposed study's limitations included using a predetermined secondary data source on opioid-related ED visits, the average cost per ED visit, and hospital bed capacity statistics. First, the secondary source limits the amount of comprehensive data dedicated to addressing the proposed study's research objectives to a specific time frame, posing the challenge of incomplete data. The participation of hospitals and states in the submission of data to HCUP across the years is not annually consistent, implying that hospital/state participation changes might influence the study findings. Second, the data on opioid-related hospital use may contain non-opioid-related codes. Further, concept definitions of the secondary data source might cause an underestimation or overestimation of the statistics. In addition to this, because it is rare for hospitals to release their private organizational financial information, I cannot measure organizational financial liabilities based on the answers to the research questions obtained from the secondary data source. These limitations are beyond the researcher's intervention since they arise from pre-existing datasets.

### **Significance**

The outcome of this analysis will be vital for health service organizations to understand the association between opioid-related ED visits and a facility's state, location, and bed capacity. The findings may inform enhanced administration and risk management in the healthcare sector, more so hospitals, aiming to save costs, boosting to save costs, boost financial efficiency, and better equipping EDs to handle opioid-related cases in these facilities. Second, the study will encourage enhanced real-time data sharing

among healthcare facilities to improve response and detection of OUD spikes for the sake of coordinated response. Moreover, the ED data on opioid-related visits can serve as a warning system that issues emergency alerts and advisories to trigger localized response. Further, ED administration as a practice can benefit from the findings of this study to facilitate planning and resource allocation, not for opioid-related cases only but for their overall operations.

Socially, the findings from this study can be taken into consideration in improving the ED systems and capacity to match the metropolitan or suburban community needs with respect to OUD treatment and management. In addition to this, the real-time opioid-related data shared among healthcare facilities coupled with the localized response efforts, as mentioned, will help reduce the social costs associated with the opioid crisis.

### **Summary and Conclusions**

From the review of literature, it is evident that healthcare costs have been simultaneously increasing with the rate of opioid-related ED visits. It is also evident that bed capacity is one of the drivers of cost in hospital administration. The community or environment within which a medical facility is located influences its service delivery. The need for efficient and effective cost management in ED administration is thus paramount. The mentioned observations justify the objective of the proposed study to examine the relationship between opioid-related emergency department visits and the financial liability of hospitals in the United States. The subsequent section captures in detail the research design and methodology for the proposed study.

## Section 2: Research Design and Data Collection

### **Introduction**

The motive for undertaking this quantitative study is to examine the relationship between opioid-related emergency department visits and financial liability of hospitals in the US. This research stems from the growing ED use rate, increasing cases of OUD, need for efficient ED administration, and existing research gap regarding opioid-related financial liabilities incurred by specific medical facilities as influenced by location and bed capacity. Data for this study comes from secondary data from the NIS and NEDS, spanning 5 years (2013 to 2017) due to restrictions on availability of data. This section includes a description of the research design and rationale, methodology, threats to validity, and a summary.

### **Research Design and Rationale**

I sought to analyze the nature of the relationship between the independent variable (opioid-related emergency department visits) and dependent variable (financial liability). First, the dependent variable was operationalized in terms of aggregate ED costs. The study also incorporated an intervening variable (bed capacity) and moderating variable (location). Second, comparative analysis between hospitals located in metropolitan and suburban areas, will be used to address differences in financial costs associated with OUD management and treatment in metropolitan and suburban communities. Requisite secondary datasets were acquired from NIS and NEDS databases that are contained in the HCUP. From these datasets five variables were taken, Number of ED visits, average costs of each ED visit, location of the hospital and the bed capacity of each hospital.

Multivariable analysis of the predictor, dependent, intervening, and moderating variables was done to establish causality and correlation.

The adopted research design is constrained by availability of the requisite secondary data. Therefore, the proposed study was limited to analyzing the relationship between opioid-related ED visits and financial liability of hospitals between 2013 and 2017.

Quantitative research in healthcare administration is vital to address efficiency in HSOs and redesigning current systems to enhance efficiency. Quantitative research is used to measure magnitude and establish the presence of a problem (Esan et al., 2016).

### **Methodology**

The research methodology suitable for this research is discussed in terms of identification, setting and sample, sampling techniques, and data analysis plan.

#### **Population**

The population targeted for the proposed study is all hospitals with reported cases of OUD management and treatment in EDs across 50 states in the US.

#### **Setting and Sample**

From the target population, a representative sample will be obtained through stratified sampling which will employ sampling frames along states and locations. Sample sizes will then be selected from each stratum proportionally, as guided by the power analysis utilized in the secondary source. Stratified sampling will reduce sampling bias hence enhance the representativeness and accuracy of the study findings.

## **Data Collection**

The NIS and NEDS databases employ different methodologies in the sampling procedures. Data on ED visits were obtained through stratified sampling in four broad categories: ownership, location, teaching status, and trauma center designation. Location is further stratified into large metropolitan, small metropolitan, metropolitan, and rural. Data on opioid-related hospital use was sampled based on the diagnosis codes for opioid cases in the US.

The relevant dataset will be obtained from HCUP Central Distributor after obtaining clearance and approval from the Institutional Review Board (IRB). A training on HCUP Data Use Agreement will be undertaken before an application and payment for the specific dataset is made. Data obtained from the HCUP database is reliable and appropriate for the proposed study because it is a national information resource that contains a large volume of hospital data in the U.S. HCUP contains multiple databases that specialize in specific areas such as the NIS, NEDS, Kids' Inpatient Database (KID), National Ambulatory Surgery Sample (NASS), and State Inpatient Database (SID), among others.

## **Sampling and Power Analysis**

The following variables were filtered from the proposed databases (NIS and NEDS) while only keeping the opioid related ED visits. Data filtering was done in SPSS by only keeping the observations with the ICD-9-CM and ICD-10CM codes related to OPIOID cases. The following variables will be used in the analysis.



**Table 1***Variable Descriptions*

Variable	Description
Opioid-related ED visits	Number of opioid-related ED visits to each hospital at any given time. These ED visits have been filtered to only capture the ED visits that are opioid related.
Financial liability & Aggregate ED visit costs	It is the average amount of money spent to cover for each opioid related ED visits at a given hospital.
Hospital location	Location of the hospital where the opioid related ED visit took place.
Bed Size	Size of bed in each hospital related to each ED visit that was opioid related

I conducted a power analysis based on the proposed research question and hypothesis to determine the sample size required. The study proposes a correlational study to examine the relationship between different variables, the proposed null hypothesis is equal to zero, that is the variables being examined have no association in the null hypothesis. Therefore, I conducted a power analysis to determine the minimum sample size required to detect a correlation coefficient of 0.1 with alpha of 0.05 and power of 80.0% and a power of 90.0%.

The sample size to achieve specified significance level and power is.

$$N = \left( \frac{z_{\alpha} + z_{\beta}}{C(r)} \right)^2 + 3$$

Where, the value of  $\alpha$ , is the probability of type I error, the value of  $\beta$ , is the probability of type II error, or (1-power) of the test and value of r, the sample expected correlation based on N observations.

At a power of 80%, the required sample size is 783 to detect a correlation coefficient of 0.1 with the alpha of 0.05 and power of 80.0%, and a sample size of 1047 was required to detect a correlation coefficient of 0.1 with alpha of 0.05 and power of 90.0%. From this power analysis, the selected databases have more than adequate observations to achieve accurate results.

### **Instrumentation and Operationalization of Constructs**

#### **Operationalization**

The independent variable, moderating and intervening variables will be operationalized directly as they appear in the secondary datasets. Opioid-related ED visits were identified based on the ICD-10-CM and ICD-9-CM codes that were treat-and-release cases. Bed capacity categorizes the hospital size as small, medium, and large. Hospital location, on the other hand, categorizes the EDs as metropolitan or suburban. The dependent variable, aggregate ED costs, will be operationalized by converting ED charges to costs using the HCUP Cost-to-Charge Ratios.

#### **Data Analysis Plan**

Multivariable analysis of the predictor variable (opioid-related ED visits), the dependent variable (aggregate ED costs), the intervening variable (bed capacity) and the moderating variable (location) will be done using Statistical Packages for the Social Sciences (SPSS), in order to establish causality and correlation. Statistical significance of these relationships will then be determined using ANOVA to enable the making of statistical inferences from the findings. Finally, the data will be validated using SPSS to enable reliable addressing of the following research questions and hypotheses:

*RQ1:* Is there a correlation between number of opioid-related ED visits and financial liability of hospitals in the US??

*H<sub>01</sub>:* There is no correlation between number of opioid-related ED visits and financial liability of hospitals in the US.

*H<sub>a1</sub>:* There is a positive correlation between number of opioid-related ED visits and financial liability of hospitals in the US.

*RQ2:* Does hospital bed capacity mediate the relationship between number of opioid-related ED visits and aggregate ED visit costs?

*H<sub>02</sub>:* Hospital bed capacity does mediate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

*H<sub>a2</sub>:* Hospital bed capacity does mediate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

*RQ3:* Does hospital location moderate the relationship between number of opioid-related ED visits and aggregate ED visit costs?

*H<sub>03</sub>:* Hospital location does moderate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

*H<sub>a3</sub>:* Hospital location does not moderate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

### **Threats to Validity**

Internal validity of the study findings will be determined with respect to the intervening and moderating variables by conducting stepwise regression and path regression to analyze the nature of the relationship and possibility of influence over the

relationship between opioid-related ED visits and the aggregate ED costs. The external validity of the study findings will be safeguarded through probability stratified sampling, ensuring representativeness and generalizability of the study findings. Construct validity of the study will be anchored on the secondary data source's accuracy in measuring the variables. On the other hand, statistical conclusion validity will be ensured during data analysis by using an appropriate statistical power.

### **Ethical Procedures**

The requisite approval for accessing the secondary data will be obtained from the IRB and HCUP Central Distributor. The guidelines set in the HCUP Data Use Agreement will be observed. The unit of analysis in the secondary data source is the hospital emergency department visit. No human participants were identified or defined by the source. Patient anonymity is therefore upheld in the HCUP database and safety of the data is ensured by the HCUP Central Distributor through the verification of order backgrounds and data use training. In cases of missing State data on a given stratum, adjustments were made based on weights obtained by dividing the number of ED visits recorded in AHA by the total number of ED visits contained in the State data (AHRQ, 2021).

### **Summary**

The proposed study on the relationship between opioid-related ED visits and financial liability (aggregate ED costs) will be quantitative. The incorporation of bed capacity and location as intervening and mediating variables, respectively, will enable further comparative analysis of the research purpose. The multivariable analysis will

enable the making of references regarding causality and correlation between the variables. The described research design will be suitable for addressing the set research questions objectively and generating generalizable findings, as will be covered in the subsequent section.

### Section 3: Presentation of the Results and Findings

#### **Introduction**

The main objective of this study was to examine the relationship between opioid-related emergency department visits and the financial liability of hospitals in the United States. The evaluation of this relationship enabled inferences on the nature of the relationship between the independent variable (opioid-related ED visits) and the dependent variable (financial liability). The dependent variable was operationalized in terms of aggregate/ total ED costs. The study also incorporated an intervening variable (bed capacity) and a moderating variable (location). The following research questions will be evaluated using quantitative data analysis techniques in this chapter to help achieve the objectives of this study;

*RQ1*: Is there a correlation between number of opioid-related ED visits and financial liability of hospitals in the US??

*H<sub>01</sub>*: There is no correlation between number of opioid-related ED visits and financial liability of hospitals in the US.

*H<sub>a1</sub>*: There is a positive correlation between number of opioid-related ED visits and financial liability of hospitals in the US.

*RQ2:* Does hospital bed capacity mediate the relationship between number of opioid-related ED visits and aggregate ED visit costs?

*H<sub>02</sub>:* Hospital bed capacity does mediate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

*H<sub>a2</sub>:* Hospital bed capacity does mediate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

*RQ3:* Does hospital location moderate the relationship between number of opioid-related ED visits and aggregate ED visit costs?

*H<sub>03</sub>:* Hospital location does moderate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

*H<sub>a3</sub>:* Hospital location does not moderate the relationship between number of opioid-related ED visits and aggregate ED visit costs.

This section of the study will include an exploratory analysis to summarize the main variables of the study, the results, and interpretations of statistical analysis for each proposed research questions and hypotheses and lastly, a discussion of the main findings from the results and statistical tests.

### **Data Collection of Secondary Dataset**

Secondary data from the NIS and NEDS databases contained in the HCUP between 2017 and 2018 will be used in this study. The following variables were filtered from the proposed databases NIS and NEDS while only keeping the opioid related ED visits. Data filtering was done in SPSS by only keeping the records and observations with the codes that are related to OPIOD cases. As a result of filtering the data to obtain

relevant observations for the study, the sample was not large enough as previously anticipated due to missing observations within the main datasets. However, enough observations based on a power analysis was still achieved to go ahead with the study.

### **Exploratory Analysis**

Descriptive statistics were conducted describe the sample that was extracted from the NEDS and NIS HCUP databases. The extracted sample contained each unique hospital identifier, a total count of the number of Opioid related ED visits (case selected using opioid related ICD-10-CM codes presented in the methodology section), and hospital location and bed capacity. The following tables are a summary of the exploration.

**Table 2**

*Descriptive Summary of Total ED Cost of Opioid Related ED Visits*

Variable	Sample size	Minimum	Maximum	Mean	Std. Deviation
Average Total Charge for ED services	894	503.02	37092.26	3708.08	2603.12
Total Opioid Related ED Visits	894	0	12263	691.24	864.15

From table 1, it was identified that from the Nationwide Inpatient Sample (NIS) and the Nationwide Emergency Department Sample (NEDS) databases there were 894 valid and unique hospitals with records of opioid relate emergency department (ED) visits/services. The summary indicates that the average costs of each opioid related ED visit amounted to \$3,708.08 with a standard deviation of \$2,603.11. The lowest costs were \$503.02, and the highest cost was \$37,092.26. Having said that, the Standard

deviation measures the amount of variation dispersion of a set of values. A low standard deviation suggests the values are close to the mean of the set, while a high standard deviation means that the values are more spread out over a wider range. On the other hand, out of the 894 valid hospitals that had recorded opioid related ED visits, they received an average of 691.24 visits in a year. The highest hospital received 12,263 visits in a year and the lowest receiving no cases at all.

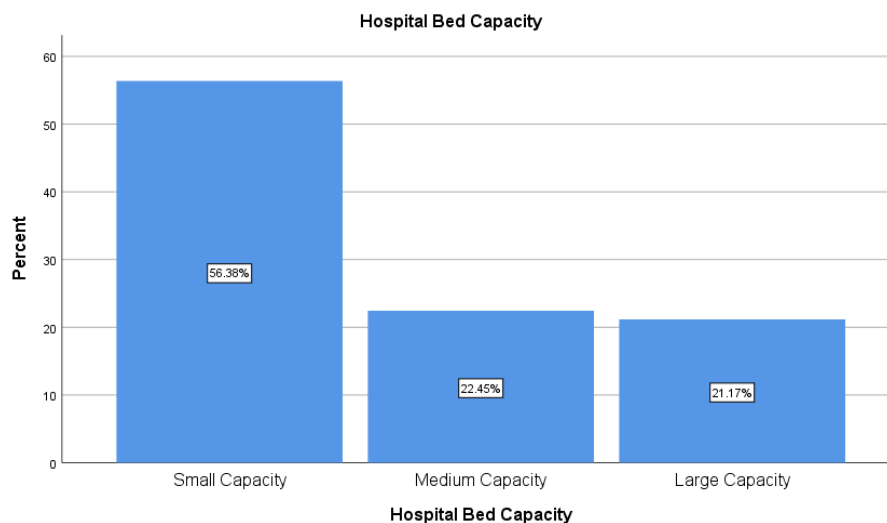
**Table 3**

*Frequency Table of Hospital Bed Capacity Valid and Cumulative Totals*

Capacity	Frequency	Percent	Valid Percent	Cumulative Percent
Small Capacity	221	24.7	56.4	56.4
Medium Capacity	88	9.8	22.4	78.8
Large Capacity	83	9.3	21.2	100.0
Total	392	43.8	100.0	

The variable bed capacity was coded as a categorical variable with three categories. Of the 894 hospitals with valid cases of opioid-related ED visits, 221 had a small bed capacity, 88 hospitals had medium bed capacity while 83 other hospitals had large bed capacities. However, 502 hospitals had not provided their bed capacities and therefore, they were treated as missing observations.



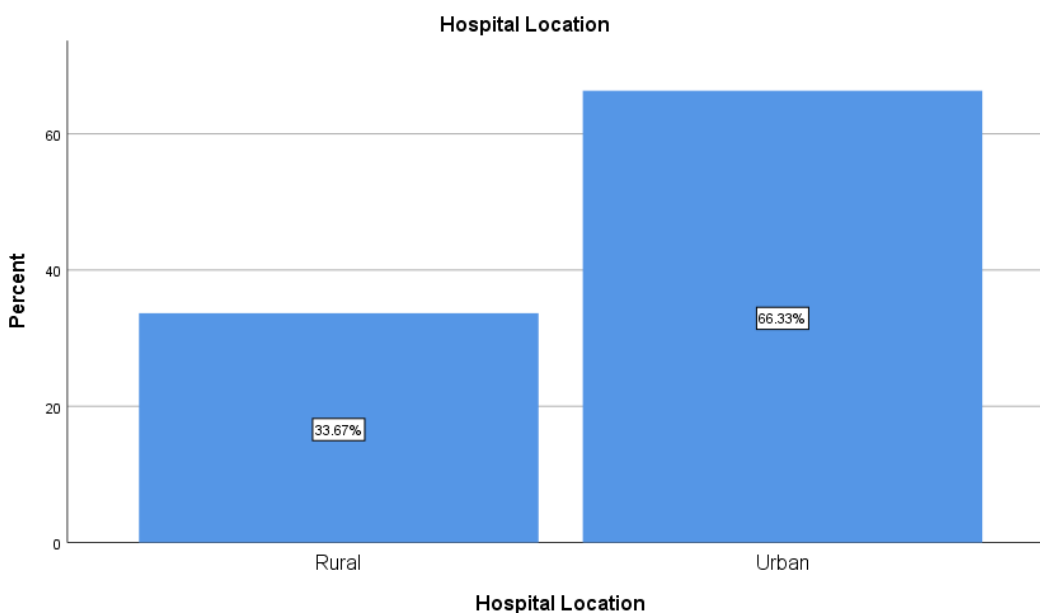
**Figure 1***Frequency Distribution of Hospital Bed Capacity*

From Figure 1, 56.38% hospitals had small bed capacities, 22.45% hospitals had medium bed capacities and 21.17% hospitals had large bed capacities.

**Table 4***Frequency Table of Hospital Location Valid and Cumulative Totals*

Location	Frequency	Percent	Valid Percent	Cumulative Percent
Rural	132	14.8	33.7	33.7
Urban	260	29.1	66.3	100.0
Total	392	43.8	100.0	
Total with missing	894	100.0		

The variable hospital location was coded as a categorical variable with two categories, rural; and urban. From table 3, out of 894 hospitals that had records of opioid-related ED visits, 132 were from a rural setting and 260 were from an urban setting. However, 502 hospitals in this sample did not have a record for their hospital locations.

**Figure 2***Frequency Distribution of Hospital Locations*

From Figure 2, the hospitals that provided their hospital location were 33.67% that were rural and 66.33% that were urban from a total of 392 hospital (table 3).

### **Analysis Results: Hypothesis Testing**

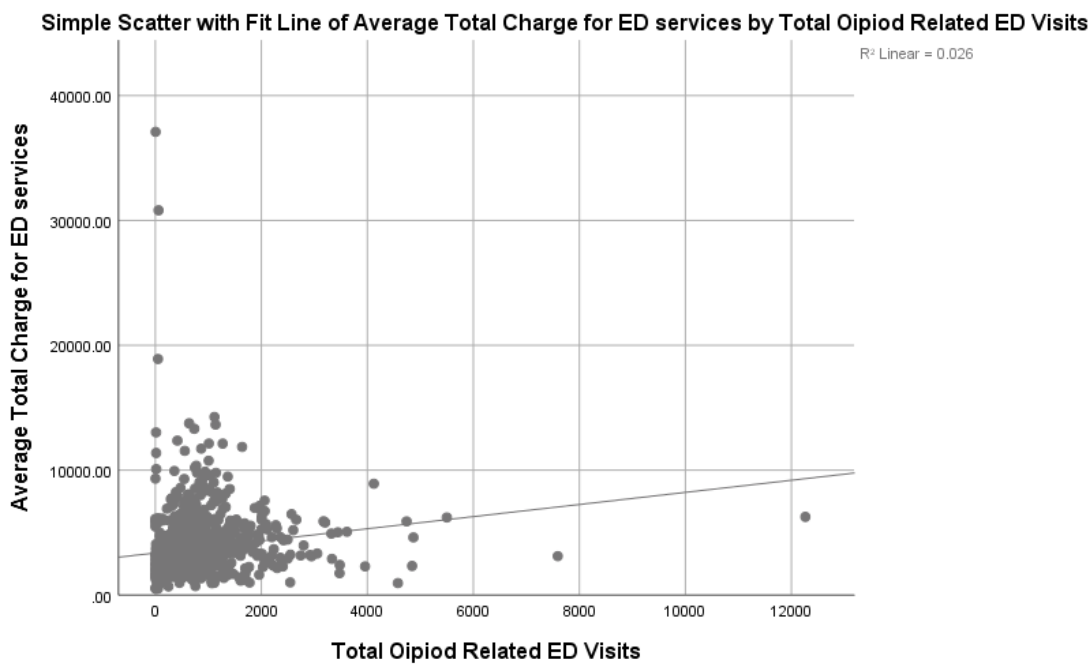
#### **Research Question 1**

To examine the relationship between the number of opioid-related ED visits and the financial liability of hospitals in the United States I used a combination of a correlation analysis and a regression analysis to determine whether a significant relationship exists between the two variables. I assessed the assumptions of linear regression using observation, a scatter plot, and a normal probability plot. By observation, both the dependent and independent variables were measured on a continuous scale, a scatter plot revealed that there was a linear relationship between the two variables (see Figure 3) and

a normal P-P plot revealed that the residual errors of the regression line were approximately normally distributed (see Figure 4).

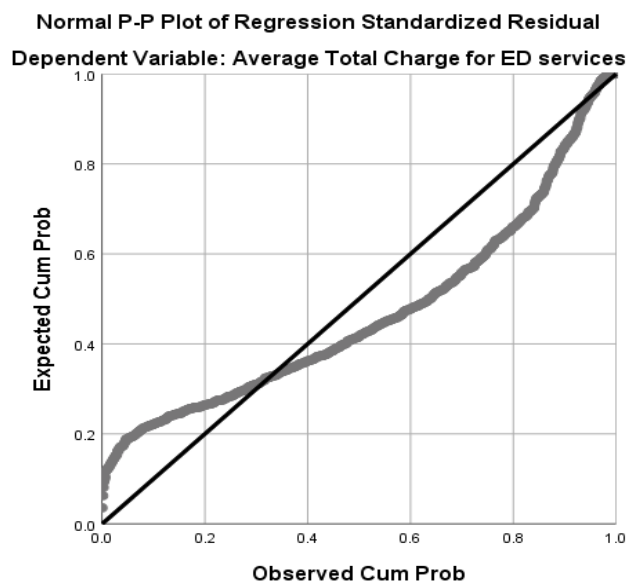
### Figure 3

*Relationship between Total ED Visit Costs and Total Number of ED Visits*



**Figure 4**

*Normal P-P Plot - Residual Errors of the Regression Line*



A sample of 894 hospital with valid opioid-related ED visits records was utilized, this sample was extracted by filtering from the NEDS and NIS databases.

The results of the Pearson correlation test were significant, ( $r=.161$ ,  $n= 894$ ,  $p < .001$ ). The results of the bivariate regression were significant,  $F(1, 893) = 27.7896$ ,  $p < .001$ .

**Table 5**

*Relationship between the Number of Opioid-Related ED Visits and ED Service Costs*

Variable	<i>B</i>	<i>SE B</i>	$\beta$	<i>t</i>	<i>p</i>
(Constant)	3372.509	110.116		30.627	.000
Opioid Visits	.485	.100	.161	4.877	.000

The regression coefficients from Table 4 indicates that the independent variable, total opioid related ED visits was a significant predictor of Total ED visit costs in a

hospital  $p = <.000$ . The coefficient for the independent variable  $\beta = .485$ , indicates that's for every 1 more opioid related ED visit, there is a 0.485 unit increase the total ED visit cost.

$$\text{Total ED Visit cost} = 3372.509 + 0.485(\text{Number of opioid related ED visits})$$

To summarize the relationship between the number of opioid-related ED visits and the financial liability of hospitals, a Pearson correlation revealed a weak positive relationship between the two. As such, when the total number of opioid-related ED visits increases, there is an increase in the average total costs for the ED visits in each hospital. A regression analysis revealed that the total number of opioid-related ED visits can be used to predict the total average costs of the ED visits cost. Therefore, I will reject the null hypothesis and accepted the alternative hypothesis and determined there is a positive correlation between the number of opioid-related ED visits and the financial liability of hospitals in the United States.

## **Research Question 2**

Bivariate and multiple linear regression was conducted to examine whether hospital bed size mediates the relationship between the number of opioid-related ED visits and aggregate ED visit costs. The predictor variable was the number of opioid related visits. Aggregate ED visit cost was the dependent variable. Hospital bed size was the mediator variable. Preliminary examination of the main assumptions of bootstrapping indicated that the sample is representative of the population.

The results of the multiple regression were significant  $F(2,891) = 12.3124$ ,  $p = <.001$  (see Tables 6, 7 and 8).

**Table 6**

*Main Effects of Hospital Bed Size Mediating the Relationship between the Number of Opioid-Related ED Visits and Aggregate ED Visit Costs*

Variable	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Constant	3468.39	151.75	22.86	.0000
Total number of ED Visits	0.4801	0.0997	4.81	.0000
Hospital bed size	-1.64	1.78	-.92	.3587

**Table 7**

*Direct Effects of X (Number of ED Visits) on Y (ED Visit Cost)*

Variable	<i>Effect (B)</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Hospital bed size	-1.64	1.78	-.92	.3587

**Table 8**

*Indirect Effects of X (Number of ED Visits) on Y (ED Visit Cost)*

Variable	<i>Effect (B)</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Hospital bed size	0.0053	0.0072	NA	NA

In a regression model to examine whether hospital bed size mediates the relationship between the number of opioid-related ED visits and aggregate ED visit costs, it was found out that by regressing aggregate ED visit costs onto Total number of ED visits, total number of ED visits significantly affected ED visit cost  $B = .485$  (table 4). However, after introducing hospital bed size as mediator effect, the change in the direct effect of number of ED visits on ED visits costs slightly changed to  $B = .4801$ . From table 7, the indirect effect of number of ED visits on ED visits costs caused by hospital bed size was just about zero  $B = .0053$ . Into perspective, the hypothesized mediated effect accounted for just about zero of all the effect of number of ED visits on ED visits costs.

As such, I failed to reject the null hypothesis and concluded that hospital bed size did not mediate the relationship between number of ED visits and ED visits costs.

I employed a Sobel test to examine the significance of the mediation effect. This test will examine whether the observed reduction in the effect of the independent variable after including the mediator variable in the model is a significant reduction.

**Table 9**

*Sobel Test*

Variable	<i>Test statistic</i>	<i>SE</i>	<i>p</i>
Sobel Test	0.8437	0.0011	.3989
Aroian Test	0.7434	0.0012	.4572
Goodman Test	1	0.0009	.3173

It was found out that the observed reduction in the effect of the independent variable after including the mediator variable in the model was not significant  $p = .3989$  (see Table 9). Therefore, it can be concluded that hospital bed size did not mediate the relationship between number of ED visits and ED visits costs.

**Research Question 3**

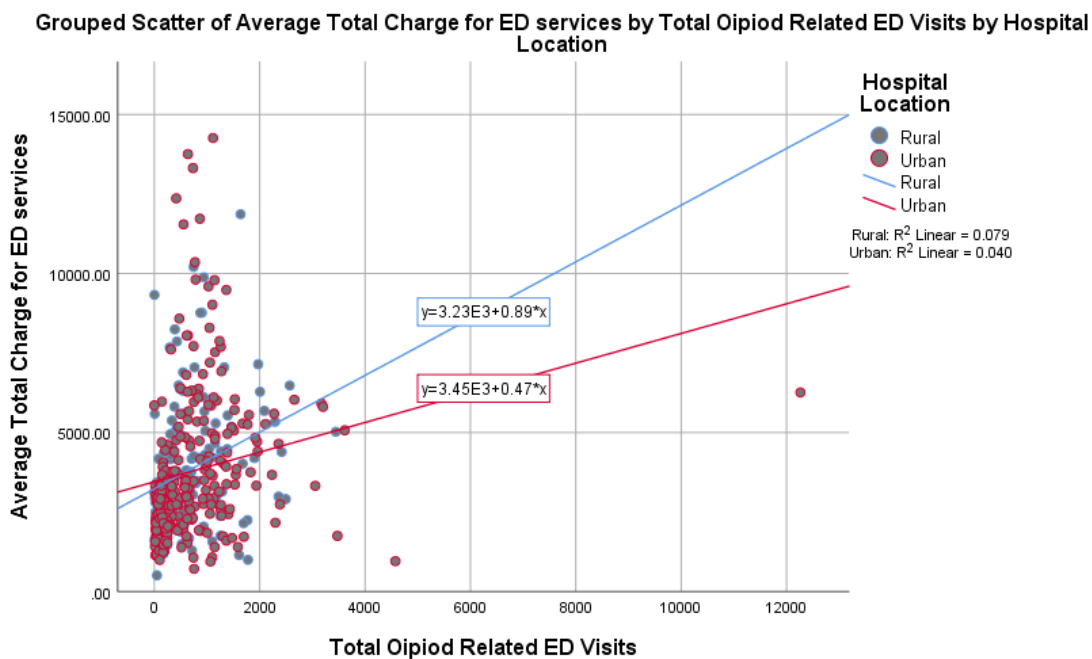
Multiple linear regression was conducted to examine whether hospital location moderates the relationship between the number of opioid-related ED visits and aggregate ED visit costs. The predictor variable is the number of opioid related visits. Aggregate ED visit costs are the dependent variable and location is the moderator variable.

Preliminary examination of the assumptions indicated both the dependent and independent variables were measured on a continuous scale, a scatter plot revealed that there was a linear relationship between the two variables as grouped by location (figure

5) and a normal P-P plot revealed that the residual errors of the regression line were approximately normally distributed (see Figure 5).

**Figure 5**

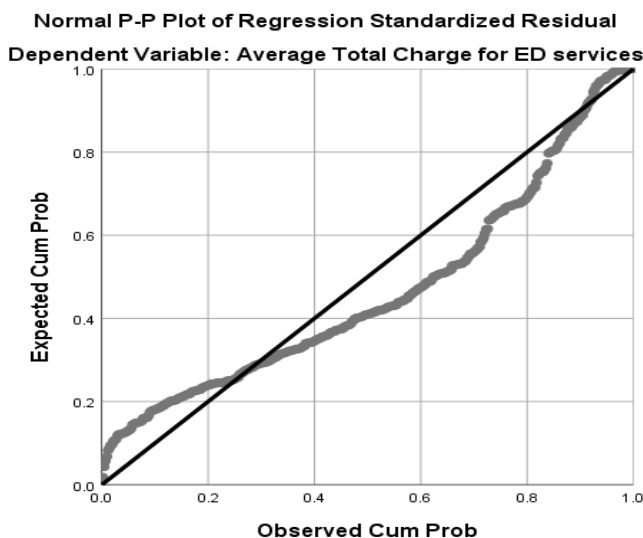
*Scatter Plot of Independent and Dependent Variables Grouped by Hospital Location*





**Figure 6**

*Normal Q-Q Plot of Residual Errors from the Model*



The results of the moderation analysis were significant  $F(3,388) = 7.039$ ,  $p < .001$ . However, the test of highest order unconditional interaction was not significant  $F(1,388) = 1.7690$ ,  $p = .184$ .

**Table 10**

*Effects of Hospital Location Moderating the Relationship between the Number of Opioid-Related ED Visits and Aggregate ED Visit Costs*

Variable	<i>B</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>
Constant	3231.6	276.684	-	11.68	.000
Total number of ED Visits	0.892	0.289	0.357	3.085	.002
Hospital Location	220.37	327.138	0.046	.674	.501
Interaction (Number of Ed visits * Hospital location)	-0.426	0.320	-0.168	-1.330	.184

Hospital location did not moderate the effects of total number of opioid-related ED visits on the aggregate ED visit cost, as evidenced by a non-significant change in variation,  $F(1,388) = 1.7690$ ,  $p = .184$  (see Table 10). Therefore, I failed to reject the null

hypothesis and concluded that the relationship between the number of opioid-related ED visits and aggregate ED visit costs is not significantly moderated by location of the hospital.

### **Summary**

This section summarizes the analysis of the main variables of the study, the results, and interpretations of statistical analysis for each proposed research questions. The statistical analysis illustrates that the relationship between the number of opioid-related ED visits and the financial liability of hospitals in the United States was statistically positive, yet weak. The Pearson correlation revealed a weak positive relationship between the two because when the total number of opioid-related ED visits increases, there is also an increase in the average total costs for the ED visits.

The statistical analysis via the Sobel test on whether hospital bed capacity mediate the relationship between the number of opioid-related ED visits and aggregate ED visit costs demonstrates that the hospital bed size did not mediate the relationship between number of ED visits and ED visits costs. And lastly, the analysis addressing whether the hospital location moderate the relationship between the number of opioid-related ED visits and aggregate ED visit costs is not statistically significant. Therefore, I agree with the null hypothesis and reject the alternative hypothesis because the relationship between the number of opioid-related ED visits and aggregate ED visit costs is not significantly moderated by location of the hospital, based on our findings from section 3.

## Section 4: Application to Professional Practice and Implications for Social Change

### **Introduction**

The utilization of the ED has been growing per capita in the U.S due to its focal role as a point of delivery for unscheduled primary care, for the treatment of non-emergent, and treatable conditions (Moore & Liang, 2020). The increasing ED utilization justifies the need for reliable performance and accessibility of its delivery system (DeLia, 2007). ED care and administration decisions are influenced by the community's needs in which a hospital is located, and the preferences of patients (DeLia, 2007). ED systems and capacity are thus expected to match or reflect its immediate community's needs. This study was aimed at examining the relationship between opioid-related emergency department visits and hospitals' financial liability in the United States. This will help hospital management make better financial risk decisions related to ED utilization.

Several problems manifest in the administration of EDs, including but not limited to, overcrowding, capacity surges, rising costs of health care services, which undermine the quality of care. The persistent opioid epidemic is also a factor that is exerting pressure on EDs across the nation (Florence et al., 2016). Efficiency is, therefore, integral for sustainable quality healthcare considering the rising costs of these services.

Academically, several empirical studies have been undertaken concerning the costs associated with the opioid epidemic: financial implications in terms of litigation costs incurred by the government and to pharmaceutical companies but studies do not detail the impact to specific hospital facilities (Charlotte, 2019; Haffajee & Mello, 2017; Weeks & Sanford, 2019). The growing ED utilization rate therefore drove the need for

the need for this study amidst the increasing cases of OUD, the need for efficient ED administration, as well as the research gap on opioid-related financial liabilities incurred by specific medical facilities (Charlotte, 2019).

The results of this study identified that there was a weak positive relationship between Total Charge for ED visits and the total number of opioid-related ED visits which meant that, when the number of opioid-related ED visits increases, there tends to be an increase the Total costs of the ED visits / financial liability to the hospital. However, further examination revealed that a hospital's bed capacity does not mediate the observed relationship, therefore, the difference between hospital bed capacities does not influence the relationship between number of visits and total costs of ED services, lastly, this relationship did not seem to be moderated by the location of the hospital.

### **Interpretation of the Findings**

The results indicated that Emergency department costs attributed to opioid related ED visits are positively related to the number of ED visits from opioid cases. Results of Greene et al. (2019), who conducted the MedEncentive Mutual Accountability and Information Therapy (MAIT) Program with 1800 members are in line with the results of this study. In their study, the researchers found out that there were reduced hospitalizations and ED visits, consequently, reduced ED healthcare costs as a result of the program under study. Hospitalizations per 1,000 reduced by 32%; ED visits decreased by 14%; while annual per capita expenditures reduced by 10.8% post-program implementation. On the other hand, this study has confirmed the findings of Shah, (2015), who assesses the factors associated with higher ED visits in the US. In their study, it

was observed that higher ED utilization, more so, unnecessary utilization of the ED results in higher costs, in addition to poor patient satisfaction, medication errors and lower quality. Priest (2019) echoed the same observation in a study concerning hospital-based services for opioid use disorder.

The results also indicated that hospital location, whether rural or urban, did not moderate the relationship between opioid-related ED visits and the associated financial liability/ total costs of ED visits which did not agree with the conclusions of peer-reviewed literature. For instance, Mosher et al. (2017) in their paper comparing trends in opioid overdose hospitalization trends among residents of rural setups and residents in urban areas in the U.S found hospitalization rates for heroin overdose were higher among urban residents at 5.5 per 100,000, compared to rural residents at 2.1 per 100,000. However, with respect to prescription opioid overdose, hospitalization rates were higher in rural populations by 20% to 30%. A study by Patel et al. (2020) acknowledged the strain placed on emergency departments by the opioid crisis revealed that those inhabitants of large metropolitan areas, those earning incomes below the 25th percentile, and those in the age bracket of 25 to 44 years were most likely to develop opioid-use disorders and visit EDs with opioid-related issues when compared to their counterparts in rural settings. However, the reviewed literature did not examine whether location would strengthen, diminish, negate, or otherwise alter the association between opioid-related ED visits and the total costs of ED services. While other literature has identified that it was more likely for people living in urban areas to be at a higher risk of being admitted to an ED service due to opioid related conditions, this study has extended this knowledge to

add that, although cases of ED visits might be different in rural and urban settings, it does not necessarily affect how the number of ED visits are associated to total ED costs.

Lastly this study examined whether a hospital's bed capacity mediates the relationship between number of visits and total costs of ED services and found that bed capacity does not. With effect of this finding, bed capacity in no way explains how the number of opioid related ED visits is related to the total costs of ED services/ visits. As a result, this finding disagrees with previous studies that concluded that, poor capacity planning such as small and inadequate bed capacities results in unnecessary and avoidable costs. However, this is not the case as this study has found that bed capacity does not lead to higher costs of Ed services.

In relation to Reason's theory of failures as incorporated into risk management within the healthcare sector by Cagliano et al. (2011); and the ED three factor crowding model by Asplin et al. (2003). Reason's theory of failures resonates with the findings of this study. I identified that the financial risk of a hospital is directly related to the number of ED visits, as such, reason theory of failure suggests that financial liability decisions in hospitals, specifically regarding OUD management, are pegged on the facility's financial risk management. Based on this theory, there is a relationship between the financial liability of a hospital and its management. On the other hand, based on this theory, the ED crowding conceptual model identifies three interdependent components which need effective managing: input, throughput, and output. ED input comprises any systemic characteristic, event, or condition which generates demand for ED services such as emergency care, unscheduled urgent care, and safety net care and in this case, opioid-

related factors, the throughput represents the time taken based on efficiency and ability of the department and lastly the output which is discharge. With these three components being interdependent based on Reason theory of failure, it would explain why an increase in input (Number of ED visits) would affect the throughput and output and the financial liability of the hospital (ED visit cost).

### **Limitations of the Study**

By using secondary data, the generalizability of this study's findings was limited to only the states and hospitals with available data in the Nationwide Inpatient Sample (NIS) and the Nationwide Emergency Department Sample (NEDS). The secondary dataset, being a predetermined data source on opioid-related ED visits, the average cost per ED visit, and hospital bed capacity statistics, ended up having many missing observations that led to reduced reliability of the sample. Lastly, the secondary dataset contained codes to represent opioid-related hospital use and ED services. However, these codes might not have been accurate and consistent and with no way to verify their validity, this study was limited to the accuracy of the initial NIS and NEDS datasets.

### **Recommendations**

While conducting this study, various challenges, strengths, and limitations were encountered. Based on them, I have identified various recommendations for further research into this topic. Due to the utilization of secondary data sources, this study was limited to the fact that the data may not have answered the specific research questions posed in this study and that it might not have contained specific information required. For instance, bed capacity was narrowed down to three categories, small, medium, and large

capacities, whereas a continuous variable might have been more appropriate. Further research using primary data might be needed to verify this study and avoid the shortcomings of secondary data.

Further research will be appropriate for this study to break down the specification of hospital location by expanding to more diverse locations instead of basing the study on a rural urban setting. A study in the literature review by Mallow et al. (2018) revealed that opioid-related hospital costs, and the other two variables, varied across the country based on geographical locations which were more characterized by factors such as weather, economic activities, dominant races, policing, and other grouping rather than being rural or urban. A study to consider these geographical factors might result in a different result other than what has been identified in this study.

### **Implications for Professional Practice and Social Change**

#### **Implications for Professional Practice**

The outcome of this analysis is vital for health service organizations to understand the association between opioid-related ED visits and a facility's state, location, and bed capacity to the total costs of ED services. The findings have clearly identified the factors that may lead to an increase in the financial liability of a hospital and factors that do not contribute to the same. These finding will help health care administrators make decisions to save costs and boost efficiency in the ED departments in a better way to handle opioid-related cases in these facilities.

On the other hand, since it has been identified that an increased number of ED visits significantly leads to an increase in the total costs of Ed services, health care



administrators will be able to develop enhanced real-time data sharing among healthcare facilities to improve response and detection of ED spikes to help hospital better administer services that in turn might reduce the costs of ED services for opioid related cases. Lastly, the insights from this study might help health care practitioners facilitate resource allocations that are in line with a facility's needs. For example, a hospital with a higher demand for its ED services might require more resources than other facilities with lower demand. This in turn might lead to a decrease in financial liability of such facilities.

### **Implications for Social Change**

The findings from this study have a positive implication for social change on a society level. According to the study's findings, an increase in the number of opioid related ED visits is associated to higher cost of ED services, as a result an increased health care expenditure. This is proof that the economic burden of the opioid crisis is evident. Management should be undertaken to improve the efficiency of ED service and allocate resources appropriately to make sure that facilities with an influx of opioid-related cases are better managed without necessarily leading to higher costs, on the other hand, the society at large should also advocate for other methods of reducing opioid-related ED visits such as creating awareness of the danger of opioids. As a result, the high number of these ED visits can be reduced, which will reduce the economic burden of such visits.

**Conclusion**

ED visits, preventable or otherwise, are associated with higher health care costs (Greene et al., 2019). Such expenses inflate the hospitals' financial liability, consequently affecting financial viability and profitability. On the other hand, this observation, more ED visits being associated to higher costs is not impacted or influenced by hospital location or bed capacities. The implication of this is the need for efficient management of the ED's in terms of cost minimization and capacity optimization or other methods such as reducing ED visits through social change.

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