2023

The Relationship Between Poverty and Hospital Readmission Rates for U.S. Patients with Chronic Obstructive Pulmonary Disease, Heart Failure, and Asthma

Gardel Benz Eliazaire
Walden University

Walden University

College of Management and Human Potential

This is to certify that the doctoral study by

Gardel Benz Eliazaire

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee

Dr. James Rohrer, Committee Chairperson, Health Sciences Faculty
Dr. Kristin Wiginton, Committee Member, Health Sciences Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2023

Abstract

The Relationship Between Poverty and Hospital Readmission Rates for U.S. Patients with Chronic Obstructive Pulmonary Disease, Heart Failure, and Asthma

by

Gardel Benz Eliazaire

Doctor of Healthcare Administration

Doctoral Study Submitted in Fulfillment

of the Requirements for the Degree of

Doctor of Healthcare Administration

Walden University

August 2023

Abstract

Hospital readmissions have continuously been a concern to health care providers and policy makers because of their negative impacts on the economy and the well-being of patients. A gap in knowledge exists in the understanding of the factors that have led to increased readmissions due to chronic cardiovascular diseases (Heart Failure) and respiratory diseases (chronic obstructive pulmonary disease [COPD] and Asthma). The aim of this study was to examine the relationship between poverty rate and hospital readmission rates for patients with COPD, Heart Failure, and Asthma in the United States using secondary data from the Healthcare Cost and Utilization Project's (HCUP's) Nationwide Readmission Database (NRD). The study sample was composed of 246,657, 54,640 and 77,189 readmission cases for COPD, Heart Failure and Asthma respectively. This study was aligned to Andersen's behavioral model of health services, which asserted that the use of health care services was supply induced and therefore strongly dependent on the structures of health systems. Furthermore, an individual's social characteristics also influence their utilization of health care services. Multivariable regression and correlation analyses were performed on the data. Readmission for COPD and Heart Failure were associated with poverty rate with the hospital readmission rate higher for patients below the poverty rate. Health practitioners and administrators should consider creating measures to reduce growing inequalities in health care delivery to ensure that the financial status of patients does not hinder their access to medical care. By addressing health care inequalities due to patients' economic status, stakeholders will be in a position to improve health care utilization and outcomes, thus effecting positive social change.

The Relationship Between Poverty and Hospital Readmission Rates for U.S. Patients with Chronic Obstructive Pulmonary Disease, Heart Failure, and Asthma

by

Gardel Benz Eliazaire

Doctor of Healthcare Administration

Doctoral Study Submitted in Fulfillment

of the Requirements for the Degree of

Doctor of Healthcare Administration

Walden University

August 2023

Acknowledgements

I am deeply grateful to my family members whose unwavering support and encouragement have been the foundation of my dissertation journey. To my parents, Elcie Guilleauto and Joseph Eliazaire, your belief in me and your sacrifices have propelled me forward. Your guidance and love have been my driving force.

I extend my heartfelt appreciation to my extended family and loved ones. My non-biological mom, Maculeuse Silencieux, your kindness has been a beacon of warmth in my life. My sister, Mania Guilleauto, your unwavering faith in my abilities has been a constant motivation. To my cousins, Elicia Eliazaire Carilus and Pierre Marc Carilus, your support has meant the world to me.

I also want to express my gratitude to my three supportive uncles, Maxime Dorlus, Arnaud Guilleauto, and Michel Joseph, for your guidance and encouragement. Lastly, to my friends, Kevin Nyakundi and Melvina West, your steadfast presence and support have been a source of strength. Each of you has played an invaluable role in this accomplishment, and I am profoundly thankful for your presence in my life.

Table of Contents

List of Figures

Section 1: Foundation of the Study and Literature Review

Hospital readmissions have continuously been a concern to U.S. health care providers and policy makers because of their negative impacts on the economy and the well-being of patients and the general population. There were an estimated 3.8 million hospital readmissions within 30 days in the United States in 2018, which constituted a readmission rate of 14.0% for all ailments (Weiss & Jiang, 2021). The average cost of readmission was $15,200, which places a burden on health care budgets and provider resources. Additionally, readmission imposes emotional and physical stress on patients who worry about the status of their health (Ho et al., 2019). Various studies have been undertaken to examine the factors that lead to these high rates of readmission.

One of the factors that contributes to high rates of readmission is the quality of health care, research indicates. Kim et al. (2021) noted that the quality of health care, especially among individuals with severe ailments such as chronic obstructive pulmonary disease (COPD), Asthma, and Heart Failure (HF), influences the chances of readmission within 30 days. Additionally, this study suggests that when patients do not receive quality diagnosis, treatments, and medications to treat or control these diseases, their conditions worsen drastically and they have a higher likelihood of being readmitted again in 30 days. Research by Ray et al. (2013) substantiates that the cost of diagnosis and treatment of pulmonary diseases such as Asthma and COPD and other conditions such as HF is very high. Ray et al. examined the costs of health care in the United States and found that in 2010, the cost of diagnosing and treating COPD increased for each progressive stage of the condition. The average yearly cost for a patient to receive standard health care

when their COPD was in Stage 1 was $1,681 whereas the average cost was $5,037 in Stage II and $10,812 in Stage III. These health care costs have increased over time with government records reporting that in 2017, the average yearly costs of managing COPD had risen to $27,579 per patient (Kauffman, 2016).

Research shows that it is very expensive to receive health care for COPD, Heart Failure and Asthma in the United States, which would mean that people living under poverty levels might not be able to afford health care for these conditions. For this reason, the economic status of patients is an identified factors that contributes to high rates of readmission, some researchers have argued (Kauffman, 2016). There is a need to determine whether there exists a relationship between poverty rate and hospital readmission rates for patients with COPD, HF, and Asthma.

Background

Inequalities in health care are a significant contributor to the increased prevalence of certain ailments in the United States. Singh and Lin (2019) studied the U.S. mortality rate in different regions based on urbanization and the impact that social determinants can have on health. The researchers found that there was higher mortality rate in more rural areas prone to deprivation. The study revealed an area of growing concern as inequalities in health care delivery have already been associated with adverse health outcomes. Singh and Lin noted that these inequalities represent a problem that needs to be addressed. Addressing the growing inequalities in health care delivery is supported by Hussein and Field (2016), who conducted sought to determine the relationship between an individual's socioeconomic status and access to basic health care. The researchers found no evidence

that individuals who are living in poor neighborhoods have access to poor health care. However, due to many economic factors, in low-income communities, there was less access to medical facilities and resources making it hard for residents in these areas to receive adequate care.

Various researchers have explored the relationship of hospital readmission to poverty level. Jencks et al. (2019) studied the independent contributions of a patient's neighborhood and a hospital's service area to the patient's risk for 30-day readmission. The researchers found that patients living in neighborhoods at the 90th percentile of disadvantage had a readmission rate of 14.1% compared with 12.5% for similar patients living in neighborhoods at the 10th percentile. This study reinforces that poverty level leads to lower quality health care and, therefore, increased chances of readmission.

In this doctoral project, I examined whether hospital readmissions varied with the economic status of patients. This focus is supported by Berman et al. (2020), who studied the association of neighborhood-level socioeconomic disadvantage with long-term outcomes among patients who experienced a myocardial infarction at a young age. The researchers found that higher neighborhood disadvantage was associated with a 32% higher all-cause mortality. Socioeconomic disadvantage was a major cause of hospital readmission. The previous literature supports further investigation of the nature of the relationship between hospital readmission and economic status to develop a clear picture of the problem and how it can be addressed.

In the body of knowledge regarding health care administration, researchers have examined factors such as hospital readmissions as a crucial influencer of how health care

is administered. Hermes et al. (2021) studied the relationship between neighborhood socioeconomic and hospitalization leading to mortality among patients with pneumonia, HF, and acute myocardial infarction. Results of the study demonstrate a positive relationship between neighborhood socioeconomic disadvantage and mortality for some conditions. This study is relevant to this study because it provides insights on how socioeconomic status can affect individual health outcomes. In another study, Knighton et al. (2016) studied the relationship between the area of deprivation index and health outcomes. They found that initial applications in three meaningfully different areas of an integrated health system provide initial evidence of its broad applicability in addressing the impact of social determinants on health. The study is beneficial to this research because it describes the association between low-income neighborhoods and the health care system and how broad factors influence the quality of care received by certain patients. As a result, it will add to the body of knowledge regarding the relationship between poverty rates and readmission for COPD, HF and Asthma.

Problem Statement

In this doctoral project, I examined the relationship between poverty rate and hospital readmission rates for patients with COPD, HF, and Asthma in the United States. The costs of treating conditions such as COPD, HF, and Asthma have been increasing annually with the costs surpassing the poverty threshold of the United States. For example, Menzin et al. (2008) found that hospitalization due to COPD and other pulmonary disease such as Asthma cost over 79% more than a hospitalization due to other non-severe diseases. This indicates that the cost of treating these diseases is very

high when compared to other ailments in the United States. The very high costs associated with treating pulmonary diseases such as COPD, Asthma, and other ailments such as HF are especially problematic for individuals who meet the federal guidelines for poverty status. The United States Department of Health and Human Services in 2021 announced that the federal poverty level for an individual was $12,880 and $26,500 for a family of four (HealthCare.gov, 2022). These incomes are not capable of supporting the average annual costs of $4147 (±$6255) for COPD care (May & Li, 2015).

These figures indicate that most people living below the poverty level in the United States are not in a position to pay for quality health care when diagnosed with diseases such as COPD, Asthma, and HF. When an individual is not able to obtain proper treatment, their COPD and Asthma conditions may progress drastically and therefore increase their chances of being readmitted to a hospital again in 30 days. These readmissions have a negative impact on health care administration as they increase the economic burden of health care delivery, constrain resources, reduce economic input as works and school days are lost, and result in physical and emotional distress among patients and their families (Mcneill & Khairat, 2020).

Hospital readmission rates are caused by a number of factors. With the known adverse impacts of hospital readmissions and the rising costs of health care for diseases such as COPD, Asthma, and HF, it is crucial that health care administrators and policy makers understand the relationship between poverty levels and readmission for patients with these conditions. This knowledge may shape their decisions and policy making, which may influence the delivery of quality health care to all members of the community.

Purpose of the Study

The main purpose of this this study was to determine the association between poverty rate, as measured using socioeconomic status, and hospital readmission of patients with COPD, Asthma, and HF. To achieve this, I measured the strength of the relationship to determine how much the economic status of a patient influences hospital readmission due to these diseases. Last, I sought to determine whether readmission rates are higher for individuals below the poverty level than those above the poverty level. Health care and hospital administration systems are challenged by the readmission rates of the patient populations they serve. Analysis of the links between economic status and health care outcomes may allow for more informed decisions and changes to optimize health care systems relative to chronic cardiovascular diseases (HF) and respiratory diseases (COPD, Asthma).

A gap in knowledge exists in the understanding of the relationship between the factors that account for the increased level of readmission to hospital due to chronic cardiovascular diseases (HF) and respiratory diseases (COPD, Asthma). Although institutional practices do influence the level of health care and, as such, the rates of readmission, the quality of health care can be curtailed by the patients' lack of money to pay for the services (Manickam et al., 2017). Therefore, although an institution may be in a position to provide quality health care, patients without the means to access this health care might not receive the required treatment. Therefore, the chances are high that they might be readmitted even though the institution provides quality health care.

The purpose of this doctoral study was to examine this knowledge gap and determine whether lack of quality health care leading to higher readmission rates is a consequence of the economic status of a patient. To achieve the study purpose, I examined the relationship between poverty level and readmission to hospital due to chronic cardiovascular diseases (HF) and respiratory diseases (COPD, Asthma). In particular, I wanted to assess whether readmission rates are more prevalent in patients below the poverty level when compared to those above the poverty level.

Research Questions and Hypotheses

To address the study purpose, I developed the following research questions (RQs) and hypotheses:

RQ1. Is readmission for COPD associated with poverty rate among residents of the United States?

$H_0$1: There is no statistical relationship between readmission for COPD and poverty rate among residents of the United States.

$H_1$1: There is a statistical relationship between readmission for COPD and poverty rate among residents of the United States.

RQ2. Do the control variables (Area Deprivation Index [Urban-Rural classification], age, gender, and insurance status) affect the association between readmission for COPD and poverty rate among residents of the United States?

$H_0$2: Urban-Rural classification, age, gender, and insurance status do not affect the association between readmission for COPD and poverty rate among residents of the United States.

$H_1$2: Urban-Rural classification, age, gender, and insurance status significantly affect the association between readmission for COPD and poverty rate among residents of the United States.

RQ3. Is readmission for HF associated with poverty rate among residents of the United States?

$H_0$3: There is no statistical relationship between readmission for HF and poverty rate among residents of the United States.

$H_1$3: There is a statistical relationship between readmission for HF and poverty rate among residents of the United States.

RQ4. Do the control variables (Urban-Rural classification, age, gender, and insurance status) affect the association between readmission for HF and poverty rate among residents of the United States?

$H_0$4: Urban-Rural classification, Age, gender, and insurance status do not affect the association between readmission for HF and poverty rate among residents of the United States.

$H_1$4: Urban-Rural classification, age, gender, and insurance status significantly affect the association between readmission for HF and poverty rate among residents of the United States.

RQ5. Is readmission for Asthma associated with poverty rate among residents of the United States?

$H_0$5: There is no statistical relationship between readmission for Asthma and poverty rate among residents of the United States.

$H_1$5: There is a statistical relationship between readmission for Asthma and poverty rate among residents of the United States.

RQ6. Do the control variables (Urban-Rural classification, age, gender, and insurance status) affect the association between readmission for Asthma and poverty rate among residents of the United States?

$H_0$6: Urban-Rural classification, age, gender, and insurance status do not affect the association between readmission for Asthma and poverty rate among residents of the United States.

$H_1$6: Urban-Rural classification, age, gender, and insurance status significantly affect the association between readmission for Asthma and poverty rate among residents of the United States.

Theoretical and Conceptual Framework

I aligned the study to Andersen's behavioral model of health services. The theory explains an individual's use of health care services (Andersen, 1995). The original model focused on an individual's predisposition to use acute health care services, enabling factors that facilitate use, and an individual's perceived or influenced need for care (Lederle et al., 2021). A key proposition is that the use of health care services is supply induced and therefore strongly dependent on the structures of the health systems. Furthermore, an individual's social characteristics also influence their utilization of health care services.

Shafeek Amin and Driver (2020) elaborated on the predisposing and enabling factors that influence use of health care services. Regarding enabling factors, financing

and organizational factors serve as conditions that enable services utilization. Individual financing factors involve the income and wealth at an individual's disposal to pay for health services and the effective price of health care, which is determined by the individual's health insurance status and cost-sharing requirements. This theory resonates with this study based on the notion that an individual's ability to pay and meet the financial requirements to obtain health care services might, due to poverty, hinder their proper utilization of health services. As such, they may receive less care than required for their conditions, therefore triggering frequent hospital readmissions (Kim & Frank-Miller, 2015).

Nature of the Study

For this study, I used a quantitative research approach. Secondary data measuring hospital readmission rates in the United States from the Healthcare Cost and Utilization Project's (HCUP's) Nationwide Readmission Database (NRD) database were analyzed in this study (see Weiss & Jiang, 2022). The independent variable was poverty rate measured as an individual's income in relation to the federal poverty level. The dependent variables were hospital readmissions due to COPD, HF, and Asthma. To address the RQs, I conducted a multiple regression analysis to determine the association between poverty rate and the readmission rate of patients with COPD, HF, and Asthma in all U.S. counties. Multiple regression analysis not only helped to identify whether a relationship existed between the dependent and independent variables, but it also helped determine the nature of the relationship, its direction, and strength. I also controlled for

predisposing, enabling, and need factors. Age, ethnicity, and gender were used to control for predisposing factors, and patient's location was used to control for enabling factors.

Literature Search Strategy

I conducted a literature review with an emphasis on materials related to hospital readmission rates due to COPD, HF, and Asthma, and factors that could be contributing to these conditions. I searched for recent literature that was not older than 10 years. Various databases were searched, including JSTOR, ProQuest Dissertations & Theses Global, SAGE Journals, and the National Library of Medicine. Keywords and phrases used in the literature search were *readmission, poverty and readmission, readmission and COPD, Asthma and Heart Failure, health services administration,* and *impact of poverty of health services utilization.*

Literature Review Related to Key Variables and Concepts

In this study, I examined the relationship between poverty rates and hospital readmission due to COPD, HF, and Asthma in the United States. The predictor variable was poverty rate level, and the responses variables were readmission due to COPD, HF, and Asthma. Literature related to the association between these variables are addressed in this section.

Association Between Poverty Levels, Health, and Hospital Readmission

Various studies have been undertaken to analyze and examine the association between poverty and hospital readmission rates. Hermes et al. (2021) studied the relationship between neighborhood socioeconomic and hospitalization leading to mortality among patients with pneumonia, Heart Failure, and acute myocardial infarction.

The results of the study demonstrate a positive relationship between neighborhood socioeconomic disadvantage and mortality for some conditions indicating that people who are economically disadvantaged are more prone to severe health outcomes. In their study of 3,471,592 Medicare patients, the authors identified that the groups of people with lower economic status had a higher 30-day mortality for some conditions even after accounting for individual levels demographics and clinical comorbidities. This revealed that poverty play a significant role in the health outcomes of individual. However, the study did not go into how poverty or being economically disadvantaged resulted in higher mortality rates for certain conditions. This study will try and examine this relationship deeper but in terms of hospital readmission.

Another study by (Andrew, et al, 2016) studied the relationship between the area of deprivation index and health outcomes. The authors found that initial applications in three meaningfully different areas of an integrated health system provide initial evidence of its broad applicability in addressing the impact of social determinants on health. The author describes the impact that social determinants can have on health. Such indices provide a geographic, area-based measure of how socioeconomically deprived residents of the state of Utah are on average (Andrew et al, 2016). The aim of the study was to provide insights on the impact of Urban-Rural classification and health care outcomes. Results of the study concluded that initial applications in three meaningfully different areas of an integrated health system provide initial evidence of its broad applicability in addressing the impact of social determinants on health. This finding can be linked to the findings of a paper by (Singh & Lin, 2019) who examined the impact that social

determinants can have on health. They found that Urban-Rural classification increased significantly and there was higher mortality rate in more deprived areas than there was in areas with low deprivation. According to the author of the study, Urban-Rural classification plays an important role in patient outcomes. Despite the overall decline in mortality, persistent or increasing inequalities in life expectancy, infant mortality, all-cause mortality, and mortality from several major causes (such as cardiovascular disease, cancer, diabetes, respiratory disease, and HIV/AIDS) have been reported to be higher in areas linked to higher social deprivation. On the other hand, low-income families tend to have less access to care, less education which can potentially lead to unwanted outcomes, mortality or readmissions.

Other studies have been conducted to explore whether poverty and low-income earning individuals and communities are adversely after by access to basic health care. Hussein and Field (2016) studied and conducted multiple analysis to determine the relationship between socioeconomic status of an individual with access to basic health care. The authors found no evidence that individuals who are living in poor neighborhoods have access to poor health care. However, due to many economic factors, it was found that low-income neighborhood residence associated with less reliance on physician offices and that low-income neighborhoods had a lower distribution of hospitals and medical centers when compared to other neighborhoods with high income earners.

This finding was also reflected by a study by (Stephen et al., 2019) exploring the independent contributions of the patient's neighborhood and the hospital's service area to

risk for 30-day readmission in Maryland. Result of the study showed that patients living in neighborhoods at the 90th percentile of disadvantage had a readmission rate of 14.1% (95% CI, 13.6% to 14.5%) compared with 12.5% (CI, 11.8% to 13.2%) for similar patients living in neighborhoods at the 10th percentile. This study was aligned to Andersen's behavioral model of health services arguing that individual's social characteristics such as disadvantaged neighborhood influence their utilization of health care services. This study did not take into account any control variables since it omitted individual characteristics and therefore subject to confounding. The association of readmission risk with the hospital's safety-net index was approximately twice the observed association with the patient's neighborhood disadvantage status. This study will expound on the findings by Stephen Et Al (2019) by incorporating control variables to fill the knowledge gap of whether the relationship between poverty rate and readmission is due to a patients lack of money to pay for quality health care to begin with by controlling for patents demographics and making a comparison between different income groups.

A meaningful gap in knowledge exists in the understanding of the relationship and association between the factors that have led to the increased level of readmission to hospital due to chronic cardiovascular diseases (Heart Failure) and respiratory diseases (COPD, Asthma). While a health delivery institution practice quality will determine the level of health care they provide and as such, the rates of readmission to their institutions, this quality health care can be curtailed by the patients lack of money to pay for the services. Therefore, while an institution may be in a position to provide quality health care, patients without the means to meet the requirements for this health care might not

get the required treatment and therefore chances are high that they might be readmitted even though the institution provides quality health care.

Association Between Hospital Readmission and Area Deprivation Index

Various studies have been undertaken to analyze and examine the association between hospital readmission and Urban-Rural classification. A study by Gershon et al. (2019) of 126,013 patients who contributed to 252,7546 COPD hospitalizations from 168 hospitals in the United States found that 19.4% resulted in a readmission within 30 days. However, the readmission for COPD in hospitals within areas of high Urban-Rural classification increased by 5% to 10 % than the sample average. The areas with high Urban-Rural classification in their study was measured using an index of socioeconomic conditions such as low median income when compared to the regions average, lack of adequate access to social amenities such as hospitals and other necessary infrastructure. This study reveals that Urban-Rural classification affects the readmissions for COPD and were used in this study to control for the effect of poverty rate on hospital readmission for COPD, Heart Failure and Asthma in the United States.

Association Between Hospital Readmission and Gender and Age

Various studies have been undertaken to analyze and examine the association between hospital readmission and gender and age. One study by Kim-Dorner et al. (2022) focused on describing the prevalence of chronic comorbidities in patients with COPD and Asthma who are under the care of general practitioners (Gp'S) and pulmonologists, as well as how they fluctuate depending on gender and age. In their study (_), analyzed 7966 COPD and Asthma patients, 45% of whom were female, over 5 years of

observation in the clinic using Elixhauser measurements and 60 unique Chronic comorbid comorbidities (CCC). Over ninety percent of patients suffered from at least one comorbid condition, and 51.7% had more than three. There was no discernible difference between the sexes in terms of the presence or absence of comorbidities. On the other hand, the Elixhauser-van Walraven index was higher in men, and the types of comorbidities that each gender experienced were distinct from one another. Comorbidities were more common in patients who were older, although they were about as common in patients who were in their 30s and 40s (Kim, Choi, Kim & Jo, 2021).

In addition to this, patients seen in general practice had a wider variety of comorbid conditions than those seen in pulmonology, making the overall number of comorbid conditions higher. All of the patients suffered from psychological co-morbidities; however the younger patients had a greater prevalence of them. As a result of this differences such as the difference types of comorbidities that each gender experienced and being more common in older patents led to a difference in the number of times patients of different genders and age had to see a doctor. These conclusions can be associated in different readmission rates for COPD and Asthma based on gender and age. It is therefore necessary to explore whether age and gender influences the relationship between hospital readmission and poverty rates.

Association Between Hospital Readmission and Insurance Status

Since the implementation of the Hospital Readmissions Reduction Program (HRRP), the number of times that Medicare patients with conditions that are explicitly

targeted by the program are readmitted to hospitals has decreased. The targeted conditions were acute myocardial infarction, Heart Failure, and pneumonia.

According to the data gathered by Ferro et al. (2019), once HRRP was implemented, the pace at which readmissions occurred reduced considerably for patients receiving Medicare as well as Medicaid. This was true for the overall readmission rate as well as for the specific target conditions. The rates of readmission for Medicare patients went down, but the total readmission rate for Medicaid patients remained significantly higher. During the course of the research, patients with private insurance had decreased overall readmission rates, which fell at a rate that was comparable to that of patients with conditions that were not the focus of the study. These results suggest that the medical; insurance status and type affects the readmission to a hospital within 30 days for various conditions. This study will examine whether insurance status affects the association between hospital readmission and poverty rates.

Financial Impact of Hospital Readmission

Readmission to hospitals can be a sign of breakdown in the health systems and in this case a very costly routine because it involves a patients return to the costliest care possible, the inpatient hospital care. Hospital readmissions have continuously been a concern to health care providers and health care policy makers because of its huge negative impacts to the economy of a country and the well-being of patients and the general population. National statistics in 2018 in the United States have revealed that there were an estimated 3.8 million hospital readmissions within 30 days which equaled to a readmission rate of 14.0% for all ailments (Weiss, A. J., & Jiang, H. J., 2021). These

readmissions cost an average of $15,200 putting a very high burden on healthcare budgets and a resource constrain on health care providers around the country.

With this high cost of readmissions, the impact of the overall health care systems is high. As the number of readmissions increases, there are chances that hospital was overcrowded and most patent will not get the required cares due to constrains in resources and manpower such as caregivers and physicians. On the other, the costs of readmission also utilize funds that would have otherwise been used to implement other health care systems such as expansion of care coverage, equipping hospital and hiring more caregivers and physicians to improves the overall health care industry in the United States (Enumah & Chang, 2021). This impact reveals the urgent need to study readmission and factors that contribute to its increase in an effort to reduce them and achieve quality health care for all people.

Emotional Cost of Hospital Readmission

When it comes to the emotional cost of hospital readmissions, it's vital to recognize how infrequently patients and direct caregivers are asked about the process and how they felt their situation was handled. In study by Smeraglio, 2019, patients generally believed their readmissions should have been avoided, with most of the patients and caregivers citing concerns such as discharge timing, follow-up, home health, and professional services (Smeraglio et al., 2019). On the other hand, healthcare professionals involved in the readmission failed to acknowledge their probable role in the readmission. For instance, the study cited that in their analysis, they found that 49% of readmissions in a certain local hospital had adequate opportunity to improve the situation but the

objective was not achieved. A self-reported questionnaire to the care givers in this local hospital revealed that most of the primary care givers and hospital management staff indicated that inadequate support, high volume of patients and few resources put a strain on the caregivers leading to problems in discharge planning, care transition and patient education (Hansen et al., 2010). As revealed by these researchers' hospital readmission has emotional consequences to both the patients and caregivers intensifying the need for proper methods to reduce readmission altogether.

Definitions

Following are operational definitions for terms used in the study:

Insurance coverage: A measure of whether a patient has or does not have health insurance.

Patient age: A control variable representing the age of a patient.

Patient gender/ ethnicity: A coded categorical variable representing the gender or ethnicity of a patient.

Patient location: The registered location of a patient. It was coded under various categories using a neighborhood deprivation index for U.S. counties to represent patients from different locations.

Poverty rate: A measure of a patient's income in relation to the federal poverty level index. It was coded as binary variable (i.e., either above or below the index).

Readmission rate: A calculated measure of readmissions in a given hospital or health institution within 30 days of discharge for the following conditions: COPD, HF, and Asthma.

Assumptions

Two assumptions were made in relation to the meaningfulness of this study. The first assumption was that the relationship between the dependent variables, readmission rates and independent variable, poverty rate was linear ad that they were normally distributed. This assumption was necessary in order to test the nature of the relationship between poverty rate and readmission rates. On the other hand, this study also made the assumptions that the secondary data, National Readmission Dataset (NRD) acquired from the HCUP database was accurate and reliable to address this study's research questions. This was necessary because the available dataset was not originally meant for this purpose.

Scope and Delimitations

I examined the relationship between poverty rates and hospital readmission due to COPD, HF, and Asthma in the United States. The rationale for the study was an increasing need to address disparities in health care coverage in the United States. By utilizing the NRD secondary dataset which utilizes a sample that is representative of the entire population of the United States population, the generalizability of the findings and conclusions of the proposed study can therefore be made for all regions across United States. However, the generalization of the findings of this proposed study were only be applicable to the United States which is the intended population.

Limitations

This study was limited to the available secondary data present in the NRD dataset. Therefore, the study was limited to data available for the year 2019, which is the latest

year that the NRD dataset was compiled. The study was also limited to the demographics of the secondary dataset. Prior knowledge of the data increases risk of bias. This risk of bias was addressed by reviewing other findings by past researchers to reduce the risk of biased views from use of secondary data.

Significance

Hospital readmission is an indicator of the quality of health care and its effectiveness. More frequent hospital readmissions can be associated with poor quality health and lack of health coverage. The results of this study will identify any relationships between poverty rates and hospital readmission rates at the population level and would provide recommendations for improvements. Depending on results of this study healthcare decision makers were in a position to identify how the economic status of an individual influences their health outcomes in particular their hospital readmission rates for chronic cardiovascular diseases (Heart Failure) and respiratory diseases (COPD, Asthma) (Halfon et al., 2006). As such, they were in position to tell whether readmission rates are a consequence of economic status and therefore these leaders can implement strategies to address economic disparities through the adoption of more effective hospital and healthcare administration policies.

Summary and Conclusions

It is evident that readmission rates are very high, and this has led to an economic burden on health care delivery and administration and it is clear that it is an issue that need to be addressed. On the other hand, the literature review had revealed that, while a health delivery institution practice quality will determine the level of health care they

provide and as such, the rates of readmission to their institutions, this quality health care can be curtailed by the patients lack of money to pay for the services. Therefore, while an institution may be in a position to provide quality health care, patients without the means to meet the requirements for this health care might not get the required treatment and therefore chances are high that they might be readmitted even though the institution provides quality health care. This creates a need to determine whether a significant relationship exists between poverty rates and readmission rates in a bid to address the issue of high readmission rates.

Section 2: Research Design and Data Collection

Introduction

The aim of this study was to examine the relationship between poverty rate and hospital readmission rates for patients with COPD, HF, and Asthma in the United States. Because of the rising costs of health care in the United States, people living under poverty levels might not be able to afford health care for these conditions. Inequalities in health care are a significant contributor to the increased prevalence of certain ailments in the United States. I analyzed secondary data from the HCUP's NRD. The database is a collection of readmission rates and other patient measures such as income over a period spanning 10 years (Weiss & Jiang, 2022). I analyzed the most recent data for the period between 2018 and 2022 where applicable. In this section, I describe the research design adopted for this study, its rationale, the data collection methodology, and the threats to validity of the study.

Research Design and Rationale

I employed a correlational quantitative research method to examine the nature of the relationship between poverty and hospital readmission rates for patients with COPD, HF, and Asthma in the United States (see Cash, 2020). The dependent variables were readmission rates within a 30-day period for either COPD, HF, and Asthma in all counties of the United States. The independent variable was operationalized in terms of poverty level based on income and poverty level indexes in United States. I also controlled for predisposing factors, enabling and need factors. Age, ethnicity, and gender

were used to control for predisposing factors, and patient's location was used to control for enabling factors.

I acquired the required secondary data set from the HCUP's NRD. I extracted four variables. The income of the patients was indexed using the Federal Poverty Level Index to determine whether a patient's income was below or above the poverty levels in United States.

I conducted a multivariable analysis of the impact of the independent and control variables on the dependent variables to establish the relationship between poverty rate and hospital readmission rates. The control variables were controlled and the difference in the relationship measured to explore causality. This research was limited to the analysis of secondary data for the period between 2010 and 2022.

Methodology

I discuss the choice of data collection methods, sampling techniques, and the data analysis plan.

Population

The target population for this study was the U.S. population, specifically people from all counties of the United States who were readmitted for COPD, HF, or Asthma during 2019.

Sampling and Sampling Procedures

The HCUP's NRD contains data on the national readmission rates for all patients regardless of the expected payer for the hospital stay. The NRD includes discharges for patients with and without repeat hospital visits in a year and those who have died in the

hospital. This database was relevant to this study because it provides nationally representative information on hospital readmissions for all ages and diagnoses. It also provides other demographic data that allow for the examination of the relationship between readmission rates and other factors such as poverty level. The data were obtained from the HCU vendor after approval and satisfaction of the requirements of the Walden University Institutional Review Board, a HCUP data use agreement was signed, training was completed, and payment was made for access to the NRD database.

I filtered seven variables from the NRD database while only keeping the records of patients who had been readmitted for COPD, HF, and Asthma in the United States. This data filtering was conducted using statistical analysis software. I filtered out data from the NRD database to keep only observations with ICD-9-CM and ICD-10CM codes for COPD, HF, and Asthma. The data were then filtered to keep only observation where the hospital was in the United States. Table 1 shows the variables that were extracted from the database (Sandelowski, 2000).

Table 1

Description of Variables

Variable	Variable description
Readmission rates (3 Variables)	This was a calculated readmission rate in a given hospital or health institution within 30-days for the following conditions; chronic obstructive pulmonary disease, heart failure and asthma
Income	This was a measure of a patient's income or income group. It was used to calculate the poverty level and its index.
Patient location	The registered location of a hospital (Were grouped under various categories using the urban-rural classification index

	for the counties of United States)
Patient age	This the age of the patient
Patient gender/ Ethnicity	This is the gender or ethnicity of the patents. It was classified under various categories
Insurance Coverage	The health insurance coverage/ status of a patient

Note. The variables in the table come from the HCUP's NRD database.

I transformed the income variable to operationalize poverty rates and levels, which are not present in the NRD database. Using the Federal Poverty Level Index (HealthCare.gov, 2022), population income was classified as being below or above the poverty level, and poverty rates were calculated from these measures for the sample.

Power Analysis to Determine the Sample Size

I conducted a power analysis to determine the required sample size that was needed to address the RQs and hypotheses. I used a correlational study design to examine the relationship between poverty and hospital readmission rates while controlling for other demographic variables. An assumption was that the null hypothesis was equal to zero, such that the independent variables did not have an association or relationship to the dependent variables. Based on this assumption, I conducted a power analysis to determine the minimum sample size required to observe a correlation coefficient of 0.1 at an alpha of 0.05 with the power of 90% and 95%. The following equation was used for the power analysis.

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

In this equation, alpha (α) was the probability of committing a Type I error, beta (β) was the probability of committing a Type II error, the correlation coefficient was the sample's expected correlation, and *N* was the total number of observations. From the

power analysis, the required minimum sample size at a power of 80% was 1,047 required to accurately detect a correlation coefficient of 0.1. A sample size of at least 1,294 was required to detect a correlation coefficient of 0.1.

Instrumentation and Operationalization of Constructs

I used the hospital readmission rates for COPD, HF, and Asthma, and the age and gender of patients as they were from the NRD database. Poverty levels were operationalized as a construct of income, and the Federal Poverty Level Index was used to determine whether the income of different counties in United States was below or above poverty level. I used this information to calculate poverty rate. Last, the Urban-Rural classification was operationalized using the NRD's hospital location under a six-category urban-rural classification scheme of U.S. counties developed by the National Center for Health Statistics (NCHS; Ingram & Franco, 2013). This classification scheme and the operationalization of Urban-Rural classification are shown in Table 2.

Table 2

Operationalization of Urban-Rural classification From Urban-Rural Classification Scheme

Urban-rural classification	Description	Assigned Urban-Rural level
"Central" counties of metro areas of >=1 million population.	According to the NCHS, these are areas that contain the entire population of the largest principal city of the MSA. They are characterized by the highest median household income, and the lowest percentage of families below the poverty level.	Because, the counties in this category encompass most of the areas that are characterized by highest median household income, and the lowest percentage of families below the poverty level, they were identified in this study as "Very Urban" areas
"Fringe" counties of metro areas of >=1 million population	According to the NHCH, these are counties in MSAs of 1 million or more population that did not qualify as large central metro counties. The too covers areas with diverse levels of social and economic integration.	Because, the counties in this category encompass most of the areas that are characterized by highest median household income, and the lowest percentage of families below the poverty level, they were identified in this study as "Urban" areas
Counties in metro areas of 250,000-999,999 population	According to the NCHS, these are areas substantially lower median population, population and housing densities, a lower median household income, and a somewhat less racially and ethnically diverse population than counties at the other urbanization levels.	Thea areas were considered in this study as "Urban to Rural" areas
Counties in metro areas of 50,000-249,999 population	These areas just like the counties with populations of 250,000 to 999,999 have substantially lower median population, population and housing densities, a lower median household income, and a somewhat less racially and ethnically diverse population than counties at the other urbanization levels.	Thea areas were considered in this study as "Rural" areas
Micropolitan counties	These are statistical areas consist of the county or counties (or equivalent entities) associated with at least one urban cluster of at least 10,000 but less than 50,000 population, plus adjacent counties	Being the counties in the lowest populated areas and the least degree of social and economic integration with the core as measured through commuting ties, these areas were identified in this study as "Very Rural" areas

Note. NCHS = National Center for Health Statistics; MSA = metropolitan statistical area.

Data Analysis Plan

The data analysis plan will involve three steps, a descriptive analysis to explore the characteristics of all variables, a Pearson correlation to determine whether there exists relationships between the dependent and independent variables and lastly multivariable regression and correlation analysis were conducted to determine whether there is a relationship between poverty rate and hospital readmission rates for patients with chronic obstructive pulmonary disease, Heart Failure and Asthma in the United States. Independent variables age, location and ethnicity were controlled to measure the difference in the strength of the relationship in a bid to determine whether and how the control variables influence the relationship between poverty and readmission. The analysis effect size was reported in this study by comparing the coefficient of determination. The following RQs and hypothesis were addressed.

RQ1. Is readmission for COPD associated with poverty rate among residents of the United States?

$H_0$1: There is no statistical relationship between readmission for COPD and poverty rate among residents of the United States.

$H_1$1: There is a statistical relationship between readmission for COPD and poverty rate among residents of the United States.

RQ2. Does the control variables (Urban-Rural classification, age, gender, and insurance status) affect the association between readmission for COPD and poverty rate among residents of the United States?

$H_0$2: Urban-Rural classification, age, gender, and insurance status do not affect the association between readmission for COPD and poverty rate among residents of the United States.

$H_1$2: Urban-Rural classification, age, gender, and insurance status significantly affect the association between readmission for COPD and poverty rate among residents of the United States.

RQ3. Is readmission for HF associated with poverty rate among residents of the United States?

$H_0$3: There is no statistical relationship between readmission for HF and poverty rate among residents of the United States.

$H_1$3: There is a statistical relationship between readmission for HF and poverty rate among residents of the United States.

RQ4. Do the control variables (Urban-Rural classification, age, gender, and insurance status) affect the association between readmission for HF and poverty rate among residents of the United States?

$H_0$4: Urban-Rural classification, age, gender, and insurance status do not affect the association between readmission for HF and poverty rate among residents of the United States.

$H_1$4: Urban-Rural classification, age, gender, and insurance status significantly affect the association between readmission for HF and poverty rate among residents of the United States.

RQ5. Is readmission for Asthma associated with poverty rate among residents of the United States?

$H_0$5: There is no statistical relationship between readmission for Asthma and poverty rate among residents in the United States.

$H_1$5: There is a statistical relationship between readmission for Asthma and poverty rate among residents in the United States.

RQ6. Does the control variables (Urban-Rural classification, age, gender, and insurance status) affect the association between readmission for Asthma and poverty rate among residents of the United States?

$H_0$6: Urban-Rural classification, age, gender, and insurance status do not affect the association between readmission for Asthma and poverty rate among residents of the United States.

$H_1$6: Urban-Rural classification, age, gender, and insurance status significantly affect the association between readmission for Asthma and poverty rate among residents of the United States.

Threats to Validity

The threats to validity of the study were countered by adding control groups to determine that the established relationships in the study are not as a result of other factors, control variables were used to mediate and moderate.

Ethical Procedures

I satisfied the requirements and obtained approval from the Walden University Institutional Review Board and HCUP administrators before accessing the database. I

followed these entities' guidelines and policies in regard to data usage, distribution, and protection.

Section 3: Presentation of the Results and Findings

Introduction

The main purpose of this this study was to determine the association between poverty rate and hospital readmission of patients with COPD, Asthma, and HF. To achieve this, I measured the strength of the relationship to determine how much the economic status of a patient influence hospital readmission due to these diseases. I also sought to determine whether the readmission rates were higher for individuals below the poverty level than for those above the poverty level. The RQs and hypotheses were

RQ1. Is readmission for COPD associated with poverty rate among residents of the United States?

$H_0$1: There is no statistical relationship between readmission for COPD and poverty rate among residents in the United States.

$H_1$1: There is a statistical relationship between readmission for COPD and poverty rate among residents in the United States.

RQ2. Do the control variables (Urban-Rural classification, age, gender, and insurance status) affect the association between readmission for COPD and poverty rate among residents of the United States?

$H_0$2: Urban-Rural classification, age, gender, and insurance status do not affect the association between readmission for COPD and poverty rate among residents of the United States.

$H_1$2: Urban-Rural classification, age, gender, and insurance status significantly affect the association between readmission for COPD and poverty rate among residents of the United States.

RQ3. Is readmission for HF associated with poverty rate among residents of the United States?

$H_0$3: There is no statistical relationship between readmission for HF and poverty rate among residents in the United States.

$H_1$3: There is a statistical relationship between readmission for HF and poverty rate among residents in the United States.

RQ4. Do the control variables (Urban-Rural classification, age, gender, and insurance status) affect the association between readmission for HF and poverty rate among residents of the United States?

$H_0$4: Urban-Rural classification, age, gender, and insurance status do not affect the association between readmission for HF and poverty rate among residents of the United States.

$H_1$4: Urban-Rural classification, age, gender, and insurance status significantly affect the association between readmission for HF and poverty rate among residents of the United States.

RQ5. Is readmission for Asthma associated with poverty rate among residents of the United States?

$H_0$5: There is no statistical relationship between readmission for Asthma and poverty rate among residents of the United States.

$H_1$5: There is a statistical relationship between readmission for Asthma and poverty rate among residents of the United States.

RQ6. Do the control variables (Urban-Rural classification, age, gender, and insurance status) affect the association between readmission for Asthma and poverty rate among residents of the United States?

$H_0$6: Urban-Rural classification, age, gender, and insurance status do not affect the association between readmission for Asthma and poverty rate among residents of the United States.

$H_1$6: Urban-Rural classification, age, gender, and insurance status significantly affect the association between readmission for Asthma and poverty rate among residents of the United States.

In this section, the findings from analysis of the 2019 NRD dataset are presented. The results are presented in tables and the interpretation of the findings reported for each step of the analysis. The results for each RQ are been presented separately after an initial presentation of descriptive statistics and demographics of the main variables of this study.

Data Collection of Secondary Data Set

This study utilized the Healthcare cost and utilization project's (HCUP's) Nationwide Readmission Database (NRD) for the year 2019. This dataset contains data on the national readmission rates for all patients regardless of the expected payer for the hospital stay. The NRD includes discharges for patients with and without repeat hospital visits in a year and those who have died in the hospital. This database was favorable and relevant to this study because it addresses a large gap in healthcare data which illustrates

the lack of nationally representative information on hospital readmissions for all ages, diagnosis and other demographic data offering a data platform that allows for the examination of the relationship between readmission rates and other factors such as this study's poverty level.

Data Use Discrepancies

Based on the plan presented in section 2 of this study, there were a few data discrepancies in data that changed the way this data was used. First, to calculate the 30-day readmission rates for COPD, heart failure and Asthma, from the NRD dataset SAS/STAT ® Survey Sampling and Analysis Procedures were used. Lastly, the hospital location was operationalized using the NRD's hospital location under a six-category urban-rural classification scheme for U.S. counties developed by the National Center for Health Statistics (NCHS), (Ingram D & Franco SJ, 2013).

Descriptive and Demographic Characteristics of the Sample

The 2019 NRD data set was comprised of 18,132,856 observations of discharges for patients with and without repeat hospital visits for a variety of diagnoses including COPD, HF, and Asthma. These data were collected from more than 30 U.S. states.

Data Cleaning and Sampling Analysis

Data cleaning, sampling and coding of the NRD readmissions dataset was conducted using SAS/STAT Survey Sampling and Analysis Procedures. The following steps were used to determine readmission rates for each ailment under study, COPD, Heart Failure and Asthma.

The first step using SAS/STAT was to create a dataset that contained all index event and discharges where the primary diagnosis was COPD, Asthma or Heart Failure using the 2019 NRD core dataset. The code used to identify these cases (See Appendix M) was a modification of the readmission analysis code by Yoon Et Al. (2017). This code identified cases that corresponded to the following ICD-10-CM codes for COPD, Heart Failure and Asthma (see Table 3).

Table 3

Identification of Cases Using ICD-10 Codes

Disease	**ICD-10 codes for each diagnosis**
COPD	Code J44.9 for non-specified COPD, code J44.1 for COPD with acute exacerbation and J44.0 for COPD with acute lower Respiratory infection.
Heart Failure	The ICD-10 code for Heart Failure used in this study was I50.9 for non-specified Heart Failure, I50.1 for left ventricular failure and I50.0 for Congestive Heart Failure. Other codes used are; I50 Heart Failure I50.1 Left ventricular failure, unspecified I50.2 Systolic (congestive) Heart Failure I50.20 Unspecified systolic (congestive) Heart Failure I50.21 Acute systolic (congestive) Heart Failure I50.22 Chronic systolic (congestive) Heart Failure I50.23 Acute on chronic systolic (congestive) Heart Failure I50.3 Diastolic (congestive) Heart Failure I50.30 Unspecified diastolic (congestive) Heart Failure I50.31 Acute diastolic (congestive) Heart Failure I50.32 Chronic diastolic (congestive) Heart Failure I50.33 Acute on chronic diastolic (congestive) Heart Failure I50.4 Combined systolic (congestive) and diastolic (congestive) Heart Failure I50.40 Unspecified combined systolic (congestive) and diastolic (congestive) Heart Failure I50.41 Acute combined systolic (congestive) and diastolic (congestive) Heart Failure I50.42 Chronic combined systolic (congestive) and diastolic (congestive) Heart Failure I50.43 Acute on chronic combined systolic (congestive) and

	diastolic (congestive) Heart Failure I50.8 Other Heart Failure I50.81 Right Heart Failure I50.810 unspecified I50.811 Acute right Heart Failure I50.812 Chronic right Heart Failure I50.813 Acute on chronic right Heart Failure I50.814 Due to left Heart Failure I50.82 Biventricular Heart Failure I50.83 High output Heart Failure I50.84 End stage Heart Failure I50.89 Other Heart Failure I50.9 Heart Failure, unspecified
Asthma	The ICD 10 codes for Asthma were, J45.9 for a non-specified Astha, J45.5 for Severe Asthma and J45.2 to J45.4 for mild to moderate Asthma. Other codes used are; J45 Asthma J45.2 Mild intermittent Asthma J45.20 Uncomplicated J45.21 With (acute) exacerbation J45.22 with status Asthmaticus J45.3 Mild persistent Asthma J45.30 uncomplicated J45.31 with (acute) exacerbation J45.32 with status Asthmaticus J45.4 Moderate persistent Asthma J45.40 uncomplicated J45.41 with (acute) exacerbation J45.42 with status Asthmaticus J45.5 Severe persistent Asthma J45.50 uncomplicated J45.51 with (acute) exacerbation J45.52 with status Asthmaticus J45.9 Other and unspecified Asthma J45.90 Unspecified Asthma J45.901 with (acute) exacerbation J45.902 with status Asthmaticus J45.909 uncomplicated J45.99 Other Asthma J45.990 Exercise induced bronchospasm J45.991 Cough variant Asthma J45.998 Other Asthma

Note. These codes are extracted from the International Classification of Diseases, Tenth Revision (ICD 10)

After identifying all cases for each of the diseases, the next step was identification of readmission for COPD, Heart Failure and Asthma that had occurred within 30 days of

discharge from the initial case. For this, PROC SQL in SAS was used and the code (See Appendix N) was also modified from the Readmission Code provided by Yon Et al. (2017). The identified cases were cleaned to remove duplicates and the readmission cases data was merged with the all-cases file and the file saved for analysis using SPSS. Table 4 is a summary of the cleaned data for each disease under observation.

Table 4

Readmission Rates

Measure	COPD	Heart Failure	Asthma
Total Observations	18,132,856	18,132,856	18,132,856
30-day readmission cases	246657	54640	77189
Number of unique hospitals	2408	2324	2162
Average Hospital readmission rate	17.5707%	21.0414%	8.5517%

Note. See Appendix A and B for SAS/STAT codes used

Description and Analysis of the Sample

A descriptive analysis was conducted to summarize the demographic characteristics of the COPD sample and the results presented in Table 5.

Table 5

Summary of Demographic Characteristics of COPD Readmissions

Variable	Sample size	Minimum	Maximum	Mean	Std. Deviation
% Readmitted within 30 days	2408	0.00%	100.00%	17.5707%	9.36246%

Average Age of Patients at admission	2408	3	90	69.06	4.551
% Of Male Patients	2408	0.00%	100.00%	42.5370%	13.67537%
% Of Female Patients	2408	0.00%	100.00%	57.4642%	13.67548%
%_of Patients with Income Below Poverty	2408	0.00%	100.00%	36.8032%	35.52190%
%_of Patients with Income Above Poverty	2408	0.00%	100.00%	63.1561%	35.53727%
%_ of Patients with Some Insurance	2408	0.00%	100.00%	97.6040%	5.46049%
%_ of Patients with NO Insurance	2408	0.00%	100.00%	2.3551%	5.08569%

As Table 5 shows, the sample was made up of 2408 hospital with the average hospital readmission rate being17.57%. Of this sample, 42.54% were male and 57.46% were female. On the other hand, 36.8% had an income below the poverty index of 2019 and 2.36% did not have any type of insurance.

A frequency distribution was used to explore the characteristic of the Urban-Rural classification of all the hospital. The result is shown in Table 6.

Table 6

Summary of Urban-Rural classification for COPD

Urban-Rural classification Category	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Hospitals in areas	372	15.4	15.4	15.4

of Very Low Urban-Rural classification				
Hospitals in areas of Low Urban-Rural classification	432	17.9	17.9	33.4
Hospitals in areas of Moderate Urban-Rural classification	407	16.9	16.9	50.3
Hospitals in areas of High Urban-Rural classification	286	11.9	11.9	62.2
Hospitals in areas of Very High Urban-Rural classification	428	17.8	17.8	79.9
Other	483	20.1	20.1	100.0

A descriptive analysis was conducted to summarize the demographic characteristics of the Heart Failure sample and the results presented in Table 7.

Table 7

Summary of Demographic Characteristics of Heart Failure Readmissions

Variable	Sample size	Minimum	Maximum	Mean	Std. Deviation
% Readmitted within 30 days	23	0.0	1	21.	16.

	2	0	0.	0	6
	4	%	0	4	7
			0	1	4
			%	4	4
				%	4
					%
Average Age of Patients at admission	2	3	9	7	9.
	3		0	0.	8
	2			4	0
	4			3	0
% Of Male Patients	2	0.	1	5	2
	3	0	0	2.	2.
	2	0	0.	3	3
	4	%	0	8	2
			0	4	0
			%	0	6
				%	5
					%
% Of Female Patients	2	0.	1	4	2
	3	0	0	7.	2.
	2	0	0.	6	3
	4	%	0	1	2
			0	7	0
			%	5	5
				%	4
					%
%_of Patients with Income Below Poverty	2	0.	1	3	3
	3	0	0	4.	5.
	2	0	0.	8	5
	4	%	0	6	8
			0	3	8
			%	2	3
				%	2
					%
%_of Patients with Income Above Poverty	2	0.	1	6	3
	3	0	0	3.	5.
	2	0	0.	5	7
	4	%	0	1	7

			0%	79%	92%
%_ of Patients with Some Insurance	23	0.30	100%	96.8%	97.6%
	24	0%	0.00%	85%	63%
			0%	73%	37%
%_ of Patients with NO Insurance	23	0.30	100%	30%	6.91%
	24	0%	0.00%	16%	19%
			0%	69%	3%

As Table 7 shows, the sample was made up of 2324 hospitals with the average hospital readmission rate being 21.04%. Of this sample, 52.38% were male and 47.62% were female. On the other hand, 34.86% had an income below the poverty index of 2019 and 3.02% did not have any type of insurance.

A frequency distribution was used to explore the characteristic of the Urban-Rural classification of all the hospital with Heart Failure 30-day readmissions. The result is shown in Table 8.

Table 8

Summary of Urban-Rural classification for Heart Failure 30-Day Readmissions

Urban-Rural classification	Frequency	Percent	Valid Percent	Cumulative Percent
Hospitals in	316	13.6	13.6	13.6

areas of Very Low Urban-Rural classification				
Hospitals in areas of Low Urban-Rural classification	467	20.1	20.1	33.7
Hospitals in areas of Moderate Urban-Rural classification	384	16.5	16.5	50.2
Hospitals in areas of High Urban-Rural classification	302	13.0	13.0	63.2
Hospitals in areas of Very High Urban-Rural classification	425	18.3	18.3	81.5
Other	430	18.5	18.5	100.0

A descriptive analysis was conducted to summarize the demographic characteristics of the Asthma sample and the results presented in Table 9.

Table 9

Summary of Demographic Characteristics of Asthma Readmissions

	N	Minimum	Maximum	Mean	Std. Deviation

					n
% Readmitted within 30 days	2	0.	1	8.	1
	1	0	0	5	2.
	6	0	0.	5	1
	2	%	0	1	7
			0	7	0
			%	%	6
					1
					%
Average Age of Patients at admission	2	1	9	4	1
	1		0	5.	4.
	6			9	1
	2			8	5
					5
% of Male Patients	2	0.	1	3	2
	1	0	0	0.	2.
	6	0	0.	8	0
	2	%	0	8	6
			0	5	2
			%	8	2
				%	1
					%
% of Female Patients	2	0.	1	6	2
	1	0	0	9.	2.
	6	0	0.	1	0
	2	%	0	1	6
			0	5	2
			%	5	3
				%	5
					%
%_of Patients with Income Below Poverty	2	0.	1	3	3
	1	0	0	5.	6.
	6	0	0.	7	3
	2	%	0	8	5
			0	5	4
			%	2	1
				%	4
					%

%_of Patients with Income Above Poverty	2162	0.00%	100.00%	62.9438%	36.55208%
%_ of Patients with Some Insurance	2162	0.00%	100.00%	92.4819%	13.76874%
%_ of Patients with NO Insurance	2162	0.00%	100.00%	7.2945%	13.55960%

As Table 9 shows, the sample was made up of 2162 hospitals with the average hospital readmission rate being 8.5517%. Of this sample, 30.89% were male and 69.12% were female. On the other hand, 35.79% had an income below the poverty index of 2019 and 7.29% did not have any type of insurance.

A frequency distribution was used to explore the characteristic of the Urban-Rural classification of all the hospital with Asthma 30-day readmissions. The result is shown in Table 10.

Table 10

Summary of Urban-Rural classification for Asthma 30-Day Readmissions

Urban-Rural classification	Frequency	Percent	Valid Percent	Cumulative Percent
Hospitals in areas of Very Hospitals in areas of Low Urban-Rural classification	375	17.3	17.3	17.3
Hospitals in areas of Low Urban-Rural classification	422	19.5	19.5	36.9
Hospitals in areas of Moderate Urban-Rural classification	406	18.8	18.8	55.6
Hospitals in areas of High Urban-Rural classification	274	12.7	12.7	68.3
Hospitals in areas of Very High Urban-Rural classification	382	17.7	17.7	86.0
Other	303	14.0	14.0	100.0

Results

Research Question 1

The first research question was aimed at exploring whether readmission for COPD was associated with poverty rate among residents of the United States. A simple regression analysis was used to examine the relationship between hospital readmission for COPD and poverty rate. 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 1) and a normal P-P plot revealed that the residual errors of the regression line were approximately normally distributed (see Figure 2).

Figure 1

Relationship Between COPD Readmissions and Poverty Rate

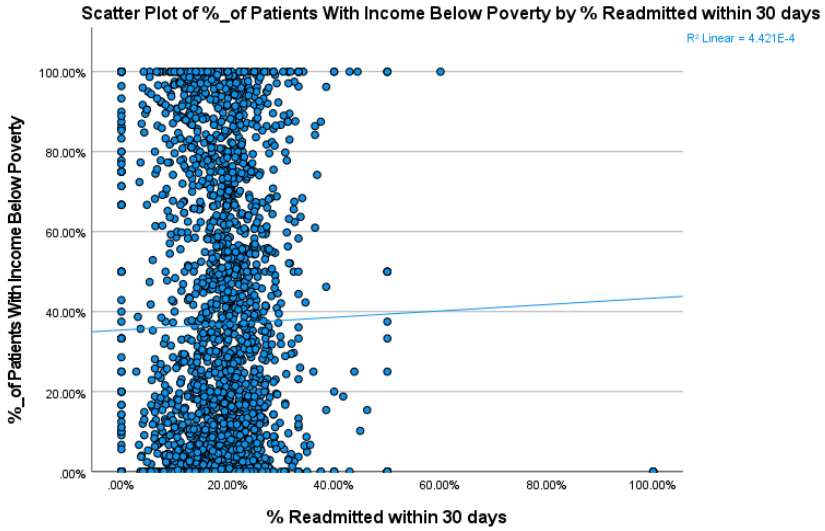
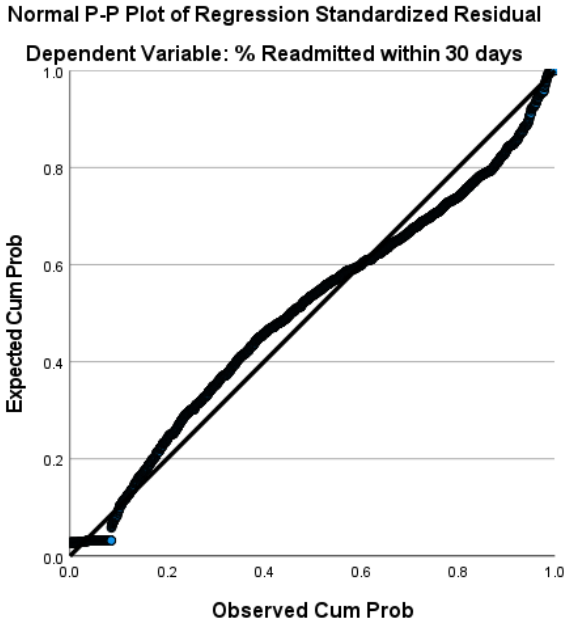


Figure 2

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



A sample of 2408 hospital with readmission cases for COPD was used for this analysis, a linear regression was done with the percentage of patients readmitted within

30 days for COPD as the dependent variable and the percentage of patients with income below poverty levels as the independent variable (see Table 11). The result of the Pearson's correlation was not significant, r= .021, p= .302 (see Appendix A). The results of the bivariate regression were also not statistically significant, F (1,2406) = 1.064, p= .302 (see Appendix B).

Table 11

Relationship Between Readmission for COPD and Poverty Rate

Variable	*B*	*SE B*	β	*t*	*p*
(Constant)	17.367	110.116		63.208	.000
% of patients with income below poverty	.006	.005	.021	1.032	.302

The coefficients of the regression (see Table 11) revealed that the independent variable, percentage of patients with income below poverty (poverty rate) was not a significant predictor of readmission rate for COPD. This was an indication that there is not a significant relationship between readmission for COPD and poverty rate.

Research Question 2

The second research question was aimed at examining whether the control variables Urban-Rural classification, Age, gender and Insurance Status affect the association between readmission for COPD and poverty rate among residents of the United States. I assessed the assumptions of multiple 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 of regression residual revealed that there was a linear relationship between the two variables, therefore linearity can be assumed (see Figure 3) and a normal P-P plot revealed that the residual errors of the regression line were approximately normally distributed and therefore, normality and homogeneity of variance can be assumed (see Figure 4).

Figure 3

Scatterplot of Regression Residuals and Predicted Values

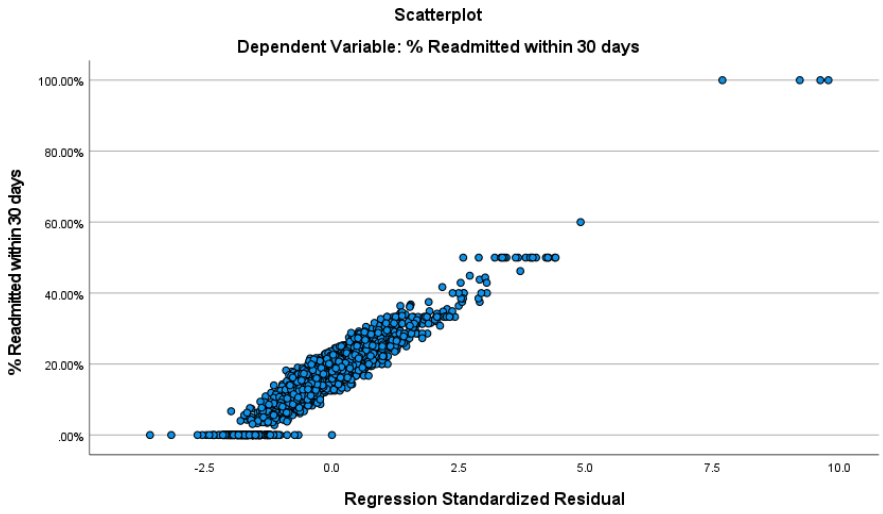
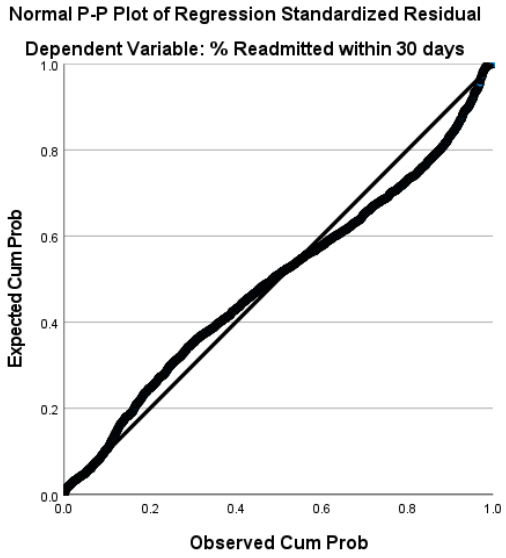


Figure 4

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



A sample of 2408 hospitals with 30-day readmission cases for COPD was used for this analysis, a linear regression was done with the percentage of patients readmitted within 30 days for Heart Failure as the dependent variable and the percentage of patients with income below poverty levels, Age, Gender, Insurance status and Urban-Rural classification as the independent variables (see Table 12). The result of the Pearson's coefficient of determination was R2= .095. This means that, the predictor variables poverty rate and the control variables, age, gender, insurance status and Urban-Rural classification in the model explained 9.5% of the variation in readmission for COPD (See appendix C). The results of the multiple regression were also statistically significant, F (1,2397) = 25.178, p= <.001 (See appendix D).

Table 12

Regression Coefficients for the Relationship Between Readmission for COPD and Poverty Rate, Gender, Age, Insurance Status, and Urban-Rural classification

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	17.367	.275		63.208	.000
	%_of Patients Income Below Poverty	.006	.005	.021	1.032	.302
2	(Constant)	20.855	9.472		2.202	.028
	%_of Patients Income Below Poverty	.023	.006	.088	4.070	<.001
	Average Age of Patients at admission	-.219	.043	-.106	-5.081	<.001
	% of Female Patients	-.050	.013	-.073	-3.811	<.001

				3.072321
%_ of Patients With Some Insurance	.183	.089	.107	2.04146
%_ of Patients With NO Insurance	.082	.096	.045	.853915
Hospitals in Urban areas	-2.160	.640	-.089	-3.037717
Hospitals in Urban to Rural areas	-3.868	.642	-.155	-6.002515
Hospitals in Rural areas	-4.958	.703	-.171	-7.051151
Hospitals in Very Rural areas	-5.819	.639	-.238	-9.101005

Other Areas	-7.658	.638	-.328	-11.994	<.001

As shown in Table 12, poverty rate, age, gender, and patients with some type of insurance and Urban-Rural classification contributed significantly to the model, p= <.05. However, percentage of patients without any insurance did not contribute significantly to the model. When all control variables are held constant, a 1% increase in poverty rate caused a 0.023% increase in readmissions for COPD. From the coefficient table, hospitals with a higher average age of patients had lower COPD readmissions (b= -.219), hospitals with a higher percentage of female patients had a decline in COPD readmission (b= -.05), hospitals with a higher percentage of patients with some type of insurance had a higher readmission for COPD (b= .183) while lack of insurance was not significant to this model.

When looking at the Urban-Rural classification variable, hospitals in low Urban-Rural classification areas have lower readmission rate for COPD than hospitals in very low Urban-Rural classification areas (b=-2.160), hospitals in moderate Urban-Rural classification areas have lower readmission rate for COPD than hospitals in very low Urban-Rural classification areas (b= -3.868), hospitals in high Urban-Rural classification areas have lower readmission rate for COPD than hospitals in very low Urban-Rural

classification areas (b= -4.958) and lastly, hospitals in very high Urban-Rural classification areas have lower readmission rate for COPD than hospitals in very low Urban-Rural classification areas (b= -5.819). This was an indication that, as Urban-Rural classification increased, there was a significant decrease in COPD hospital readmissions. In overall, this was an indication that the control variables, age, gender and Urban-Rural classification significantly influenced the relationship between readmission for COPD and poverty rate because in the first model, the relationship was not significant.

From the standardized coefficients column in table 13, the control variable Urban-Rural classification levels were the strongest predictor variables with the category 'other area' and hospitals in 'very rural areas' having the highest significant effect $\beta = -.328$ and $\beta = -.238$ respectively on hospital readmission for COPD. This was followed by average age of patients, $\beta = -.106$ and then the poverty rate $\beta = .088$. Insurance status was not a significant predictor of hospital readmission for COPD.

Research Question 3

The third research question was aimed at exploring whether readmission for Heart Failure was associated with poverty rate among residents of the United States. A simple regression analysis was used to examine the relationship between hospital readmission for Heart Failure and poverty rate. 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 5) and

a normal P-P plot revealed that the residual errors of the regression line were approximately normally distributed (see Figure 6).

Figure 5

Relationship Between Heart Failure Hospital Readmissions and Poverty Rate

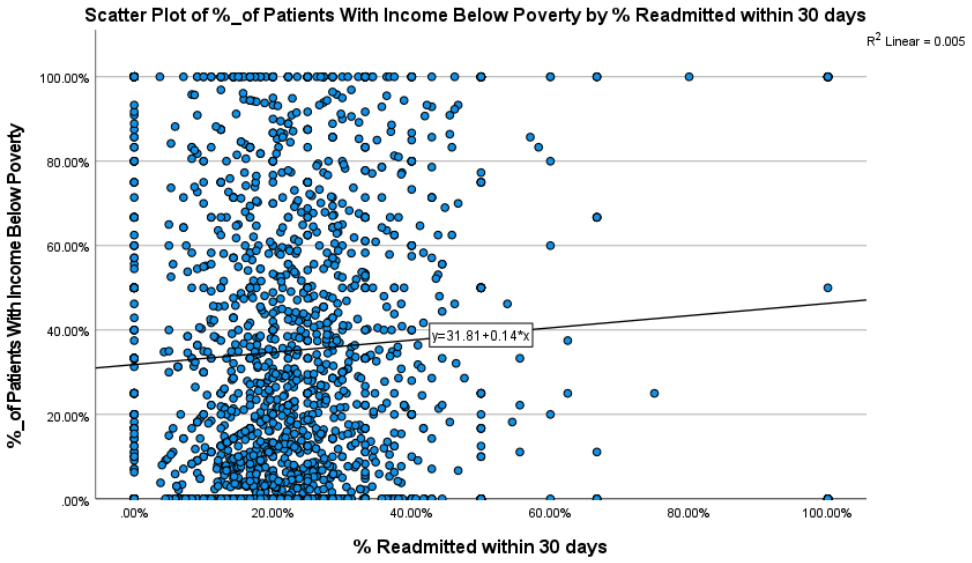
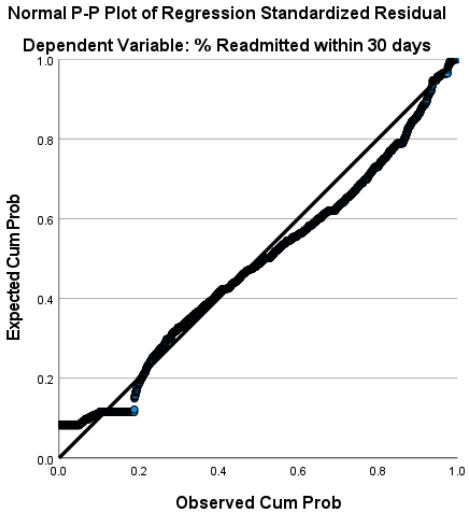


Figure 6

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



A sample of 2324 hospitals with 30-day readmission cases for Heart Failure was used for this analysis, a linear regression was done with the percentage of patients readmitted within 30 days for Heart Failure as the dependent variable and the percentage of patients with income below poverty levels was the independent variable (see Table 13). The result of the Pearson's correlation was significant, r= .068, p= <.001 (See appendix E). The results of the bivariate regression were also statistically significant, F (1,2323) = 10.765, p= <.001 (See appendix F).

Table 13

Regression Coefficients for the Relationship Between Readmission for Heart Failure and Poverty Rate

Variable	*B*	*SE B*	β	*t*	*p*
(Constant)	19.932	.483		41.246	<.001
% of patients with income below	.032	.010	.068	3.281	<.001

The coefficients of the regression from Table 13 revealed that the independent variable, percentage of patients with income below poverty (poverty rate) was a significant predictor of readmission rate for Heart Failure, B = .032, p= <.001. This was an indication that there was a relationship between readmission for Heart Failure and poverty rate, such that for every 1% increase in patients with income below poverty, there is a 0.032% increase in 30-day hospital readmissions for Heart Failure.

Research Question 4

The second research question was aimed at examining whether the control variables Urban-Rural classification, Age, gender and Insurance Status affect the association between readmission for Heart Failure and poverty rate among residents of the United States. I assessed the assumptions of multiple 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 of regression residual revealed that there was a linear relationship between the two variables, therefore linearity can be assumed (see Figure 7) and a normal P-P plot revealed that the residual errors of the regression line were approximately normally distributed and therefore, normality and homogeneity of variance can be assumed (see Figure 8).

Figure 7

Scatterplot of Regression Residuals and Predicted Values

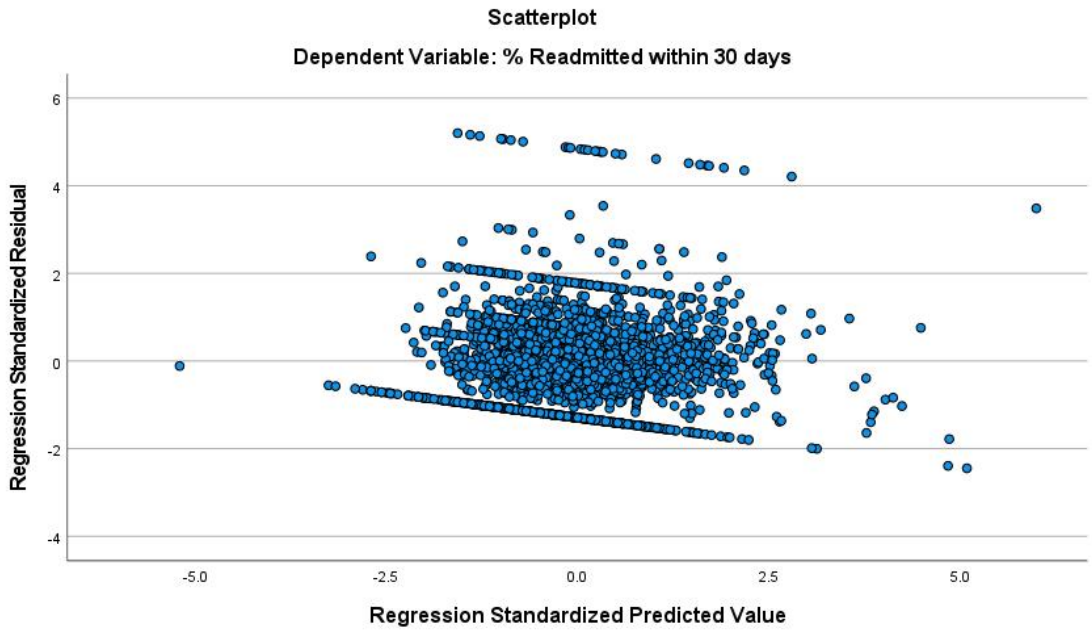
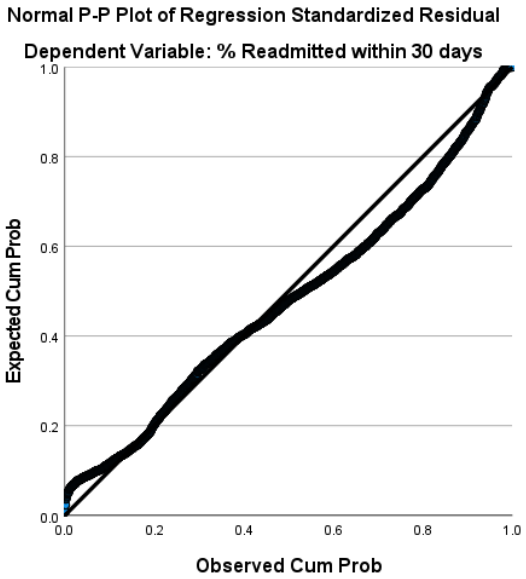


Figure 8

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



A sample of 2324 hospitals with 30-day readmission cases for Heart Failure was used for this analysis, a linear regression was done with the percentage of patients readmitted within 30 days for Heart Failure as the dependent variable and the percentage of patients with income below poverty levels, Age, Gender, Insurance status and Urban-Rural classification as the independent variables (see Table 14). The result of the Pearson's coefficient of determination increased from, R2= .005 to R2= .049. This meant that, without the control variables, the predictor variable poverty rate explained 0.5% of the variation in readmission for Heart Failure, while with the control variables, age, gender, insurance status and Urban-Rural classification, the model explained 4.9% of the variation in readmission for Heart Failure (See appendix G). The results of the multiple regression were also statistically significant, F (1,2323) = 11.958, p= <.001 (See appendix H).

Table 14

Regression Coefficients for the Relationship Between Readmission for Heart Failure and Poverty Rate, Gender, Age, Insurance Status, and Urban-Rural classification

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	19.932	.483		41.266	<.001
%_of Patients with Income Below Poverty	.010	.010	.068	3.458	.001

		3			2	C
		2			8	1
					1	
2	(Constant)	2	17.606		1	.
		C			.	2
		.			1	4
		6			7	1
		3			2	
		3				
	%_of Patients with Income Below Poverty	.	.010	.089	4	<
		C			.	.
		4			C	C
		2			1	C
					9	1
	Average Age of Patients at admission	-	.039	-.151	-	<
		.			6	.
		2			.	C
		5			6	C
		7			C	1
					5	
	% of Female Patients	.	.016	.072	3	<
		C			.	.
		5			4	C
		4			2	C
					6	1
	%_ of Patients with Some Insurance	.	.174	.083	1	.
		1			.	2
		9			1	7
		2			C	C
					4	
	%_ of Patients with NO Insurance	.	.180	.026	.	.
		C			3	7
		6			5	2
		3			1	6
	Hospitals in Urban areas	-	1.200	-.080	-	.
		3			2	C
		.			.	C
		3			7	5

Hospitals in Urban to Rural areas	-4.667	1.244	-.104	-3.750	<.001
Hospitals in Rural areas	-4.631	1.319	-.093	-3.511	<.001
Hospitals in Very Rural areas	-6.339	1.252	-.147	-5.064	<.001
Other Areas	-5.573	1.312	-.130	-4.248	<.001

As shown in Table 14, poverty rate, age, gender, and Urban-Rural classification contributed significantly to the model, p= <.05. However, insurance status (those with some insurance and those without) did not contribute significantly to the model. When all control variables are held constant, a 1% increase in poverty rate caused a 0.042% increase in readmissions for Heart Failure, up from 0.032% when the model does not have control variables. From the coefficients table, hospitals with a higher average age of

patients had lower Heart Failure readmissions for Heart Failure (b= -.257), hospitals with a higher percentage of female patients had an increase in Heart Failure readmission (b= .054). When looking at the Urban-Rural classification dummy variable, hospitals in low Urban-Rural classification areas have lower readmission rate for COPD than hospitals in very low Urban-Rural classification areas (b= -3.337), hospitals in moderate Urban-Rural classification areas have lower readmission rate for COPD than hospitals in very low Urban-Rural classification areas (b= -4.667), hospitals in high Urban-Rural classification areas have lower readmission rate for COPD than hospitals in very low Urban-Rural classification areas (b= -4.635) and lastly, hospitals in very high Urban-Rural classification areas have lower readmission rate for COPD than hospitals in very low Urban-Rural classification areas (b= -6.339). This was an indication that the control variables, age, gender and Urban-Rural classification significantly influenced the relationship between readmission for Heart Failure and poverty rate.

From the standardized coefficient, average age of patients was the strongest predictor variable β = -.151 followed by the Urban-Rural classification of hospitals in very rural areas β = -.147, hospitals in urban to rural areas β = -.104 and then hospitals in rural areas β = -.093. The variable with the least effect was gender β =.072. Insurance status was not a significant predictor of hospital readmission for COPD.

Research Question 5

The fifth research question was aimed at exploring whether readmission for Asthma was associated with poverty rate among residents of the United States. A simple

regression analysis was used to examine the relationship between hospital readmission for Asthma and poverty rate. 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 9) and a normal P-P plot revealed that the residual errors of the regression line were approximately normally distributed (see Figure 10).

Figure 9

Relationship Between Asthma Readmissions and Poverty Rate

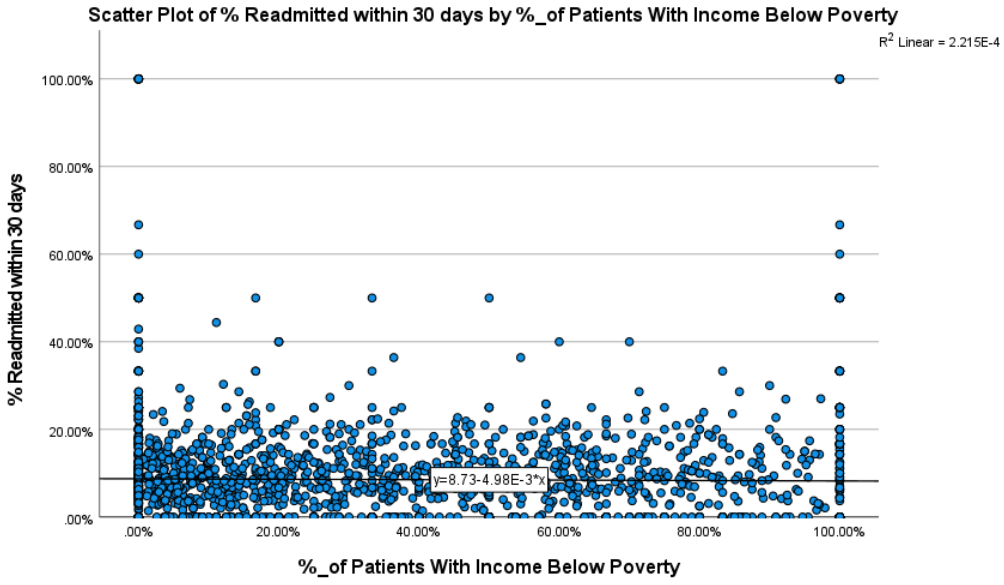
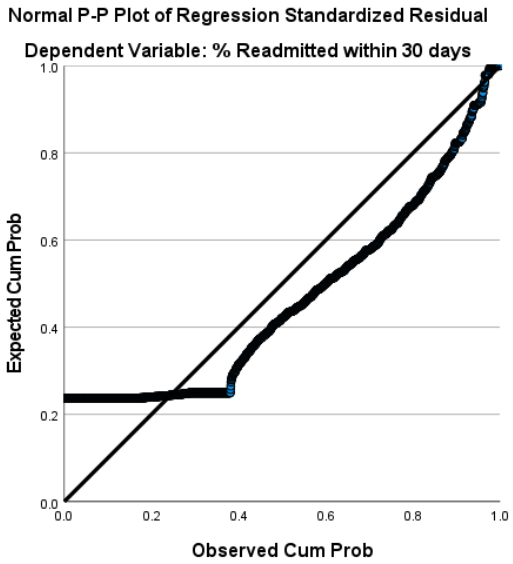


Figure 10

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



A sample of 2162 hospitals with readmission cases for Asthma was used for this analysis, a linear regression was done with the percentage of patients readmitted within 30 days for Asthma as the dependent variable and the percentage of patients with income below poverty levels as the independent variable (see Table 15). The results of the Pearson's correlation were not significant, r= -.015, p= .489 (See appendix I). The results of the bivariate regression were also not statistically significant, F (1,2161) = .479, p= .489 (See appendix J).

Table 15

Relationship Between Readmission for Asthma and Poverty Rate

Variable	*B*	*SE B*	B	*t*	*p*

(Constant)	8.730	.367		23.763	<.001
% of patients with income below poverty	-.005	.007	-.015	-692	.489

The coefficients of the regression from Table 15 revealed that the independent variable, percentage of patients with income below poverty (poverty rate) was not a significant predictor of readmission rate for Asthma. This was an indication that there did not exist a significant relationship between readmission for Asthma and poverty rate.

Research Question 6

The last research question was aimed at examining whether the control variables Urban-Rural classification, Age, gender and Insurance Status affect the association between readmission for Asthma and poverty rate among residents of the United States. I assessed the assumptions of multiple 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 of regression residual revealed that there was a linear relationship between the two variables, therefore linearity can be assumed (see Figure 11) and a normal P-P plot revealed that the residual errors of the regression line were approximately normally distributed and therefore, normality and homogeneity of variance can be assumed (see Figure 12).

Figure 11

Scatterplot of regression residuals and predicted values

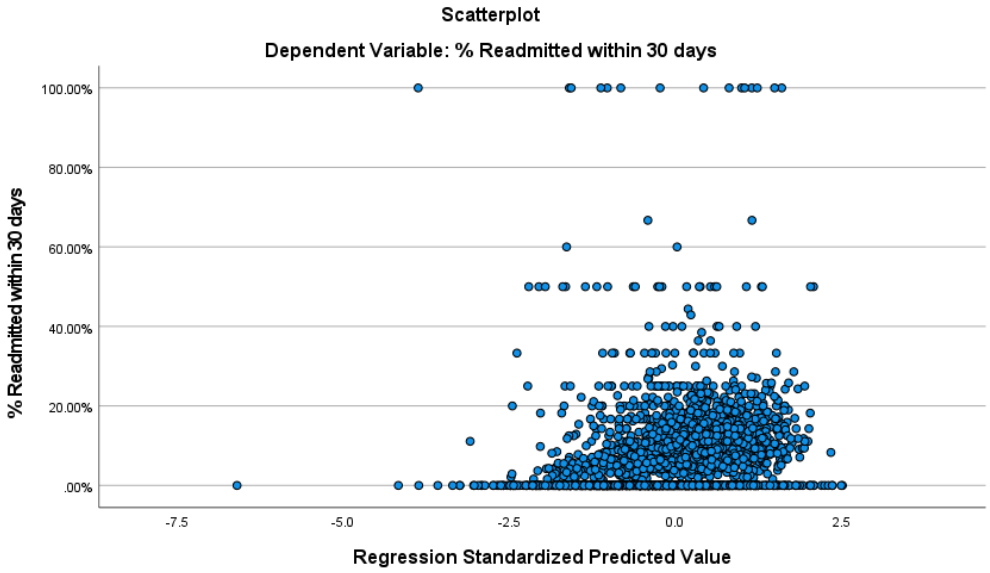
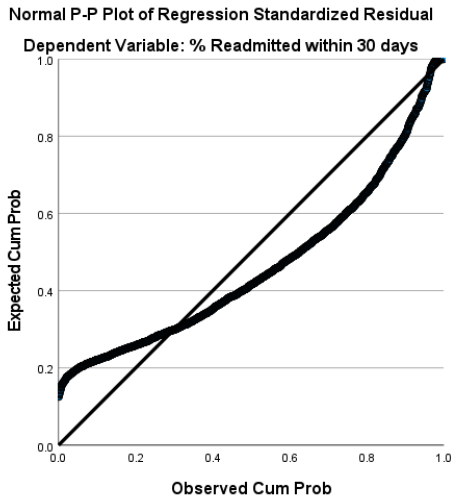


Figure 12

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



A sample of 2162 hospitals with 30-day readmission cases for Asthma was used for this analysis, a linear regression was done with the percentage of patients readmitted within 30 days for Asthma as the dependent variable and the percentage of patients with income below poverty levels, Age, Gender, Insurance status and Urban-Rural classification as the independent variables (see Table 16). The result of the Pearson's coefficient of determination increased was R2= .030. This meant that, the predictor variables poverty rate, age, gender, insurance status and Urban-Rural classification explained 3% of the variation in readmissions for Asthma (See appendix K). The results of the multiple regression were also statistically significant, F (10,2151) = 6.553, p= <.001 (See appendix L).

Table 16

Regression Coefficients for the Relationship Between Readmission for Asthma and Poverty Rate, Gender, Age, Insurance Status, and Urban-Rural classification

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.730	.367		23.763	<.001
	%_of Patients with Income Below Poverty	-.005	.007	-.015	-.692	.489
2	(Constant)	-10.870	9.394		-1.157	.247
	%_of Patients with Income Below Poverty	.010	.008	.031	1.328	.184

Average Age of Patients at admission	.117	.020	.136	5.877	<.001
% Of Female Patients	-.007	.012	-.012	-.553	.580
%_ of Patients with Some Insurance	.162	.093	.183	1.745	.081
%_ of Patients with NO Insurance	.152	.094	.170	1.618	.106
Hospitals in Urban areas	-1.147	.865	-.037	-1.325	.185
Hospitals in Urban to Rural areas	-1.756	.864	-.056	-2.032	.042
Hospitals in Rural areas	-1.628	.963	-.044	-1.690	.091
Hospitals in Very Rural areas	-3.346	.889	-.105	-3.765	<.001
Other Areas	-4.017	.947	-.115	-4.240	<.001

As shown in Table 16, age, and moderate Urban-Rural classification, very high Urban-Rural classification and other Urban-Rural classification contributed significantly to the model, p= <.05. However, poverty rate, insurance status (those with some insurance and those without), gender and insurance status did not contribute significantly to the model. This was an indication that the control variables, did not significantly influence the relationship between readmission for Asthma and poverty rate because, poverty rate was still not a significant predictor of readmissions for Asthma even after controlling for, age, gender, insurance and Urban-Rural classification.

Summary

The results of this study revealed that there did not exist a significant relationship between readmission for COPD and poverty rate, however, after controlling for age, and gender, insurance status and Urban-Rural classification, poverty rate significantly predicted COPD readmissions indicating that as percentage of patients with income below poverty increased, there was an increase in hospital readmission for COPD. On the

other hand, there was a significant relationship between readmission for Heart Failure and poverty rate such that an increase in the percentage of patients with income below poverty caused an increase in hospital readmission for Heart Failure. After controlling for age, and gender, insurance status and Urban-Rural classification, poverty rate the strength of this relationship increased. Lastly, the results indicated that there did not exist a significant relationship between readmission for Asthma and poverty rate, the relationship was also not significant after controlling for age, and gender, insurance status and Urban-Rural classification.

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

Introduction

The purpose of this this study was to determine the association between poverty rate, as measured using socioeconomic status, and hospital readmission of patients with COPD, Asthma, and HF. To achieve this, I measured the strength of the relationship to determine how much the economic status of a patient influences hospital readmission due to these diseases. I also sought to determine whether the readmission rates was higher for individuals below the poverty level than those above the poverty level. Hospital administration systems are challenged by readmission rates of the patient populations they serve. Analysis of the links between economic status and health care outcomes may allow stakeholders to make better informed decisions and implement recommended changes to optimize health care systems administration relative to chronic cardiovascular diseases (HF) and respiratory diseases (COPD, Asthma).

I used a quantitative research approach. Secondary data measuring the hospital readmission rates in the United States from the HCUP's NRD database (Weiss & Jiang, 2022) was the data set for this study. The independent variable was poverty rate measured as an individual's income in relation to the federal poverty level. The dependent variables were hospital readmission for COPD, HF, and Asthma. To address the RQs, I conducted a multiple regression analysis to determine the association between poverty rate and the readmission rate of patients with COPD, HF, and Asthma in all the counties of the United States. I also controlled for predisposing factors, enabling and need factors. These variables were age, gender, insurance status and Urban-Rural

classification. These variables were identified in the literature review as having a possible influence on the relationship between poverty rates and hospital readmission.

Interpretation of the Findings

The results of this study indicated that there did not exist a significant relationship between readmission for COPD and poverty rate, however, after controlling for age, and gender, insurance status and Urban-Rural classification, poverty rate significantly predicted COPD readmissions indicating that as percentage of patients with income below poverty increased, there was an increase in hospital readmission for COPD. The control variables contributed differently to the model. Percentage of patients without insurance did not contribute significantly to the model. However, an increase in average age at a hospital caused a reduction in readmission for COPD, and readmission for COPD was lower among female patients than male patients and lastly, an increase in the percentage of patients with some insurance led to an increase in readmissions for COPD. On the other hand, as hospital's location transitioned from urban to rural, it led to a higher decrease in COPD hospital readmissions with more readmissions in very urban areas than those in rural areas.

From these results, it is evident that poverty rates and a combination of other socio-economic factors are related to readmission rates. The results of this study agree with the findings of Jencks et. al (2019), that poverty level leads to lower quality health care and therefore, increased chances of readmission. The results also suggest that, people with insurance and those living in Urban areas, areas with good access to care and adequate hospitals and infrastructure were more likely to be readmitted for COPD than

those living in Rural areas without good access to care and hospitals. These results agree with the findings of Hussein and Field (2016) who determined that low-income neighborhood residents were associated with less reliance on physician offices and that low-income neighborhoods had a lower distribution of hospitals and medical centers when compared to other neighborhoods with high income earners. This means that in areas of Rural, patients are less likely to be in a position to go back to a hospital when ill and that lack of care support such as availability of insurance makes it hard for patients to seek readmission when ailing from COPD.

The study also found out that there was a significant relationship between readmission for Heart Failure and poverty rate such that an increase in the percentage of patients with income below poverty caused an increase in hospital readmission for Heart Failure. After controlling for age, and gender, insurance status and Urban-Rural classification, poverty rate the strength of this relationship increased. Hospitals with a higher average age of patients had lower heart failure readmissions for heart failure while hospitals with a higher percentage of female patients had an increase in heart failure readmission. Lastly, those living in Urban areas, areas with good access to care and adequate hospitals and infrastructure were more likely to be readmitted for COPD than those living in areas of Rural areas without good access to care and hospitals.

These results agree with the findings of Kim-Dorner et al. (2022) that the types of comorbidities that each gender experienced were distinct from one another and that but disagreed that Comorbidities were more common in patients who were older, although they were about as common in patients who were in their 30s and 40s. On the other hand,

the study results also agree with the findings by Jencks et. al, (2019) that people who are economically disadvantaged do not have good access to health care and therefore illnesses reoccur frequency leading increased chances of readmission.

However, the study disagrees with the findings by Stephen et al., (2019) that patients living in neighborhoods at the 90th percentile of disadvantage had a higher readmission rate compared with similar patients living in neighborhoods at the 10th percentile. The results have determined that, persons who are living in areas at the 10th percentile, urban and Very Urban areas had higher readmission rates. This difference, just like Hussein and Field (2016) discovered can be because, in areas of Rural areas, patients are less likely to be in a position to go back to a hospital when ill and that lack of care support such as availability of insurance makes it hard for patients to seek readmission when ailing from COPD.

Lastly, this study found out that poverty rate was not associated with readmission for Asthma and that the control variables did not change this relationship. However, age did influence readmission significantly and Urban to Rural, very Rural and other Urban-Rural classification contributed significantly to the model. While poverty rate did not affect readmissions for Asthma, area in areas of Rural, patients are less likely to be in a position to go back to a hospital when ill and that lack of care support such as availability of insurance makes it hard for patients to seek readmission when ailing from Asthma a factor that can also be associated to poverty.

Limitations to the Study

This study was limited to the available secondary data present in the NRD data set. Therefore, the study was limited to data available for 2019, which is the latest year that the NRD data set was compiled. The study was also limited to the demographics of the secondary data set. Furthermore, the utilization of the NRD secondary data set meant that I had no way to verify the consistency and accuracy of the data, especially the coding of individual health conditions.

Recommendations

While conducting this study, I encountered various limitations. Based on these limitations, I have identified areas that could be improved for a further exploration of this topic. Because of the use of a secondary data set, the data may not have answered the specific RQs in this study. For instance, the coverage of the Urban-Rural classification variable was only based on a hospital location population and patient's income in a given hospital. However, the Urban-Rural classification is correctly measured with more factors including infrastructure availability and the ranking of health institutions as results. Therefore, future researchers may want to use a more comprehensive Urban-Rural classification scale. On the other hand, the NRD dataset contained readmission data for approximately 30 states that submitted their data to the HCUP. This means that the sample could not be a full representation of the readmission rates in the United States. A more representative sample may allow for a more accurate generalization of the study results across the United States.

Implications for Professional Practice and Social Change

Implications for Professional Practice

The results of this analysis are crucial to the health care professional practice as it will help healthcare decision makers identify how the economic status of an individual influences their health outcomes in particular their hospital readmission rates for chronic cardiovascular diseases (Heart Failure) and respiratory diseases (COPD, Asthma). The study has identified that hospital readmission rates for COPD and Heart Failure were influenced by a combination of several socioeconomic factors. From these findings, the following are the implications for professional practice.

From the findings it is evident that readmission for COPD and Heart Failure are associated with poverty rate with hospital readmission rate being higher for patients below the poverty rate. As a results of this, the national health practitioners and health care administration should consider creating measures that reduce the growing inequalities in health care delivery specifically ensuring that the financial status of a patients does not hinder their access to medical care. As a result of addressing the health care inequalities based on financial ability, the hospital readmission rates will decline among people living below poverty and as a result a reduction in overall health care costs associated with readmissions.

On the other hand, another area of implication for professional practice is the inequality in coverage of insurance and health care resources. The study has identified that, readmission increase for people with insurance and those living in areas that are not deprived. This signals that, economically disadvantaged people could be reluctant to seek

medical care when their health gets worse due to fear of the medical expenses as defined by Andersen's behavioral model of health services and a finding by Berman et. al, (2020) that, higher neighborhood disadvantage was associated with a 32% higher all-cause mortality. By developing policies that ensure universal health coverage and availability of health care services to all people would reduce this health care inequalities.

Lastly, this study identified that hospital readmissions are influenced significantly by factors that are beyond the control of a hospital's administration. While an institution may be in a position to provide quality health care, patients without the means to meet the requirements for this health care, or are influenced by factors such as their age and location might not get the required treatment and therefore chances are high that they might be readmitted even though the institution provides quality health care. As such, hospitals should not be held entirely accountable for high readmission rate for COPD, heart failure and asthma.

Implications for Social Change

From the results of this study, it was evident that those living in areas with low Urban-Rural classification, areas with good access to care and adequate hospitals and infrastructure were more likely to be readmitted for COPD than those living in areas of high Urban-Rural classification without good access to care and hospitals. This can be attributed to the theory, Andersen's behavioral model of health services that lack of access to health services and individual's ability to pay and meet the financial requirements to get healthcare services due to poverty, might hinder their proper

utilization of health services. Based on this findings, social change is required to create awareness among the society on the need to seek medical care even when they cannot be able to afford it and are in fear of the implications of the high medical bills associated with readmission for an ailment. As a result of this, health care inequalities based on economic status and disadvantages can be eradicated.

Conclusion

Costs of readmission for are very high and they put a very high burden on healthcare budgets and a resource constrain on health care providers around the country. However, failure to get proper care through readmission can also led to a high mortality rate than usual. On the other hand, readmission causes a significant amount of emotional and physical stress among patients who worry about the status of their health. The findings of this study can be leveraged to identify areas that need improvement in the United States such as delivering universal health care such that economically disadvantaged populations and reducing the gap in neighborhood deprivation such that the entire communities can access the care they need despite their inability to cover their medical expenses or where they come from.

References

Andersen, R. M. (1995). Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health and Social Behavior*, *36*(1), 1–10. https://doi.org/10.2307/2137284

Berman, A. N., Biery, D. W., Singh, A., Baek, J., Wu, W. Y., Wadhera, R. K., Divakaran, S., DeFilippis, E. M., Hainer, J., Cannon, C. P., Plutzky, J., Polk, D. M., Nasir, K., Di Carli, M. F., Ash, A., Bhatt, D. L., & Blankstein, R. (2020). Socioeconomic disadvantage is associated with higher long-term cardiovascular mortality following myocardial infarction: The YOUNG-MI registry [Abstract]. *Circulation*, *142*(Suppl. 3), Article A16195. https://doi.org/10.1161/circ.142.suppl_3.16195

Cash, P. (2020). Where next for design research? Understanding research impact and theory building. *Design Studies*, *68*, 113–141. https://doi.org/10.1016/j.destud.2020.03.001

Enumah, S., & Chang, D. C. (2021). Association of hospital-wide readmission rates with cost of debt among US acute care hospitals. *Journal of the American College of Surgeons*, *233*(5), S125–S126. https://doi.org/10.1016/j.jamcollsurg.2021.07.242

Ferro, E. G., Secemsky, E. A., Wadhera, R. K., Choi, E., Strom, J. B., Wasfy, J. H., Wang, Y., Shen, C., & Yeh, R. W. (2019). Patient readmission rates for all insurance types after implementation of the Hospital Readmissions Reduction Program. *Health Affairs*, *38*(4), 585–593. https://doi.org/10.1377/hlthaff.2018.05412

Gajanan, G., Hattiholi, J., & Alisha, C. (2013). Risk factors for frequent hospital readmissions for acute exacerbations of COPD. *Clinical Medicine Research*, *2*(6), 167–173. https://doi.org/10.11648/j.cmr.20130206.20

Gershon, A. S., Thiruchelvam, D., Aaron, S., Stanbrook, M., Vozoris, N., & Tan, W. C., Cho, E., & To, T. (2019). Socioeconomic status (SES) and 30-day hospital readmissions for chronic obstructive pulmonary (COPD) disease: A population-based cohort study. *PLOS ONE*, *14*(5), Article e0216741. https://doi.org/10.1371/journal.pone.0216741

Halfon, P., Eggli, Y., Prêtre-Rohrbach, I., Meylan, D., Marazzi, A., & Burnand, B. (2006). Validation of the potentially avoidable hospital readmission rate as a routine indicator of the quality of hospital care. *Medical Care*, *44*(11), 972–981. https://doi.org/10.1097/01.mlr.0000228002.43688.c2

Hansen, L. O., Williams, M. V., & Singer, S. J. (2010). Perceptions of hospital safety climate and incidence of readmission. *Health Services Research*, *46*(2), 596–616. https://doi.org/10.1111/j.1475-6773.2010.01204.x

HealthCare.gov. (2022). *Federal poverty level (FPL)*. Retrieved April 15, 2022, from https://www.healthcare.gov/glossary/federal-poverty-level-fpl/

Hermes, Z., Joynt Maddox, K. E., Yeh, R. W., Zhao, Y., Shen, C., & Wadhera, R. K. (2021). Neighborhood socioeconomic disadvantage and mortality among Medicare beneficiaries hospitalized for acute myocardial infarction, heart failureHeart Failure, and pneumonia. *Journal of General Internal Medicine*, *37*, 1894–1901. https://doi.org/10.1007/s11606-021-07090-z

Ho, K.S., Sheehan, J. and Salonia, J. (2019) 'Thirty-day readmission among patients with acute respiratory distress syndrome and effects on outcomes', *Acute critical care* [Preprint]. doi:10.1183/13993003.congress-2019.oa3297.

Hussein, M., Diez Roux, A. V., & Field, R. I. (2016). Neighborhood socioeconomic status and primary health care: Usual points of access and temporal trends in a major US urban area. *Journal of Urban Health, 93*(6), 1027–1045. https://doi.org/10.1007/s11524-016-0085-2

Ingram, D. D., & Franco, S. J. (2014). *2013 NCHS urban-rural classification scheme for counties* (Vital and Health Statistics, Series 2, No. 166). U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf

Jencks, S. F., Schuster, A., Dougherty, G. B., Gerovich, S., Brock, J. E., & Kind, A. J. H. (2019). Safety-Net Hospitals, Neighborhood Disadvantage, and Readmissions Under Maryland's All-Payer Program: An Observational Study. *Annals of Internal Medicine*, *171*(2), 91–98. https://doi.org/10.7326/M16-2671

Kauffman, G.W. (2016) 'Can respiratory therapists IMPACT COPD readmissions and costs?', *Respiratory Care*, 61(9), pp. 1267–1269. doi:10.4187/respcare.04999.

Kim, J., & Frank-Miller, E. (2015). Poverty, Health Insurance Status, and Health Service Utilization Among the Elderly. *Journal Of Poverty*, *19*(4), 424-444. https://doi.org/10.1080/10875549.2015.1015070

Kim, T., Choi, E., Kim, W., & Jo, H. (2021). The Association with COPD Readmission Rate and Access to Medical Institutions in Elderly Patients. *International Journal Of Chronic Obstructive Pulmonary Disease, Volume 16*, 1599-1606. https://doi.org/10.2147/copd.s302631

Kim-Dorner, S., Schmidt, T., Kuhlmann, A., Graf von der Schulenburg, J., Welte, T., & Lingner, H. (2022). Age- and gender-based comorbidity categories in general practitioner and pulmonology patients with COPD. *Npj Primary Care Respiratory Medicine, 32*(1). doi: 10.1038/s41533-022-00278-8

Knighton, A. J., Savitz, L., Belnap, T., Stephenson, B., & VanDerslice, J. (2016). Introduction of an Area Deprivation Index Measuring Patient Socioeconomic Status in an Integrated Health System: Implications for Population Health. *EGEMS (Washington, DC), 4*(3), 1238. https://doi.org/10.13063/2327-9214.1238

Lederle, M., Tempes, J., & Bitzer, E. (2021). Application of Andersen's behavioural model of health services use: a scoping review with a focus on qualitative health services research. *BMJ Open, 11*(5), e045018. https://doi.org/10.1136/bmjopen-2020-045018

Manickam, R.N. *et al.* (2017) 'Area-level poverty and excess hospital readmission ratios', *The American Journal of Medicine*, 130(4). doi:10.1016/j.amjmed.2016.08.047.

May, S.M. and Li, J.T. (2015) 'Burden of chronic obstructive pulmonary disease: Healthcare costs and beyond', *Allergy and Asthma Proceedings*, 36(1), pp. 4–10. doi:10.2500/aap.2015.36.3812.

Mcneill, H. and Khairat, S. (2020) 'Impact of intensive care unit readmissions on patient outcomes and the evaluation of the National Early Warning Score to Prevent Readmissions: Literature Review', *JMIR Perioperative Medicine*, 3(1). doi:10.2196/13782.

Menzin, J., Boulanger, L., Marton, J., Guadagno, L., Dastani, H., & Dirani, R. et al. (2008). The economic burden of chronic obstructive pulmonary disease (COPD) in a U.S. Medicare population. *Respiratory Medicine*, *102*(9), 1248-1256. https://doi.org/10.1016/j.rmed.2008.04.009

Ray, S., Guarascio, Finch, & Self, T. (2013). The clinical and economic burden of chronic obstructive pulmonary disease in the USA. *Clinicoeconomics And Outcomes Research*, 235. https://doi.org/10.2147/ceor.s34321

Sandelowski, M. (2000). Combining Qualitative and Quantitative Sampling, Data Collection, and Analysis Techniques in Mixed-Method Studies. *Research In Nursing &Amp; Health*, *23*(3), 246-255. https://doi.org/10.1002/1098-240x(200006)23:3<246::aid-nur9>3.0.co;2-h

Shafeek Amin, N., & Driver, N. (2020). Health care utilization among Middle Eastern, Hispanic/Latino, and Asian immigrants in the United States: an application of

Andersen's behavioral model. *Ethnicity &Amp; Health*, 1-19. https://doi.org/10.1080/13557858.2020.1830034

Singh, G. K., & Lin, C.-C. C. (2019). Area Deprivation and Inequalities in Health and Health Care Outcomes. *Annals of Internal Medicine*, *171*(2), 131–132. https://doi.org/10.7326/M19-1510

Stephen F Jencks , Alyson Schuster , Geoff B Dougherty , Sule Gerovich , Jane E Brock , Amy J H Kind (2019). Safety-Net Hospitals, Neighborhood Disadvantage, and Readmissions Under Maryland's All-Payer Program: *An Observational Study.* 2019 Jul 16;171(2):91-98. doi: 10.7326/M16-2671.

Weiss, A. J., & Jiang, H. J. (2021, July). *Overview of clinical conditions with frequent and costly hospital readmissions by payer, 2018* (Statistical Brief No. 278). Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project. https://www.hcup-us.ahrq.gov/reports/statbriefs/sb278-Conditions-Frequent-Readmissions-By-Payer-2018.jsp

Appendix A: Correlational Analysis of Chronic Obstructive Pulmonary Disease

Correlations

		% Readmitted within 30 days	%_of Patients With Income Below Poverty
% Readmitted within 30 days	Pearson Correlation	1	.021
	Sig. (2-tailed)		.302
	N	2408	2408
%_of Patients With Income Below Poverty	Pearson Correlation	.021	1
	Sig. (2-tailed)	.302	
	N	2408	2408

Appendix B: Regression Analysis of Variance for Chronic Obstructive Pulmonary Disease

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	93.272	1	93.272	1.064	.302[b]
	Residual	210893.774	2406	87.653		
	Total	210987.046	2407			

a. Dependent Variable: % Readmitted within 30 days

b. Predictors: (Constant), %_of Patients With Income Below Poverty

Appendix C: Multiple Regression Model Summary of Chronic Obstructive Pulmonary Disease

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.021[a]	.000	.000	9.36233%	
2	.308[b]	.095	.091	8.92494%	2.034

a. Predictors: (Constant), %_of Patients With Income Below Poverty

b. Predictors: (Constant), %_of Patients With Income Below Poverty, Urban-Rural classification=High Urban-Rural classification, % of Female Patients, %_ of Patients With Some Insurance, Urban-Rural classification=Moderate Urban-Rural classification, Average Age of Patients at admission, Urban-Rural classification=Very High Urban-Rural classification, Urban-Rural classification=Low Urban-Rural classification, Urban-Rural classification=Other, %_ of Patients With NO Insurance

c. Dependent Variable: % Readmitted within 30 days

Appendix D: Multiple Regression Analysis of Variance for Chronic Obstructive Pulmonary Disease

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	93.272	1	93.272	1.064	.302[b]
	Residual	210893.774	2406	87.653		
	Total	210987.046	2407			
2	Regression	20055.146	10	2005.515	25.178	<.001[c]
	Residual	190931.900	2397	79.655		
	Total	210987.046	2407			

a. Dependent Variable: % Readmitted within 30 days

b. Predictors: (Constant), %_of Patients With Income Below Poverty

c. Predictors: (Constant), %_of Patients With Income Below Poverty, Urban-Rural classification=High Urban-Rural classification, % of Female Patients, %_ of Patients With Some Insurance, Urban-Rural classification=Moderate Urban-Rural classification, Average Age of Patients at admission, Urban-Rural classification=Very High Urban-Rural classification, Urban-Rural classification=Low Urban-Rural classification, Urban-Rural classification=Other, %_ of Patients With NO Insurance

Appendix E: Correlational Analysis of Heart Failure

Correlations

		% Readmitted within 30 days	%_of Patients With Income Below Poverty
% Readmitted within 30 days	Pearson Correlation	1	.068**
	Sig. (2-tailed)		.001
	N	2324	2324
%_of Patients With Income Below Poverty	Pearson Correlation	.068**	1
	Sig. (2-tailed)	.001	
	N	2324	2324

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

Appendix F: Regression Analysis of Variance for Heart Failure

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2980.431	1	2980.431	10.765	.001[b]
	Residual	642899.326	2322	276.873		
	Total	645879.756	2323			

a. Dependent Variable: % Readmitted within 30 days

b. Predictors: (Constant), %_of Patients With Income Below Poverty

Appendix G: Multiple Regression Model Summary of Heart Failure

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.068[a]	.005	.004	16.63950%	
2	.222[b]	.049	.045	16.29456%	1.987

a. Predictors: (Constant), %_of Patients With Income Below Poverty

b. Predictors: (Constant), %_of Patients With Income Below Poverty, % of Female Patients, Urban-Rural classification=High Urban-Rural classification, %_ of Patients With Some Insurance, Urban-Rural classification=Moderate Urban-Rural classification, Average Age of Patients at admission, Urban-Rural classification=Very High Urban-Rural classification, Urban-Rural classification=Low Urban-Rural classification, Urban-Rural classification=Other, %_ of Patients With NO Insurance

c. Dependent Variable: % Readmitted within 30 days

Appendix H: Multiple Regression Analysis of Variance for Heart Failure

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2980.431	1	2980.431	10.765	.001[b]
	Residual	642899.326	2322	276.873		
	Total	645879.756	2323			
2	Regression	31748.936	10	3174.894	11.958	<.001[c]
	Residual	614130.820	2313	265.513		
	Total	645879.756	2323			

a. Dependent Variable: % Readmitted within 30 days

b. Predictors: (Constant), %_of Patients With Income Below Poverty

c. Predictors: (Constant), %_of Patients With Income Below Poverty, % of Female Patients, Urban-Rural classification=High Urban-Rural classification, %_ of Patients With Some Insurance, Urban-Rural classification=Moderate Urban-Rural classification, Average Age of Patients at admission, Urban-Rural classification=Very High Urban-Rural classification, Urban-Rural classification=Low Urban-Rural classification, Urban-Rural classification=Other, %_ of Patients With NO Insurance

Appendix I: Correlational Analysis of Asthma

Correlations

		% Readmitted within 30 days	%_of Patients With Income Below Poverty
% Readmitted within 30 days	Pearson Correlation	1	-.015
	Sig. (2-tailed)		.489
	N	2162	2162
%_of Patients With Income Below Poverty	Pearson Correlation	-.015	1
	Sig. (2-tailed)	.489	
	N	2162	2162

Appendix J: Regression Analysis of Variance for Asthma

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	70.905	1	70.905	.479	.489[b]
	Residual	320024.614	2160	148.160		
	Total	320095.519	2161			

a. Dependent Variable: % Readmitted within 30 days

b. Predictors: (Constant), %_of Patients With Income Below Poverty

Appendix K: Multiple Regression Model Summary for Asthma

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.015[a]	.000	.000	12.17208%	
2	.172[b]	.030	.025	12.01718%	1.990

a. Predictors: (Constant), %_of Patients With Income Below Poverty

b. Predictors: (Constant), %_of Patients With Income Below Poverty, Urban-Rural classification=High Urban-Rural classification, % of Female Patients, %_ of Patients With Some Insurance, Urban-Rural classification=Moderate Urban-Rural classification, Urban-Rural classification=Other, Average Age of Patients at admission, Urban-Rural classification=Very High Urban-Rural classification, Urban-Rural classification=Low Urban-Rural classification, %_ of Patients With NO Insurance

c. Dependent Variable: % Readmitted within 30 days

Appendix L: Multiple Regression Analysis of Variance for Asthma

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	70.905	1	70.905	.479	.489[b]
	Residual	320024.614	2160	148.160		
	Total	320095.519	2161			
2	Regression	9463.878	10	946.388	6.553	<.001[c]
	Residual	310631.641	2151	144.413		
	Total	320095.519	2161			

a. Dependent Variable: % Readmitted within 30 days

b. Predictors: (Constant), %_of Patients With Income Below Poverty

c. Predictors: (Constant), %_of Patients With Income Below Poverty, Urban-Rural classification=High Urban-Rural classification, % of Female Patients, %_ of Patients With Some Insurance, Urban-Rural classification=Moderate Urban-Rural classification, Urban-Rural classification=Other, Average Age of Patients at admission, Urban-Rural classification=Very High Urban-Rural classification, Urban-Rural classification=Low Urban-Rural classification, %_ of Patients With NO Insurance

Appendix M: SAS Codes for Identification of Cases of Chronic Obstructive Pulmonary Disease, Heart Failure, and Asthma

```
%LET YEAR = 2018;
%LET CODES = "J449","J440", "J441";
%LET TIMEFRAME = 30;
DATA NRD_&YEAR._INDEXEVENTS
        READMCANDIDATES (DROP = DISCWT LOS NRD_STRATUM
INDEXEVENT);
        SET NRD_&YEAR._CORE (OBS = MAX
                                        KEEP = HOSP_NRD KEY_NRD DISCWT
NRD_STRATUM AGE
                                        DMONTH DIED LOS NRD_VISITLINK
                                        NRD_DAYSTOEVENT I10_DX1
ZIPINC_QRTL FEMALE PAY1 PL_NCHS);
        ATTRIB INDEXEVENT LENGTH = 3 LABEL="COPD Index Event";
        INDEXEVENT = 0;
         /* Inclusion/Exclusion  Criteria to Identify TAVR Index Events */
        IF (I10_DX1 IN (&CODES.))
                AND AGE GE 1
                AND DMONTH LE 11
                AND DIED = 0
                AND NOT MISSING(LOS)
        THEN INDEXEVENT = 1;
        DROP I10_DX1 DMONTH DIED;
        IF INDEXEVENT = 1 THEN OUTPUT NRD_&YEAR._INDEXEVENTS;
        OUTPUT READMCANDIDATES;
RUN;
```

Appendix N: SAS Codes for Identification of 30-Day Readmission Cases

Identification of 30-day readmission cases

```
PROC SQL ;
CREATE TABLE READMISSIONSALL AS
SELECT I.HOSP_NRD AS HOSP_NRD_INDEX
, I.KEY_NRD AS KEY_NRD_INDEX
, R.*
FROM NRD_2019_INDEXEVENTS I /* INDEX EVENTS */
INNER JOIN READMCANDIDATES R /* READMISSIONS */
ON I.NRD_VISITLINK = R.NRD_VISITLINK /* LINK PATIENTS */
AND I.KEY_NRD NE R.KEY_NRD /* NOT A SELF JOIN */
AND R.NRD_DAYSTOEVENT - ( I.NRD_DAYSTOEVENT + I.LOS )
BETWEEN 0 AND 30
AND I.INDEXEVENT = 1
ORDER BY I.HOSP_NRD, I.KEY_NRD, R.NRD_DAYSTOEVENT; /* SORT BY
DATE */
QUIT ;;
```

Removal of duplicate readmission cases

```
DATA READMISSIONSCLOSEST;
SET READMISSIONSALL ( RENAME=(HOSP_NRD=HOSP_NRD_READMIT
HOSP_NRD_INDEX=HOSP_NRD
KEY_NRD = KEY_NRD_READMIT
KEY_NRD_INDEX=KEY_NRD)) ;
BY HOSP_NRD KEY_NRD ;
IF FIRST.KEY_NRD ;
RUN;
```

Merging readmission cases data and all cases data

```
DATA READMISSIONS_SQL ;
MERGE NRD_2019_INDEXEVENTS
READMISSIONSCLOSEST ( IN=INR
RENAME=( NRD_DAYSTOEVENT=DAYSTOREADMISSION )
DROP=NRD_VISITLINK KEY_NRD_READMIT ) ;
BY HOSP_NRD KEY_NRD ;
ATTRIB READMIT LENGTH = 3 LABEL='READMISSION WITHIN 30 DAYS (0/1)'
;
READMIT = INR ;
LABEL DAYSTOREADMISSION = 'READMISSION DATE';
```

```
RUN ;;
```

Saving merged data to file

```
PROC EXPORT DATA=READMISSIONS_SQL
   OUTFILE="C:\USERS\KIHUM\DESKTOP\BENZ
NRD\NRD_2019\NRD_2019_CORE\NRD_2019_COPD.CSV"
   DBMS=CSV
   REPLACE;
RUN;
```