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Impact of COVID-19 on Hospital Expenses of Diabetes and Obesity Patients in Rural Eastern North Carolina

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This is to certify that the doctoral study by

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Walden University
2024

Abstract

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MA/MS, Walden University 2015

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Doctoral Study Submitted in Partial Fulfillment

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Doctor of Health care Administration

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Abstract

Multiple chronic conditions have caused a significant increase in hospital expenses. Diabetes and obesity have been identified as variables that negatively impact patient outcomes, but hospital expenses for diabetes and obesity patients who had and did not have COVID-19 had not been explored. The purpose of this quantitative correlational study was to compare the difference in hospital expenses, if any, of diabetes and obesity patients with and without COVID-19 at a North Carolina rural health care center. The study's design was a correlational analysis using simple linear regression guided by Andersen's behavioral model of health service utilization. The dependent variable was hospital expenses, and the independent variables were diabetes and obesity among patients with and without a COVID-19 diagnosis. Secondary data included 1,900 male and female inpatients from a rural North Carolina hospital who had diabetes and obesity from 2020 to 2021. Results indicated a statistically significant positive relationship between hospital expenses and COVID-19 patients with diabetes and obesity. The total charges increased by $22,195 with the presence of a COVID-19 diagnosis. The implications for positive social change include policy formation and future planning initiatives to help lower costs and improve patient outcomes.

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Dedication

I dedicate this degree to my husband, Jamonte Bradley, my kids, Ka'shiya, Jamonte Jr, and Jaycee Bradley, and my mom. You all are my reason and my motivation. Thank you for your support and for your unconditional love.

Table of Contents

List of Tables

Section 1: Foundation of the Study and Literature Review

COVID-19 is a novel disease caused by a coronavirus called SARS-CoV-2 that presents with flu-like symptoms that have caused a huge burden on the U.S. health care system (Centers for Disease Control and Prevention [CDC], 2021b). The federal government had allocated 4.6 trillion in response to the COVID-19 pandemic (U.S. Spending.gov, 2022). Although health care costs have steadily been on the rise, COVID-19 sharply increased the national health expenditures by 9.7% to 4.1 trillion in 2020 and represented 19.7% of the gross domestic product (CMS.gov, 2022b). Health care spending is estimated to increase at an annual rate of 5.4% and is projected to be 6.2 trillion by year 2028 (CMS.gov, 2022b).

Certain conditions have been identified that have a relationship with higher costs of care with a COVID-19 diagnosis. Of particular interest are two conditions that play a part in elevated cost of care in health care systems: diabetes and obesity. Diabetes is one of America's leading causes of death, and every year $237 billion is spent on diabetes management (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDKD], 2022). An estimated 34.2 million people are diagnosed with diabetes, and medical expenditures with diabetes were twice as high as those without diabetes (NIDDKD, 2022). Diabetes has three main types: Type 1, Type 2, and gestational (CDC, 2022). Type 1 is defined as a condition in which the pancreas produces little to no insulin, Type 2 is characterized by an impairment in how the body controls and uses glucose, and gestational diabetes occurs when the body cannot make enough insulin during pregnancy

(CDC, 2024). Obesity is a chronic metabolic disease defined as abnormal or excessive fat accumulation that presents a risk to health and is defined clinically as body mass index (BMI) over 30 (Chooi et al., 2019). I conducted a comparison study of the impact of diabetes and obesity on hospital expenses for COVID-19 patients' and non-COVID-19 patients to determine the impact, if any, of COVID-19 and to help create policy changes for future initiatives that may improve COVID-19 patient outcomes. This capstone study aimed to examine the relationship, if any, between COVID-19, diabetes, and obesity and to inform hospital leaders and health care policymakers of the impact of the comorbidities on COVID-19 patient outcomes.

The theoretical framework, Andersen's behavioral model of health service utilization, was used to guide the study. Andersen's behavioral model of health service utilization is used to discover conditions that either facilitate or impede utilization (Andersen, 2008). The literature review outlines existing knowledge and a gap in the research.

Background

Diabetes and obesity account for a large percentage of patients who present with complications in health care systems (Leitner et al., 2017). According to Smati et al. (2020), the prevalence of obesity is exemplified by the high percentage of obese patients who require advanced levels of care. In the United Kingdom, 73.3% of patients admitted to the intensive care unit were obese or overweight (Smati et al., 2020). Likewise, diabetic patients consume a large portion of health care expenditures (Smati et al., 2020).

In the United States in 2017, diabetes accounted for 24% of all health care dollars spent (Wang et al., 2022). Diabetes and obesity are diseases that could negatively impact COVID-19 patient outcomes.

According to Di Fusco et al. (2021), diabetes and obesity were among the most prevalent comorbid conditions in COVID-19 patients. Smati et al. (2020) also found that COVID-19 patients frequently reported diabetes and obesity as comorbidities. The researchers also studied 5,700 COVID-19 patients who were admitted to hospitals in New York and found that 41.7% of patients were obese and 33.3% had diabetes. The relationship between obesity and early COVID-19 prognosis in inpatients with Type 2 diabetes was studied and found that obesity affected COVID-19 outcomes in patients younger than 75. According to Smati et al., the combination of obesity and diabetes could lead to a high risk of severe COVID-19 outcomes such as intubation for mechanical ventilation or death. Di Fusco et al. also found a large resource consumption and high costs incurred from treating COVID-19 within hospitals.

As stated by Czernichow et al. (2021), the burden of COVID-19 continued to increase in 2020 and 2021. Czernichow et al. found that obesity was associated with higher hospital expenses concerning COVID-19. Czernichow et al. completed this study in Europe, and of the total hospital costs for COVID-19, 44% were related to obese patients, while only 21% of Europeans suffer from obesity. This indicated a disproportionate number of obese patients had a more significant number of adverse outcomes such as the need for intensive care unit stays and the need for mechanical

ventilators to sustain life. Ohsfeldt et al. (2021) found that diabetes and obesity were among the most frequent comorbidities. Among patients with comorbid conditions, the overall cost of care for COVID-19 inpatient care was higher in those with diabetes or obesity (Ohsfeldt et al., 2021). These studies showed the overall hospital expenses for diabetes and obesity among COVID-19 patients, but there was a gap in knowledge regarding the comparison of the differences in hospital expenses, if any, between diabetes and obesity patients with COVID-19 and without COVID-19. The aim of the current study was to assess the effect, if any, that diabetes and obesity have had in the COVID-19 and non-COVID-19 patient population on hospital expenses in a rural North Carolina health care system.

Although researchers had investigated COVID-19's effect on patients with diabetes and obesity there was little comparative research done and a gap existed between COVID-19 patients and non-COVID-19 patients to test the difference in hospital expenses in rural North Carolina (Ohsfeldt et al., 2021). This study analyzed the differences and/or similarities of diabetes and obesity hospital expenses between COVID-19 and non-COVID-19 patients. Results may inform health care leaders of the financial implications of diabetes and obesity and its possible effect on the financial health of the health care organization.

Problem Statement

COVID-19 has had a profound impact on the U.S. health care system (CMS.gov, 2022). COVID-19 has negatively affected many aspects of daily life and has caused

considerable changes in health care delivery (CMS.gov, 2022). COVID-19 affects patients with comorbidities, diabetes, and obesity at a higher rate than patients who did not present with these comorbidities (CDC, 2021a). As a result, expenses are often greater for these conditions (Ohsfeldt et al., 2021). There was a need for additional research on COVID-19 related topics because of the multifaceted effects that COVID-19 placed on health care and communities globally. Research has shown how COVID-19 infiltrated the health care system and had an exponential effect on patients with comorbidities, but there are still questions about the financial implications of COVID-19 and diabetes and obesity (Hasan et al., 2019). The research problem that was addressed in the current study was the difference in hospital expenses, if any, of diabetes and obesity patients with and without COVID-19.

Purpose of the Study

The purpose of this comparative quantitative study was to compare the difference in hospital expenses, if any, of diabetes and obesity patients with and without COVID-19 at a North Carolina rural health care center. The independent variables (diabetes and obesity patients with and without COVID-19) were defined as the population of patients who had diabetes and obesity as a diagnosis and included those with COVID-19 and those without COVID-19. The dependent variable (hospital expenses) was defined as hospital charges accumulated during the patient's inpatient stay.

The results of this study may inform hospital administrators and health care policymakers regarding the cost of care and potential burden on the population they serve

(CDC, 2004; Zhang et al., 2004). Identifying and comparing those most at risk for high cost of care and hospital expenses can lead to identifying trends and creating policies as well as physician guidelines that seek to lower hospital expenses (Hasan et al., 2019). The current study was important because it may provide valuable information pertaining to the relationship between diabetes, obesity, and COVID-19 hospital costs (see Curtis et al., 2016). The current study may also assist in forecasting future impacts on organizations' financial status. The independent variables were COVID-19 diagnosis, diabetes diagnosis, and obesity diagnosis, and the dependent variable was hospital expenses. Results may clarify the financial implications of diabetes and obesity in COVID-19 and non-COVID-19 patients that may enable health care leaders to make informed decisions and plan for future strategic initiatives. The gap in the research that this paper examined was whether there were any differences in hospital expenses of diabetes, obesity, and COVID-19 and non-COVID-19 patients.

Research Question and Hypotheses

RQ: What is the difference, if any, in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity?

H_o: There is no statistically significant difference in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity.

H_a: There is a statistically significant difference in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity.

Theoretical Framework

The theory that grounded this study was Andersen's (2008) behavioral model of health service utilization. Andersen's behavioral model of health service utilization was developed to identify and study the determinants of a population's health services utilization, to study the inequality in access to health care services, and to aid the policymaking process that strives to improve access equity to health care services. The theory was created to help researchers explain how and why individuals utilize certain types of health care services (Andersen, 2008). Andersen's behavioral model of health service utilization states that health service utilization follows a logical order of sequence: predisposing, enabling, and need factors (Li et al., 2016). Health care utilization is driven by conditions found within the community. As the need of the community fluctuates, so does the utilization of health care services. The existence of health inequalities is a reality that health administrators are facing. Those with preexisting conditions are more likely to experience illness. Health care systems and health administrators have some degree of control over the health of the population they serve.

Andersen's behavioral model of health service utilization aligned with the nature of my study because the theory is used to study the determinants of an organization's health services utilization and may assist the policymaking process to increase equitable access to health services (see Andersen, 2008). Andersen's behavioral model of health service utilization was ideal to assess the impact of multiple chronic conditions and health service utilization. Health service utilization relates to cost because health service

utilization increases health care costs (Li et al., 2016). Multiple chronic diseases are a significant need factor and constitute an increase in health service utilization in health care organizations (Li et al., 2016). Health care organizations and health administrators have a responsibility to their communities to provide support for those most at risk.

COVID-19 disproportionally affected those with comorbid conditions, specifically those with diabetes and obesity (Huang et al., 2021; Williams et al., 2020). It was essential to compare the financial implications of those with diabetes and obesity within the COVID-19 and non-COVID-19 population within health care organizations to measure the effect COVID-19 had on health care organizations. Andersen's behavioral model of health service utilization grounded my research and may inform hospital administrators and health care policymakers to create unique programs that target improved health outcomes for COVID-19 patients with the comorbidities of diabetes and obesity and may lower the cost of care for health care organizations.

Nature of the Study

The study was a quantitative correlational study. Linear regression analysis was used to determine whether a relationship existed between the variables of COVID-19 patients, diabetes, obesity, and hospital expenses. Secondary data, which were not previously used for research were used from a rural health care system in North Carolina.

Literature Search Strategy

To examine the relationship between COVID-19, diabetes, obesity, and hospital expenses in a rural health care system in North Carolina, I began my search by reviewing

recent (2018–2022) peer-reviewed articles via the Walden University Library. These databases included JSTOR, CINAHL, and EBSCOhost. Additionally, Google Scholar was used to find open access articles. I obtained several important articles published within the last 5 years. The following search terms were used to discover literature: *COVID-19 impact*, *financial implications of COVID-19*, *COVID-19*, and *diabetes* and *obesity*. Variations of the terminology were used to make certain the search results were thorough.

Literature Review Related to Key Variables and/or Concepts

The financial security of health care organizations is paramount to the health of the communities in which they reside. Diabetes, obesity, and COVID-19 have negatively affected the cost of care in hospitals (Ohsfeldt et al., 2021). More research was needed to determine the financial implications that diabetes and obesity with and without COVID-19 have had on health care organizations. America is no stranger to epidemics (Martinez et al., 2023). An epidemic is defined by the CDC as a sudden jump in the number of cases of a contagious disease within a specific area during a particular period (Martinez et al., 2023). COVID-19 is a seminal disease that quickly became a pandemic. Never had a disease affected a worldwide population simultaneously. One epidemic affected the world for over 90 years: 1918 H1N1 flu (Martinez et al., 2023). The H1N1 flu caused the influenza pandemic and was known as the Spanish flu and is still found around the world every year (Martinez et al., 2023). The H1N1 flu can be compared to the COVID-19 pandemic because it caused an unprecedented number of deaths during its height. Even in

2009, the H1N1 flu (then referred to as swine flu) was devastating and accounted for 12,469 deaths in the United States (Martinez et al., 2023). Today, COVID-19 has accounted for 1 million deaths in the United States in a little over 2 years and has cost 4.6 trillion in government (CDC, 2022). The enormity of the cost and impact of COVID-19 warranted the need for further research.

Role of Regulatory Bodies

Regulatory agencies help to create policies that provide access to care, protect the public, and set high standards for medical professionals (Portnoy, 2020). The role of regulatory bodies such as the CDC and the Food and Drug Administration (FDA, in the creation of health care policies and initiatives has long been established (Maryville University, 2022). The CDC (2021a) is known as America's public health protection agency and has the right to implement regulations that help to protect Americans from health and safety threats in and outside of the United States. The regulations that the CDC creates help in the development of medical screening protocols for advanced practitioners, limit the importing of items that may create a threat to public health, and defend against infectious diseases that could spread into the United States (CDC, 2021a) Although there is some controversy about how much control the government has during pandemics, the CDC has a responsibility for the health of the nation. Conners (2020) discussed the governments, and more specifically the CDC's, role and responsibility during public health crises. Urgency is shown in several ways including percentage of the sick, loss of revenue, increase in expenses, and public outcry. Conners explained the

CDC's authority to enforce regulations and policies that are necessary to prevent the spread of communicable diseases. This could include grant programs focused on areas of need identified by health care administrators.

In comparison, the U.S. FDA (2018) is also responsible for the advancement of public health by organizing the process that medical innovations must undergo to ensure that the products are effective, safe, and affordable. Additionally, the FDA disseminates information to the public that provides accurate and science-based data geared toward improving health. The relationship between government regulatory bodies and health crises has a long history (Portnoy, 2020). One of the earliest examples of the U.S. government becoming involved in health care is in the late 1700s when President Adams established the Act for the Relief of Sick and Disabled Seamen that provided health care for sailors through payroll deduction (Maryville University, 2022). One recent example of a public health initiative backed by the CDC is the National Action Plan for Cancer Survivorship: Advancing Public Health Strategies (National Center for Chronic Disease Prevention and Health Promotion, 2004). This plan was developed by the CDC and the Lance Armstrong Foundation to identify and promote cancer survivorship needs (National Center for Chronic Disease Prevention and Health Promotion, 2004; White et al., 2017). Some of the objectives included identifying appropriate methods and resources to aid in the ongoing surveillance of people whose lives have been impacted by cancer and establishing a solid body of research that would impact various issues that cancer survivors face (White et al., 2017).

Quality adjusted life-year is an outcome measure that drives health policy. Briggs et al; (2021) found that during the first wave of COVID-19 many deaths were found in those with comorbid conditions, and there was a significant loss of quality adjusted life-year expectancy with those deaths. Zhang et al. (2004) highlighted the importance of diabetic research that leads to disease and disease complication prevention. Zhang et al. discussed the high cost of diabetes care and that the costs will continue to increase. Policymakers and medical professionals rely on scientific research to inform them regarding which programs need to be developed, which is important in a world in which there are limited resources and an increasing demand for disease awareness and prevention (Zhang et al., 2004). The current study may inform stakeholders and add to the body of knowledge that can be used to promote disease awareness and prevention.

COVID-19

COVID-19 is caused by a coronavirus called SARS-CoV-2 (CDC, 2021b). COVID-19 causes respiratory symptoms that feel like flu or pneumonia (CDC, 2021b). COVID-19 was first seen in Wuhan City, China in the latter part of 2019 (Martinez et al., 2023). From there it spread quickly to other parts of the world (Martinez et al., 2023). By May 2020, there were a million cases and 100,000 deaths reported in the United States (Martinez et al., 2023). To date, there have been 91.5 million cases of COVID-19 in America, with 1.03 million deaths reported (CDC, 2021b).

Ohsfeldt et al. (2021) used Premier hospital data to evaluate inpatient hospital costs for COVID-19 patients in the United States. Their research found that patients who

required advanced medical care such as mechanical ventilation had the greatest hospital and ICU cost and length of stay. One of the key drivers of cost was found to be obesity.

Diabetes

Diabetes is a disease that affects a large percentage of the world's population and has three main types: Type 1, Type 2, and gestational diabetes (American Diabetes Association, 2018). Type 1 diabetes is a condition in which the pancreas produces little to no insulin, Type 2 diabetes is an impairment in the way the body controls and uses glucose, and gestational diabetes is a condition that occurs during pregnancy in which the body cannot make enough insulin (CDC, 2022; National Institute of Diabetes and Digestive and Kidney Disease, 2022). Diabetes is the major cause of blindness, kidney failure, heart attacks, stroke, and lower limb amputations. The number of Americans living with diabetes has doubled within the last 20 years and is attributable to many different causes such as genetics, lifestyle, and behavioral factors (CDC, 2024). Diabetes is important to study because it negatively affects outcomes for hospitalized patients and because diabetic patients have more serious diseases and require advanced medical treatment more often than patients who have no or different comorbidities (CDC, 2024). This significantly increases cost of care for diabetic patients (CDC, 2024; Zhang et al., 2004). The cost of care for diabetes was 327 billion in 2017, and diabetes accounted for 1 in 4 health care dollars spent in the United States (Peterson, 2018). Williams et al. (2020) found that there is a need for further research directed at the improvement of the

determinants and trends to create disease prevention programs. Additionally, research was needed to compare the financial impact of COVID-19 and diabetes.

Obesity

Obesity has been described as an abnormal fat accumulation that poses a risk to health (Mayo Clinic, 2022). Obesity has been clinically defined as a body mass index (BMI) of 30 and above (Huang et al., 2021). Obesity's prevalence has doubled worldwide since 1980, and a third of the world's population is classified as obese (Chooi et al., 2019). Ward et al. (2019) projected that obesity will continue to increase, and the prevalence will be higher than 50% in 29 states and not below 35% in any state. In addition, projections indicated that 1 out of 4 adults will have severe obesity by the year 2030 (Chooi et al., 2019; Ward et al., 2019).

Obesity has exerted high economic costs on the U.S. health care system (West Virginia Health Statistic Center, 2022). The treatment, management, and prevention of obesity is a costly endeavor (Hasan et al., 2019). Obesity represented a 32% increase in medical costs when compared to those with normal weight (Hasan et al., 2019).

Huang et al., 2021 tells that obesity has been shown to impact infectious disease outcomes. In 2009 during the H1N1 pandemic, obesity was linked to the severity of disease for the first time. Numerous studies have linked the severity of and increased death from COVID-19 with obesity. A cohort study in New York found that severe obesity was associated with increased patient mortality and poor inpatient outcomes. Similarly, a study conducted in China revealed that patients who had a BMI higher than

25 made up 25% of their severely ill COVID-19 patients. Given the high number of short-term and long-term complications associated with obesity, efforts are needed to facilitate health interventions and social policies (Hasan et al., 2019; Huang et al., 2021).

Definitions

Comorbidity: A patient having the presence of two or more diseases (Valderas et al., 2009).

COVID-19: A novel disease caused by a coronavirus called SARS-CoV-2 that presents with flu-like symptoms (CDC, 2021b). COVID-19 causes respiratory symptoms that feel like the flu or pneumonia (CDC, 2022). To date, there have been 91.5 million cases of COVID-19 in America, with 1.03 million deaths reported (CDC, 2022)

Diabetes: A disease that causes difficulty or the inability to produce or respond to insulin, which is a hormone that is produced by the pancreas (NIDDK, 2016). Diabetes has three main types: Type 1, Type 2, and gestational, (NIDDK, 2016). Type 1 is defined as a condition in which the pancreas produces little to no insulin, Type 2 is characterized by an impairment in how the body controls and uses glucose, and gestational occurs when the body cannot make enough insulin during pregnancy (CDC, 2022)

Hospital expenses: Charges for all services that are provided by a health care organization to a patient (CMS.gov, 2020). Charges include billed charges such as room and board, medical services provided by medical staff, and pharmacy charges (CMS.gov, 2020).

Obesity: A chronic metabolic condition defined as abnormal or excessive fat accumulation that presents a risk to health and is defined clinically as BMI over 30 (Chooi et al., 2019).

Assumptions

I assumed that all patients who entered the hospital were tested for COVID-19 and the COVID-19 diagnosis was captured in the data set. I also assumed that all patients' diabetes and obesity diagnoses were accurately captured in the data set.

Scope and Delimitations

This study focused on the comparison of patients with COVID-19 who had obesity and diabetes and non-COVID-19 patients with obesity and diabetes and the hospital costs associated with each group. The study captured only patients who had diabetes and obesity and were at least 18 years of age. The results included COVID-19 patients and non-COVID-19 patients who had a diabetes and an obesity diagnosis that were discharged between January 1, 2020, and December 31, 2021. All insurance payers were included.

Limitations

This study incorporated a secondary data set from a rural health care organization in North Carolina. The study was limited to a rural community and included only patients admitted within the rural community's health care system. This study also relied on coding accuracy within the data set. I sought to examine whether there was a relationship between COVID-19 patients, diabetes and obesity, and hospital expenses. Although my

study sought to understand the relationship between hospital costs and diabetic and/or obese patients with and without COVID-19, I could not state that COVID-19 was the sole reason for difference in hospital expenses.

Significance

The significance of studying the relationship between hospital expenses, diabetes and obesity, and COVID-19 and non-COVID-19 patients cannot be understated. This study helped to find evidence to fill the gap in the literature regarding the financial implications between hospital expenses, diabetes, obesity, COVID-19, and non-COVID-19 patients. Filling this gap may assist hospital administrators and other health care leaders in creating policy changes for future processes and programs that may improve COVID-19 patient outcomes (Portnoy, 2020).

Summary and Conclusions

Diabetes and obesity have had a considerable influence on the rising cost of health care. COVID-19 added more financial burdens to the United States health care system (Ohsfeldt et al., 2021). The literature review helped me design a study to examine the associations between hospital expenses diabetes, obesity, and COVID-19. Additional research was needed to compare the financial implications, if any, between diabetes, obesity, and COVID-19. The cost of COVID-19 and diabetes and obesity was known, but what was not known was whether there is any difference in the cost of care between COVID-19 and non-COVID-19 patients with diabetes and obesity. The secondary data source was a database from a rural health care organization in North Carolina. I used the

Statistical Package for Social Sciences (SPSS) to convert the secondary data, which assisted in the analysis of the variables. Results may allow for better hospital planning regarding funding and governmental programs aimed at improving patient outcomes. Section 2 includes a discussion of the research design, population, and rationale for the study.

Section 2: Research Design and Data Collection

The study examined the relationship between hospital expenses, diabetes, obesity, and COVID-19 and non-COVID-19 patients. Hospital expenses are charges that are billed to insurance payers. The study's design was a quantitative analysis using linear regression guided by the Andersen's behavioral model of health service utilization. The dependent variable was hospital expenses, and the independent variables were diabetes and obesity and patients with and without a COVID-19 diagnosis. This section covers the research design, methodology, and threats to validity.

Research Design and Rationale

In this study, I used a quantitative design using linear regression analysis. This design choice was consistent with research designs used in similar studies that sought to compare two groups within a population. The independent variables were diabetes and obesity and patients with and without a COVID-19 diagnosis. The dependent variable was hospital expenses. The linear regression analysis helped me answer the research question pertaining to whether diabetes and obesity are predictive of hospital expenses for patients with and without a COVID-19 diagnosis.

Methodology

G*Power Analysis

G*Power analysis was conducted to determine the required sample size needed to detect any effects that may result from the independent variables with attention to the size of the effect, the type of statistical tests that were used, and the alpha level (level of

significance) of the study (see Faul et al., 2007). The level of power is helpful to detect the probability of a Type II error (failing to reject a false null hypothesis) occurring (Tomczak et al., 2014). A priori power analysis for a linear regression was conducted in G*Power using an alpha of 0.05, a power of 0.95, an effect size of 0.15, and 2 as the number of predictors. Based on those inputs, the desired sample size was 200 (see Faul et al., 2007).

Target Population

I gathered data from a hospital in rural North Carolina. In this study, I focused on patients admitted with the primary reason of diabetes and/or obesity with and without COVID-19 on their problem list. Havenon et al. (2021) sought to address the hospital discharge rates, demographic factors, and outcomes of hospitalization associated with the COVID-19 pandemic among United States patients with ischemic stroke in 2020. The methodology that Havenon et al. used was like my study's approach. The study was a retrospective cohort study using Vizient data from 2019 to 2020. Results indicated that after COVID-19's emergence, hospital discharges of patients with ischemic stroke decreased but returned to prepandemic levels by mid-year 2020. The difference between this study and my study was that I chose to focus on the clinical aspects and did not address the financial impact. The financial impact is essential because health care organizations are businesses, and the viability of the business is vital to support the clinical aspects of health care and the health of the communities that the health care organizations serve.

Setting and Sample

I used secondary data sources to answer the research question addressing whether there is a difference in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity. No consent forms were necessary because the data had already been obtained and no live participants were involved. Data collection did not begin until I received Walden University's Institutional Review Board approval. The IRB approval number for this study is 07-31-0424875.

Instruments and Materials

I used a secondary data set from a rural North Carolina health care organization's database. The secondary data set included a general medical and surgical hospital and provided data about hospital expenses, diabetes, obesity, and patients with and without a COVID-19 diagnosis. SPSS was used to conduct linear regression analysis. After completing the analysis, I interpreted the results to determine whether the null hypothesis should be accepted or rejected.

The dependent variable was hospital expenses. The independent variables were diabetes, obesity, and patients with and without a COVID-19 diagnosis. The Internal Revenue Service (2022) defined *hospital expenses* as any costs incurred during the diagnosis, cure, treatment, or prevention of disease that affects a part or function of the human body.

Hospital expenses for the sake of the current study were defined as the cost of treatment and services rendered during an inpatient hospital stay. Each hospital stay or

encounter is assigned a hospital account record (HAR) number. The HAR number is then used to track all medical expenses incurred during the visit. Hospital expenses were measured using the total patient balance for a single encounter hospital stay. The scale for hospital expenses was any real numbers reported for the total patient balance for a single hospital stay.

Diabetes is characterized by a person's inability to make enough insulin or the ability to use the insulin the body produces properly and can lead to serious health conditions that include heart and kidney disease (CDC, 2024). There are three types of diabetes: Type 1, Type 2, and gestational (CDC, 2024). Type 1 diabetes typically presents as the body stops producing insulin; in Type 2 diabetes, the body makes insulin but is unable to use it properly, and gestational diabetes is a type of diabetes that develops in pregnant women who previously did not have diabetes (CDC, 2024). In the current study, diabetes was measured using the presence of a diabetes code under the final diagnoses in the patient's HAR. In ICD-10-CM, diabetes is characterized by the following codes: E08 diabetes mellitus due to underlying condition, E09 drug or chemical induced diabetes mellitus, E10 Type 1 diabetes mellitus, E11 Type 2 diabetes mellitus, and E13 other specified diabetes mellitus (CMS.gov, 2022a). Any diagnosis of diabetes (Type 1, Type 2, or gestational) was counted as the presence of diabetes (CDC, 2024).

Obesity was a categorical and nominal variable. *Obesity* was defined as the abnormal or excessive accumulation of fat that poses a risk to health (Mayo Clinic, 2022). Obesity is measured using a calculation known as adult BMI (Yu et al., 2021). If a

person's BMI is 30.0 or higher, then, it is classified as obesity (Mayo Clinic, 2022). In ICD-10-CM, obesity is categorized by the following codes: E66.0 obesity due to excess calories, E66.01 morbid (severe) obesity due to excess calories, E66.1 drug-induced obesity, E66.2 morbid (severe) obesity with alveolar hypoventilation, E66.3 overweight, E66.8 other obesity, and E66.9 obesity unspecified (CMS.gov, 2022b; Mayo Clinic, 2022). There are also codes that relate to a patient's BMI (CMS.gov, 2022b). These codes were also considered and were as follows: Z68.3 BMI 30-39, adult; and Z68.4 BMI 40 or greater, adult. Diabetes was a categorical and nominal variable (CMS.gov, 2022b). Any diagnosis of obesity that met the listed requirements and/or the presence of the listed BMI codes was considered as the presence of obesity.

COVID-19 was defined as a disease that is caused by a virus termed SARS-CoV-2 (CDC, 2021). COVID-19 manifests as cold and flu-like symptoms (CDC, 2021). COVID-19 has been known to attack the respiratory system and can negatively affect other body systems (CDC, 2021). COVID-19 was measured by the presence of ICD-10 code U07.1, COVID-19. This code encompasses all cases of COVID-19 whether the diagnosis is achieved through testing, symptoms, exposure, or a combination of all three (CMS, 2022). Any diagnosis of COVID-19 that had the presence of ICD-10 code U07.1 was considered as the presence of COVID-19 (see CMS, 2022). COVID-19 was a categorical and nominal variable.

The study focused on a health care organization in rural North Carolina. The research included data from 2020 to 2021 and aimed at discovering connections between

COVID-19 patients with diabetes and obesity, non-COVID-19 patients with diabetes and obesity, and hospital expenses. To account for other factors that may have influenced the study's results, I measured the control variables of age and gender. Age was a metric variable that used the ratio scale as had a starting point of zero. Gender was a categorical and nominal variable, and because it had only two characteristics it was considered a binary variable (see DATAtab, 2023). Using linear regression analysis, I added age and gender with the independent variables of diabetes and obesity diagnosis as predictors. The results then showed the relationship between health care expenses and diabetes and obesity diagnoses with and without a COVID-19 diagnosis while holding age and gender fixed (see DATAtab, 2023). The research question and hypotheses were the following:

RQ: What is the difference, if any, in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity?

H_o: There is no statistically significant difference in hospital expenses between COVID-19 patients and non-COVID-19 patients with diabetes and obesity.

H_a: There is a statistically significant difference in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity.

Data Analysis

I used linear regression to analyze the data to determine whether there was any difference in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity. Linear regression using SPSS software was conducted to answer the research question concerning the dependent variable, hospital expenses. Categorical

variables (diabetes, obesity, and COVID-19 and non-COVID-19 diagnosis) were analyzed to determine hospital expenses in each area. Data cleaning was conducted so that any encounters that had not been final billed were excluded and to eliminate any duplicate or erroneous encounters. ICD-10 codes were used to limit the results to only those who had all necessary components: diabetes (any of the previously listed codes), obesity (any of the previously listed codes), and COVID-19 (the previously listed code) or the absence of the COVID-19 code for diabetes and obesity patients without COVID-19. The control variable was employed to limit the results only to those age 18 years and older. People under 18 may respond to treatment differently and may have different outcomes beyond the established norm for adults, so to prevent confounding people I excluded those under age 18.

Alexopoulos (2010) described data analysis as extracting an accurate estimation from raw data. The data analysis process in the current study sought to address whether there was a relationship between a response variable and explanatory variables. The type of regression model that best fits the data depends on the response variable's distribution (Alexopoulos, 2010). A linear regression model is used if the response variable is continuous (Alexopoulos, 2010). In the current study, the variable was continuous and normal, so the best fit was the simple linear regression model. Simple linear regression helped me estimate the linear equation's coefficient and best predict the value of the dependent variable. This study sought to investigate differences in hospital expenses between diabetes and obesity patients with and without a COVID-19 diagnosis. The

simple regression equation was y = a + bX, with a being the constant coefficient and b being the coefficient associated with COVID diagnosis (STHDA, 2018). I assigned 2 if the patient had COVID-19 and 1 if the patient did not have COVID-19. This variable was then used a predictor in the simple regression equation, which stated b1 + x2 for diabetic and obese patients who had COVID-19 and b2 +x1 for diabetic and obese patients who did not have COVID-19 (see STHDA, 2018). The coefficients could then be understood because b2 was the hospital expenses for non-COVID-19 patients with diabetes and obesity and b1 was the hospital expenses for COVID-19 patients with diabetes and obesity (see STHDA, 2018).

I used SPSS to simplify the analysis of complex statistical information in my study. SPSS helped me identify any correlations or relationships that may have existed between the variables. The statistical test of the hypothesis was linear regression. Linear regression helped me determine whether a difference existed between two groups (see Alexopoulos, 2010). The threshold for determining statistical significance was set by the *p* value. If the *p* value was less than 0.05, then the null hypothesis would be rejected and I would conclude that there was a statistically significant relationship between the predictor and the response variable (see Alexopoulos, 2010). If the *p* value was not less than 0.05, then I would fail to reject the null hypothesis (see Alexopoulos, 2010). I tested certain assumptions to make sure they were met. The model's residuals were checked for normality, random distribution, and homoscedasticity (Alexopoulos, 2010).

Threats to Validity

To reduce the threats to statistical validity, I limited the range restriction only to the extent necessary to explore the relationship between the independent and dependent variables (Alexopoulos, 2010). If the limitation of the range is too great, incorrect estimates may be obtained (Alexopoulos, 2010). *External validity* refers to concerns about the generality of a study's results to individuals other than the study's population. There were several threats to external validity that were considered. First, the selection of the study population was analyzed. This study's population consisted of de-identified HAR encounters that were admissible for use without requiring explicit consent from participants. The temporal, ethnic, socioeconomic, and geographical aspects of this study support generalizability. Because this was a retrospective study, the time that will have elapsed will not affect the study's generalizability because other researchers can use the same time frame and possibly obtain similar results. *Internal validity* is the confidence level that exists between the cause-and-effect relationship that the study seeks to establish that cannot be explained by additional factors. I checked for internal validity by examining whether the variables changed together and whether the independent variable changed before the dependent variables. I also adjusted for confounding factors (age and gender) that could have affected the results of the study.

Ethical Procedures

There was one agreement needed to gain access to secondary data set. This agreement was an application to access data from study site's electronic health record. I

submitted a quality determination form to the study site to determine whether they categorized this research as a quality endeavor or a human subject. The determination from the quality form required local institutional review board approval from the hospital. At that point, there were no ethical concerns that were related to the processes found within the secondary data set. There were also no ethical concerns related to the data collection such as participants refusing participation or early withdrawal. The data were de-identified and anonymous. The only identifiers used were the patient's age, sex, diabetes diagnosis, obesity diagnosis, and final billing (hospital costs) for each encounter. The data were stored on a local computer that was issued from the organization. The data were password protected and will be stored as long as required. Only I and the applicable Walden University team members had access to the data. The data will be destroyed once the research is completed and all requirements for data retention have been met. A potential ethical issue could have stemmed from using secondary data within my work environment, but the data were separate and different from my job function.

Summary

I conducted this quantitative study to examine whether there was a difference in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity. Simple linear regression using SPSS software was completed to determine whether there was a relationship between COVID-19 patients with diabetes and obesity and non-COVID-19 patients with diabetes and obesity. A rural North Carolina hospital

organization's database was used as the secondary data source. This section discussed the research design and rationale, data analysis, methodology, and threats to validity.

Section 3: Presentation of the Results and Findings

The goal of this study was to examine the relationship between hospital expenses, diabetes, obesity, and COVID-19 and non-COVID-19 patients. The purpose of this comparative quantitative study was to compare the difference in hospital expenses, if any, of diabetes and obesity patients with and without COVID-19 at a North Carolina rural health care center. The independent variables (diabetes and obesity patients with and without COVID-19) were defined generally as the population of patients who had diabetes and obesity as a diagnosis and included those with COVID-19 and those without COVID-19. The dependent variable (hospital expenses) was defined generally as hospital charges accumulated during the patient's inpatient stay. Hospital expenses are charges that are billed to insurance payers. The study's design was a correlational analysis using simple linear regression guided by Andersen's behavioral model of health service utilization. The dependent variable was hospital expenses, and the independent variables were diabetes and obesity and patients with and without a COVID-19 diagnosis. This section covers data collection of secondary data, results, and a summary.

Data Collection of Secondary Data

The time range for the sample population was limited to 2020–2021. There were no discrepancies in the use of the secondary data set from the plan presented in Section 2. The descriptive and demographic characteristics of the sample were male and female inpatients with any insurance providers aged 18 and above who had diabetes and obesity. The sample included those who had been diagnosed with COVID-19 and those who were

not diagnosed with COVID-19. The sample was representative of the population due to probability sampling in which all members of the population have an equal chance of being selected. The original sample size was 12,406. Of those 12,406, only 952 had a COVID-19 diagnosis. Because the desired sample size was 200, I randomly selected 950 COVID-19 and non-COVID-19 encounters. The representative samples were chosen at random, and this helped to reduce the probability of biased results. Because the study was a simple linear regression, there was no need to complete univariate analyses.

Results

Simple linear regression was used to determine whether there was a relationship between diabetes and obesity patients with COVID-19, diabetes and obesity patients without COVID-19, and the cost of care as determined by total charges. Table 1 highlights the sample size and the mean and standard deviation of the variables. Total charges for diabetes and obese patients with COVID-19 were $77,608,298. The mean charges for diabetes and obese patients with COVID-19 were $81,607. Total charges for diabetes and obese patients without COVID-19 were $56,382,183. The mean charges for diabetes and obese patients without COVID-19 were $59,412. The total charges for COVID-19 and non-COVID-19 diabetes and obese patients were $133,990,482. The mean for total charges for COVID-19 and non-COVID-19 diabetes and obese patients was $70,522, and the standard deviation for total charges was $104,420. When the standard deviation is higher than the mean, it indicates that the data points are more spread out from the mean. This suggests that the values in the data set were more

dispersed and that there was greater variability in the data. The individual data points were further away from the average, which made the distribution spread out more and less concentrated around the mean. There were also a few 0 values, which resulted in a higher standard deviation than mean. When the standard deviation is higher than the mean, it is recommended to use range and median to measure dispersion and central tendency, respectively (Alexopoulos, 2010). Because the range was larger than the mean, it showed that there was a lot of variation in the data. The mean charges of $70,521 were greater than the median ($35,601) and the mode ($19,006), which indicated right skewness or positive skewness. When the data are positively skewed, this means that the data at the extreme area have higher numerical values than most of the other data points so that the mean of all the data points goes up.

Table 1

Comparison of Total Charges of Diabetic and Obese Patients with COVID-19 and Without COVID-19

Patient	Total charges	Average charges	*SD*	Range	Median	Mode
With COVID-19	$77,608,298	$81,607	$122,989	$1,156,848	$35,568	$19,006
Without COVID-19	$56,382,183	$59,412	$80,159	$1,150,222	$35,658	None
Both	$133,990,482	$70,521	$104,420	$1,167,053	$35,601	$19,006

Table 2 shows the correlation between the variables. SPSS excluded the variable non-COVID-19 diabetic and obese patients because of its lack of predictive power. If an independent variable does not contribute to predicting the dependent variable, then SPSS may exclude it from the regression model. The significance (sig.) was less than .001. The correlation between an encounter that had a COVID-19 diagnosis, and the total charges was a statistically significant positive relationship.

Table 2

Correlation of Diabetic and Obese Patients With COVID-19 Versus Total Charges

Patient	Pearson correlation	Sig. (1-tailed)	*N* COVID
With Covid	.106	.00	950
All	1.0	<.001	1900

Table 3 indicates the significance between the independent and the dependent variables as indicated by the R^2 result. R^2 is used to denote the strength of the correlation between the two variables. There was a correlation of .011 between the COVID-19 diagnosis and total cost of care for diabetic and obese patients. The value of .011 indicated that 1.1% of the variance in total costs was explained by a COVID-19 diagnosis. The standard error of the estimate was high, which indicated that the sample means were widely spread around the population mean.

Table 3

Model Summary of Diabetic and Obese Patients With COVID-19

Model	*R*	R^2	Adjusted R^2	*SE* of estimate
1	.106	.011	.011	103,883.75

Table 4 shows the independent variable (COVID-19 diagnosis) had a *p* value of .001. If the *p* value was greater than 0.05, then the independent variable (COVID-19 diagnosis) would not have significantly predicted the dependent variable. Because the *p* value was .001 and was lower than 0.05, the COVID-19 diagnosis significantly predicted total charges. Results indicated 99.9% confidence that a COVID-19 diagnosis predicted the total cost of care as explained by total charges. SPSS excluded the variable non-COVID-19 diabetic and obese patients because of its lack of predictive power. If an independent variable does not contribute to predicting the dependent variable, then SPSS may exclude it from the regression model. Secondly, the sign of the unstandardized coefficient *B* for the independent variable was positive. Therefore, I concluded that the independent variable positively predicted the dependent variable. Likewise, if the independent variable increases, then the dependent variable increases. The coefficient for encounter with a COVID-19 diagnosis was $22,194. If an encounter had a COVID-19 diagnosis, then the total charges were predicted to increase by $22,194. The standardized beta ranges from 0 to 1. The closer the value is to 1, the stronger the relationship.

Because the beta was .106, the relationship matched the 1.1% variance of total costs illustrated in Table 3.

Table 4

Coefficients of Diabetic and Obese Patients With COVID-19

Diabetic & Obese Patients	Unstandardized Coefficient (UC) B	UC Standard Error	Standardized Coefficient (SC) Beta	SC t	SC Sig.
Constant	$59,412	$3,372		17.62	<.001
Covid	$22,194	$4,766	.106	4.656	<.001

Table 5 indicates that the results of analysis of variance were significant, $F = 21.68$, $p = .001$. In a linear regression model, each variable uses one degree of freedom (*df*). The sample size was 1,900 so the *df* was 1,898. The *df* determines whether the data and the variables are a good fit. If there are not enough data for the linear regression, then there will be imprecise estimates and low statistical power.

Table 5

Analysis of Variance for Diabetic and Obese Patients With COVID-19

Model	Sum of squares	*df*	Mean square	*F*	Sig
Regression	$233,989,878,154	1	$233,989,878,154	21.68	< .001
Residual	$20,482,900,011,982	1,898	$10,791,833,515.30		
Total	$20,716,889,890,136	1,898			

The correlation between an encounter that had a COVID-19 diagnosis, and the total charges was a statistically significant positive relationship. The presence of a COVID-19 diagnosis increased the total charges, indicating that the null hypothesis must be rejected. The significance (sig.) was less than .001. R^2 was used to denote the strength of the correlation between the two variables. There was a correlation of .011 between the COVID-19 diagnosis and the total cost of care for diabetic and obese patients. The value of .011 indicated that 1.1% of the variance in total costs was explained by a COVID-19 diagnosis. This suggests that there are many additional factors that may affect diabetic and obese patients' total cost of care and that the effect size for COVID-19 was low.

The independent variable's (COVID-19 diagnosis) *p* value was .001. If the *p* value was greater than 0.05, then the independent variable (COVID-19 diagnosis) would not have significantly predicted the dependent variable. Because the *p* value was .001 and was lower than 0.05, then COVID-19 diagnosis significantly predicted total charges. Results indicated 99.9% confidence that a COVID-19 diagnosis predicted the total cost of care as explained by total charges. Secondly, the sign of the unstandardized coefficient *B* for the independent variable was positive. Therefore, I concluded that the independent variable positively predicted the dependent variable. If the independent variable increases, then the dependent variable increases. The coefficient for encounter with a COVID-19 diagnosis was $22,194.84. If an encounter had a COVID-19 diagnosis, then the total charges were predicted to increase by $22,194.84. The null hypothesis stated that there was no statistically significant difference in hospital expenses between COVID-19

and non-COVID-19 patients with diabetes and obesity. To reject the null hypothesis, there must have been a statistically significant difference in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity. I rejected the null hypothesis that the slope of the regression line was 0 and concluded that a COVID-19 diagnosis significantly predicted total charges. The research question addressed the difference, if any, in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity. The null hypothesis stated that there was no statistically significant difference in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity. To reject the null hypothesis, there must have been a statistically significant difference in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity. I rejected the null hypothesis that the slope of the regression line was 0 and concluded that a COVID-19 diagnosis significantly predicted total charges.

Summary

This study sought to answer the following research question: What is the difference, if any, in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity. The null hypothesis stated that there was no statistically significant difference in hospital expenses between COVID-19 patients and non-COVID-19 patients with diabetes and obesity. The alternative hypothesis stated that there was a statistically significant difference in hospital expenses between COVID-19 and non-COVID-19 patients with diabetes and obesity. Based on the results from the linear

regression, the *p* value was less than 0.5, which indicated that the null should be rejected, and the alternative hypothesis should be accepted. My research indicated that there was a statistically significant difference in hospital expenses between COVID-19 patients and non-COVID-19 patients with diabetes and obesity.

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

This study sought to examine the relationship between hospital expenses, diabetes, obesity, and COVID-19 and non-COVID-19 patients. This correlational analysis was completed using simple linear regression guided by the Andersen's behavioral model of health service utilization. The dependent variable was hospital expenses, and the independent variables were diabetes and obesity patients with and without COVID-19. The study found that there was a positive relationship between hospital expenses and COVID-19 compared to non-COVID-19 patients. The presence of COVID-19 affected the hospital expenses. The explanation of COVID-19 and total hospital charges was not high but moderately low. The presence of COVID-19 diagnosis accounted for 1.1% of the variance in total charges.

Interpretation of the Findings

Researchers had investigated COVID-19's effect on patients with diabetes and obesity, but there was little research done on COVID-19 patients and non-COVID-19 patients to test the difference in hospital expenses in rural North Carolina (see Di Fusco et al., 2021). COVID-19 has affected patients with comorbidities such as diabetes and obesity at a higher rate than patients who did not have any comorbidities (Czernichow et al., 2021; Smati et al., 2020).

The current findings extend the knowledge in the following ways. First, the evidence supports that there is a connection between a COVID-19 diagnosis, diabetes and obesity, and hospital costs. Previous studies highlighted the rising costs of health care and

identified diabetes and obesity as some of the leading diagnoses that contribute to those costs. The findings also indicated that the inclusion of a novel virus such as COVID-19 may exacerbate an already overwhelmed system and may negatively affect an exhausted health care system (Di Fusco et al., 2021; Hasan et al., 2019).

Andersen's (2008) behavioral model of health service utilization is aimed at understanding why people use health care services, the inequality in access to health services, and the creation of policies that allow for equal access to health care services. Health care utilization is driven by conditions found within a community. Andersen's behavioral model of health service utilization can be instrumental in the discovery of conditions that facilitate or obstruct utilization (Andersen, 2008). This related to the current study because COVID-19 increases the urgency and exacerbates the conditions of diabetes and obesity, thereby increasing utilization of health care services (see Di Fusco et al, 2021).

Rural areas have several deficits when compared with urban areas (Li et al., 2016). The lack of advanced care practitioners, facilities, and the means to afford health care are problematic. Access can be defined as the availability of services within a certain area either by location or financial considerations (Aday & Andersen, 1974). The higher the cost of care, the more unequal the access will be because higher costs generally mean greater complexity of illnesses. This may lead to more advanced-level practitioners being needed in a system that is already deficient in the number of medical staff available (Aday & Andersen, 1974). The current results indicated that 1.1% of patients with

diabetes and obesity who were diagnosed with COVID-19 experienced higher costs than those diabetic and obese patients who did not have COVID-19. Although the percentage was low, the effect could still be felt because the differences between the costs could vary. In 2017, $327 billion were spent on diabetes medical costs, and $173 billion was spent on obesity medical costs (CDC, 2022). To put this in perspective, a 1.1% increase in the cost of care for diabetes and obesity would be $3.27 billion and $1.73 billion, respectively (CDC, 2022).

Limitations of the Study

One limitation that was present in my study was the need to limit the number of samples to represent a normal distribution. The power analysis indicated that an adequate sample size would need to be at least 200. Some of the samples had to be limited to prevent skewed data. The original sample size was 12,405 diabetic and obese patients, but only 950 patients had a COVID diagnosis. I randomly selected 950 cases from the patients who did not have a COVID diagnosis so that I could provide a more accurate assessment. Another limitation was the sample itself. The sample comprised people who resided in a rural North Carolina community and may not be representative of the total population of the United States health care system.

Recommendations

There is a need to expand and improve trend identification. Health care costs have been trending to rise each year (Hasan et al., 2019). The correlation between COVID-19 and non-COVID-19 patients diagnosed with diabetes and obesity and hospital costs is

significant. There is a need for additional research that addresses the multifaceted financial effect that COVID-19 has on the global health care system. The current study indicated a significant relationship between diabetes and obesity patients, a COVID-19 diagnosis, and cost of care. Additional research is needed to identify the socioeconomic factors that can explain the differences in cost of care. For example, diabetics with COVID-19 and diabetics without COVID-19 could be studied to determine whether there are lifestyle choices or socioeconomic factors that may be involved in the difference in cost of care.

Additional studies are needed to examine the relationship between diabetes and obesity and hospital costs and length of stay by race. Findings from the current study may prompt population health initiatives that may drive disease prevention. Early evidence suggested that diabetes increased during the pandemic and the National Health Institute projected that over 700 million adults could be living with diabetes (Hacker, 2024). The results of the current study could create forward thinking for budget and population health planning by encouraging investment in innovation that places the patient at the center of their care (see Hacker, 2024). An increase in self-monitoring programs that allow patients to have a more active part in their care could increase patient knowledge, drive better chronic care management, and slow exacerbation of diabetes and obesity (Hacker, 2024).

Implications for Professional Practice and Social Change

Professional Practice

The results of the current study highlight the need for health care administrators to perform regular need assessments for the community in which they reside. Novel viruses such as COVID-19 may place an additional burden on a weighed down health care system. Attention needs to be placed on patients with chronic conditions that currently burden the health care system. Diabetes and obesity patients may impact cost of care for other serious conditions such as stroke. Health care administrators need to become more involved in their community and provide educational opportunities and special programs that bridge the gap between inpatient discharges and primary care visits. There is no single solution; if the financial implications are to be improved, it will consist of health care administrators and the community working together.

Andersen's behavioral model seeks to understand what drives or motivates people to seek or utilize health care services. In line with this theoretical model, health administrators would do well to consider the community in which they reside and push for involvement and investment in the lives of the people whom they serve. According to Aday and Andersen (1974), there are several characteristics of an at-risk population. There are predisposing, enabling, and need-based concerns that drive the utilization of health services (Aday & Andersen, 1974). The utilization of health care services is further defined by service type, location, and purpose. Health administrators are responsible for identifying at-risk populations and managing resources. The increase in patients with

comorbidities results in an increase in health care costs. As patient become sicker, as defined by presence of one or more comorbidities, the resources they consume will be greater and the cost of care will higher.

Health care resources in rural communities are already scarce and fragmented. Additional burden would be unadvisable, and solutions are needed to manage health care resources more effectively. The current study showed that there is a positive correlation between diabetes and obesity, COVID-19 diagnosis, and total cost of care. Previous studies showed that COVID-19 increased the cost of medical care overall, but the current study indicated a direct correlation between a COVID-19 diagnosis and diabetes and obesity. This knowledge is essential because it further delineates how COVID-19 places a burden on the health care system. Although many of the population were not affected (in my study only 950 patients out of 12,405 patients had a COVID-19 diagnosis), it still accounted for an increase in cost of care, which is contrary to health care administrators' goal to provide quality and affordable care.

Positive Social Change

This study may create social change related to the financial implications of diabetes and obesity in COVID-19 and non-COVID-19 patients that may enable health care leaders to make informed decisions and plan for future initiatives. Analyzing the differences and/or similarities of diabetes and obesity hospital expenses between COVID-19 and non-COVID-19 patients may impact the financial security of a health care organization. Leaders may use this information to create programs that promote chronic

disease awareness and reduce reliance on pharmaceutical products that increase medical spending. Health care leaders could then focus on prevention, which may decrease the financial burden of diabetes and obesity. According to Kampen et al. (2014), disease prevention might decrease diabetes and obesity's cost of care. Prevention would help to deter costs that are associated with diabetes and obesity and could, thereby, result in decreased health care costs. This could lead to the creation of a unique program whose goal is to improve health outcomes for diabetes and obesity patients with COVID-19 and to lower or prevent current costs of care from rising.

In the event of another epidemic, careful attention to chronic diseases such as diabetes and obesity would be warranted because this population accounts for a large percentage of health expenditures in the health care system (CMS, 2020). One suggestion is to become involved in regulatory agencies such as the CDC to promote wellness and improve financial security of health care organizations. Health care administrators can help to create policies that increase and equalize access to care and set high standards for the quality of care that their communities experience.

Conclusion

COVID-19 is a novel virus that changed the structure of health care in the United States. Many departments and elective procedures were changed to slow the spread of the virus. This led to a delay in care for many and created an additional burden to patients who already consumed much of the U.S. health care system's resources (Hacker, 2024). The current study found a statistically significant association between COVID-19,

diabetes and obesity, and cost of care. COVID-19increases the burden of patients with comorbidities who are among the most vulnerable groups. Health care administrators may encourage positive social change and help to create relief in a burdened system. Government agencies are also looking for solutions to many of the financial problems that health care organizations face. Federal agencies such as CMS are poised to help health care organizations provide the most affordable and highest quality of care to the communities that they serve. Health care administrators should turn to agencies such as the CMS and push for more targeted measures that will help reduce costs while increasing quality of care. Additional research is needed to identify the socioeconomic factors that may explain the differences in cost of care.

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