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# Changes in Operating Performance in Rural Hospitals from 2012 to 2019

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## Abstract

Rural hospitals treat patients while dealing with the challenges of an inadequate workforce, limited financial resources, and an isolated geographic location, leading to difficulties in achieving financial viability. The purpose of this quantitative study was to analyze the operating performance of rural, general, medical and surgical hospitals in the United States and to determine if performance had changed from 2012 to 2019. Guided by x-efficiency theory, this study addressed whether hospital ownership explained variation in performance and if performance had changed from 2012 to 2019. A random sample of 394 rural hospitals was used, with data drawn from the American Hospital Association Guides for 2012 and 2019. A 2-step method of analysis that included both data envelopment analysis and linear regression was employed to generate the findings. The results of this study revealed that ownership was not associated with performance scores in 2012 and weakly associated with performance in 2019. Performance scores did not change over time. The implications for social change include the need for rural hospitals to modify structures and operations to improve efficiency while increasing services, access, and operations to their patients.

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# Dedication

I dedicate this dissertation work to God almighty the author and finisher of my faith and the lamp unto my feet, who has not let my feet to be moved in times of trials and tribulations. I also dedicate this work to my husband, Sobirimabo Young-Harry, who has been a formidable support through this journey. To my parents, Mr. & Mrs. Onadeko, thank you for your prayers and talks of wisdom. To my kids, Eleanor & Truman Young-Harry, this is for you. Thank you all.

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# Section 1: Foundation of the Study and Literature Review

## Introduction

Rural hospitals play a critical role in health supply chains by issuing provider services to rural populations throughout the nation. Unlike urban care facilities, rural hospitals may not offer an entire range of patient care oftentimes leading to patient migration in several cases (Crump, Fricker, Ziegler, & Wiegman, 2016). Patient migration can occur in rural hospitals when patients opt to seek treatment at distant facilities to receive inpatient care services. On average, rural hospitals have 25 beds and a physical infrastructure over 10 years old, while offering a range of inpatient and outpatient services, including surgical and obstetric services, cardiac care, and limited forms of cancer screening (Scarbrough, Moore, Shelton, & Knox, 2016). Health services such as dental care, hospice services, intensive care facilities, and psychiatric units remain dominantly absent from rural care providers (Baskin, Baker, Bryan, Young, & Powell-Young, 2015; Weinhold & Gurtner, 2014). Rural hospitals need to be aware of their operations to find ways to provide care that is more efficient because the scale and scope of these hospitals may lead to inefficiency due to set infrastructural and administrative expenses. To address this issue, the aim of this study was to evaluate the operating performance of rural, general, medical and surgical hospitals throughout the United States by identifying measures of improvement in relation to the objective measure of efficiency.

## Problem Statement

Currently, determination of medical output in terms of services to patients in rural hospitals are essentially based on consumer sovereignty, where hospitals compete to develop high-quality healthcare products while reducing the cost of doing business as consumers control determinations of what services should be offered (Gandjour & Kourouklis, 2020). Additionally,

the application of pricing competition in producing services and goods-desired assumptions can also be found in the rural sector. In a movement to improve patient care and enhance the value of healthcare services, Batalden et al. (2016) discussed how healthcare services are typically coproduced, stating that coproduced healthcare services involve both patients and healthcare providers determining the best course of treatment together. Healthcare services, especially in rural populations, depend on strong, meaningful, and collaborative partnerships between patients and clinicians, placing stronger components of consumer sovereignty at the forefront (Turakhia & Combs, 2017).

Rural hospitals treat patients while dealing with the challenges of an inadequate workforce, little to no financial resources, and an isolated geographic location that consists of older Americans that are likely to be uninsured with low incomes (Prengamen, 2016). These hospitals struggle to meet certain standards when it comes to the quality of patient care and access, affecting reimbursement (Ferreira & Marques, 2019). Additionally, Barber, Lorenzoni, and Ong (2019) found that rural hospitals face the challenge of cost minimization, considering the relative prices of marginal productivity of inputs subject to market competition and government set prices. Inputs in the healthcare field are specific variables utilized in order to obtain outcomes; an example of inputs could include doctors, with patient care being the output (Chowdhury & Zelenyuk, 2016). With information on healthcare benefits becoming more available to consumers, prices are significantly reducing, making it difficult for rural hospitals to balance between service efficiency and the marginal cost of the outputs that provide information on the quantity and quality of goods and services, affecting patients' consumption behavior over time (Sloan & Hsieh, 2017).

Despite the handicaps mentioned, rural care facilities contribute to achieving important federal and state health objectives. Hospitals in rural communities are critical elements of the economy because they provide high-skilled jobs as well as financial and structural bases for supporting physician practice groups and health clinics (Berliner, 2019). According to Mein Goh, Gao, and Agarwal (2016), rural hospitals provide social work and other forms of community outreach, even on an online basis, to reach all members of their communities.

This study was aimed at contributing to improving health services and initiatives by providing information on how to maximize operating performance in rural hospitals for financial stability and the continuous delivery of healthcare. The knowledge gap was highlighted by previous research efforts that indicated a less extensive investigation of elements, such as number of beds and number of staff and the impact of census change in the rural health setting, providing a research premise for this investigation. Because health service organizations perform in terms of patient satisfaction and financial outcomes, I evaluated the operating performance of rural, general, medical and surgical hospitals throughout the United States by identifying measures of improvement in relation to the objective measure of efficiency using a two-step method of analysis that included data envelopment analysis (DEA) and linear regression.

## Purpose of the Study

The purpose of this quantitative study was to analyze the operating performance of all rural, general, medical and surgical hospitals in the United States by determining if their performance had changed during 2012 and 2019. A secondary purpose of this study was to determine if any predictors of performance had changed during 2012 and 2019 by using a two-step method of analysis that included both DEA and linear regression. DEA is a method that evaluates a sample using linear programming techniques (Mardani, Zavadskas, Streimikiene,

Jusoh, & Khoshnoudi, 2017). Rural hospitals need to be aware of their operating performances in order to find ways to provide care that is more efficient because the scale and scope of these hospitals may lead to inefficiency due to set infrastructural and administrative expenses (Giancotti, Guglielmo, & Mauro, 2017).

Various environmental factors, such as changes in the healthcare delivery system, competition among hospitals, regulatory pressure, medical technology, and healthcare reform, drove the need to pursue efficiency. As such, the areas under study included a comparison of 197 U.S. hospitals from 2012 and 197 different U.S. hospitals from 2019. In this study, I focused on how the variables of number of beds and number of staff were affected by ownership in relation to performance scores. Ownership was included as an independent variable because rural hospitals were either under state government or private ownership. This variable affected all other variables because there was a clear difference in terms of number of beds and number of staff that influenced service delivery and operating performance. Private healthcare institutions are thought to perform better in terms of service delivery and staffing but are a barrier for individuals who cannot afford their services. In comparison, state- or government-owned hospitals and healthcare institutions tend to have an increased number of staff and relatively affordable medical services and goods in conjunction with a higher occupancy rate (McCay et al., 2019).

Data relating to the variables were limited to 2012 and 2019 because this was the most current data available for this geographical area. By drawing the relationships between these variables, it was possible to effectively determine how they contributed to or hindered rural health hospitals' operating performances.

## Research Questions and Hypotheses

This study was guided by the following three research questions and their corresponding hypotheses:

RQ1: Does ownership explain variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2012?

$H_0$1: Ownership explains variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2012.

$H_a$1: Ownership does not explain variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2012.

RQ2: Does ownership explain variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2019?

$H_0$2: Ownership explains variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2019.

$H_a$2: Ownership does not explain variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2019.

RQ3: Do the performance scores of general medical and surgical hospitals in the United States change between the years of 2012 and 2019?

$H_0$3: Performance scores of general medical and surgical hospitals in the United States changed between the years of 2012 and 2019.

$H_a$3: Performance scores of general medical and surgical hospitals in the United States have not changed between the years of 2012 and 2019.

## Theoretical Foundation of the Study

In this study, I used the x-efficiency theory, which is a theory that highlights the degree of efficiency maintained by rural hospitals under conditions of imperfect competition (Frantz, 2019). Previous economic theorists and models tended to discuss how companies were always rational, meaning that they continued to maximize production at the lowest possible costs, even if the markets were not efficient (Thaler, 2016). Leibenstein (1978) challenged this notion and derived an anomaly of "x," which was defined as an unknown efficiency. Particularly useful for assessing change over two different time periods, this theory aided me in better understanding changes that had occurred in rural hospital efficiency of the years 2012 and 2019. The x-efficiency theory has also been used by researchers employing DEA and regression analysis to study public hospitals (e.g., Katharakisa & Katostaras, 2016; Narci, Ozcan, Sahin, Tarcan, & Narci, 2015). In both of these studies, the authors used the x-efficiency theory to measure the efficiency of inputs and outputs in relation to hospital and healthcare efficiency. This model has aided in understanding healthcare economics at a more robust level because it delves deeper than highlighting basic demand and supply forces when discussing how economics could affect current rural healthcare and hospital operational performances based on number of beds and number of staff (Moore, Lavoie, Bourgeois, & Lapointe, 2015). The disequilibrium on demand and supply results in the problems faced by many healthcare institutions. Consequently, this framework recognizes that inputs of medical services and goods are riddled with a societal value judgement that affected the rural healthcare and hospitals by making it difficult for administrators

and health managers in rural areas to predict the best cause of action (Donabedian, Wheeler, & Wyszewianski, 1982).

Because the performance of health service organizations can be measured in terms of patient satisfaction and financial outcomes, the x-efficiency theory can be used to provide valuable insight when evaluating the operating performance of rural, general, medical and surgical hospitals throughout the United States by identifying measures of improvement in relation to the objective measure of efficiency. Because health information is available to consumers of healthcare products, healthcare providers must balance marginal input with output, influencing the general operations of rural hospitals since staffing and affordability of medical services and goods must be considered. Hence, conditions both within and outside care facilities such as rural hospitals are used to determine the strategies that favor specific situations. The use of x-efficiency theory aligned with factors under study, including number of beds and number of staff. Based on this framework, evaluating these variables would enable healthcare administrators and hospital managers to determine the strategic direction rural hospitals can take to improve performance operating rates (Donabedian et al., 1982).

## Nature of the Study

In this study, I employed a quantitative methodology with a two-step analysis comprised of DEA and linear regression. In practice, DEA does not focus on testing hypotheses about individual variables but instead focuses on the overall fit of the model using an optimization algorithm (Lee & Yoon, 2017). Using a DEA model aided in meeting the research objectives of examining the various input and output metrics that influenced hospital efficiency in rural health settings. DEA was appropriate for this study because it is a nonparametric method in operations research that measured productive efficiency in decision-making (Kohl, Schoenfelder, Fügener,

& Brunner, 2019). Nonparametric methods of analysis were beneficial to this study because they did not require me to make any assumptions regarding the distribution of the population being studied; hence, the method is referred to as a distribution-free method (see Henderson & Parmeter, 2015).

Using this methodology, I gathered data from the American Hospital Association that provided admission and outpatient visits between the years of 2012 and 2019. The sample in this study included 1,875 rural hospitals located in the United States. Data were gathered from 197 hospitals from the year 2012 and 197 hospitals from the year 2019. By comparing the models from 2012 and 2019, I assessed whether the dynamics of operating performance in rural hospitals had changed. The forthcoming conclusions are directed towards establishing the best practices that, if adopted, would present better patient outcomes in rural, general, medical and surgical hospitals.

## Literature Search Strategy

This extensive literature review included a variety of peer-reviewed articles and studies that were focused on rural, general, medical and surgical hospitals throughout the U.S. healthcare industry. The literature included a focus on the historical background of rural, general, medical and surgical hospitals in the United States, where there appeared to be limited research specifically evaluating occupancy rates and the impact of census change in the rural health setting. As such, I conducted a review of the existing literature in order to gain a broader understanding of all relevant topics closely related to occupancy rate, admissions per bed, staff per bed, and length of stay as well as operating performance in rural, general, medical and surgical hospitals. Additional references, such as published government/industry reports, and

online sources, such as professional/industry-focused websites concerning rural healthcare and their associated hospitals and the effectiveness that they brought to each area, were also used.

To locate literature for this review, I searched different research databases, including PsycINFO, PsycARTICLES, PsycCRITIQUES, PsycEXTRA, SAGE Journals, SocINDEX, PubMed, CINAHL Plus, and EMBASE, for articles published between the years of 2015 and 2019. Older references were considered when I was examining topics from a historical perspective. Keyword search terms and phrases included: *rural hospitals, rural general medical and surgical hospitals, rural general medical and surgical hospitals AND California, rural hospitals AND efficiency AND ownership, rural hospitals AND efficiency AND number of beds, rural hospitals AND efficiency AND number of staff,* and *rural hospitals AND efficiency AND ownership AND number of beds AND number of staff.*

## Literature Review Related to Key Variables and Concepts

The purpose of this literature review was to highlight both historical and recent research that addressed the operating performance of rural, general, medical and surgical hospitals while addressing the gap in the literature that focused on adding to the investigation of elements, such as ownership, number of beds, number of staff, and the impact of census. In this literature review, I also highlighted literature that discussed treatment and price in relation to other variables found in rural hospitals, such as admission per bed, occupancy rate, staff per bed, and length of stay.

Rural hospitals play a critical role in health supply chains by issuing provider services to rural populations throughout the nation. Unlike their urban care facility counterparts, rural hospitals may not offer an entire range of patient care, oftentimes leading to patient bypass in several cases (Crump et al., 2016). Currently in rural hospitals, the determination of medical output in terms of services to patients are majorly based on consumer sovereignty and the

application of pricing competition in producing services and goods-desired assumptions (Colla, Bynum, Austin, & Skinner, 2016). In a movement to improve patient care and enhance the value of healthcare services, Batalden et al. (2016) discussed how healthcare services are typically coproduced; coproduced healthcare services involve both patients and healthcare providers determining the best course of treatment together. Healthcare services, especially in rural populations, depend on strong, meaningful, and collaborative partnerships between patients and clinicians, placing stronger components of consumer sovereignty at the forefront (Turakhia & Combs, 2017).

**Rural, General, Medical and Surgical Hospitals**

Scarbrough, Moore, Shelton, and Knox (2016) reported that rural hospitals tend to have 25 beds and a physical infrastructure over 10 years old while offering a range of inpatient and outpatient services, including surgical and obstetric services, cardiac care, and limited forms of cancer screening. Although rural health centers provide patients with quality care, they also encounter challenges such as inadequate workforces, little to no financial resources, and isolated geographic locations that consists of older Americans that are likely to be uninsured with little to no incomes (Prengamen, 2016). Additionally, these hospitals struggle to meet certain standards, which affects reimbursement and patient care levels as well as regimens of treatment (Balasubramanian & Jones, 2016). Chaudhary, Shah, Zogg, Changoor, and Haider (2017) openly discussed the differences in rural and urban outcomes and signified that 19% of the U.S. population live in rural areas, with only 10% of the physician workforce serving this population, demonstrating the negative effects that patients can experience due to a shortage of physicians.

Chaudhary et al. (2017) explored the differences in outcomes of emergency general surgery between rural and urban hospitals, using precollected data from a sample of 3,749,265

patients from the National Inpatient Sample. The researchers investigated differences in outcomes, including mortality, morbidity, length of stay, and total cost of hospital care. The results of their study indicated that patients treated at rural hospitals had a higher chance of in-hospital mortality, lower odds of major complications, shorter lengths of stay, and $744 of higher costs of hospitalization than their urban counterparts. The authors argued that these findings were inconsequential in comparison to that of urban hospitals because urban hospitals are larger in nature and can take on more complex cases. However, when comparing cases that do not require rural hospitals to transfer their patients to larger urban hospitals, the authors reported that equivalent outcomes can typically be found.

Ogola, Haider, and Shafi (2017) also investigated outcomes between rural and urban hospitals and found that individuals who were treated at rural hospitals typically experienced higher mortality rates in terms of emergency general surgery. The authors concluded that hospitals who treated a higher volume of patients tended to experience lower mortality rates due to the number of surgeons and staff that were able to handle more complex cases, increasing outcomes outside of the rural area. These studies provided strong examples of the struggles that rural hospitals face when treating patients; therefore, it is important to understand how different variables found in rural hospitals can affect patient treatment and outcomes based upon historical and recent changes in the rural health setting. I conducted the current study to add to the knowledge concerning these variables and their effect.

**Rural Hospital Ownership**

There are many variables concerning ownership in the medical field, with hospitals being either for-profit or not-for-profit. Freedman and Lin (2018) explored whether not-for-profit hospitals were more likely to make expensive investments in relation to uncertain returns and the

potential value to public good. The researchers investigated whether the adoption of electronic medical records (EMR) and found that not-for-profit hospitals used EMR at a rate of 18% more than their for-profit counterparts. Additionally, in terms of ownership, in the state of California, Dalton and Warren (2016) found that for-profit hospitals tended to outsource patient services at higher rates than their public and private nonprofit counterparts. The authors argued that this is because private, nonprofit hospitals are more restricted in terms of how they consume net revenues, experiencing a higher diminishing value of a dollar that is saved and ensuring that outsourcing services would not save them money in the long run. The authors also found that through a panel of California hospitals, nonprofits are more interested in controlling physician-intensive services, whereas public hospitals are more interested in labor-intensive services. Although Freeman and Lin found that 18% of not-for-profit hospitals utilized EMR, it should be noted that many not-for-profit hospitals can receive funding for the adoption of newer technologies, such as EMR, which aids in their ability to utilize technologies; however, for-profit hospitals are more likely to use such services than their not-for-profit counterparts because they have greater experience with being less restricted from a financial standpoint (Kazley & Ozcan, 2007).

From a historical aspect, Horwitz and Nichols (2011) discussed rural hospital ownership in terms of medical service provision, market mix, and different spillover effects that were experienced. The authors found that rural, nonprofit hospitals were more likely to offer unprofitable services, increasing the amount of underprovided services. Additionally, nonprofit, rural hospitals appeared to respond less to changes of service profitability in comparison to their for-profit counterparts, effecting medical service provision at both hospital and market levels. Horwitz and Nichols suggested that nonprofit hospital regulation should concentrate on the direct and spillover effects of ownership. It should be noted that the authors failed to discuss how rural,

not-for-profit hospitals have less opportunities when it comes to deciding what cases or treatments that they would offer their patients. Because of their location in rural areas, rural hospitals are oftentimes plagued with services that are considered unprofitable; however, they are essential within the area that they operate because limited services are oftentimes offered in more remote communities (Lindrooth, Perraillon, Hardy, & Tung, 2018).

Shen, Eggleston, Lau, and Schmid (2005) discussed general hospital ownership throughout the United States without specifically focusing on rural and urban areas. The authors completed a meta-analysis study that investigated hospital ownership and financial performances, finding that across the board, there were minimal differences in costs amongst governmental, for-profit, and not-for-profit acute hospitals; however, there were also minimal differences in relation to revenue and profits between the three different types of hospital ownership. One limitation of Shen et al.'s study was the fact that they did not specifically explore rural and urban areas, which is an essential element due to many differences between the demographics of the patient and the community services that are offered. The presence or absence of these different variables in a hospital can lead to differences in financial performance, especially if a hospital identifies as for-profit or not-for profit. Examining these variables would have strengthened the authors' study.

To demonstrate how hospital ownership can affect rural hospitals, Mullner, Rydman, Whiteis, and Rich (1989) concentrated on investigating rural community hospitals and the factors that were correlated with their closing. The authors completed a quantitative study of 483 rural hospitals that were at a risk of closing and examined different variables during the years of 1980 to 1987. They concluded that there were four variables that appeared to place rural hospitals at risk to close: for-profit ownership; nongovernment, not-for-profit ownership; the presence of a skilled nursing and long-term care unit, and the number of other hospitals within the county. Funding issues found within for-profit and nongovernment, not-for-profit ownership affected

whether a rural hospital closed, highlighting that governmental, public hospitals experienced increased funding, allowing them the opportunity to operate more efficiently with patients' needs at the forefront.

When looking at the stark differences that have been demonstrated between these two historical studies, Shen et al. (2005) argued that differences occur simply because of the modeling framework and study assumptions that are utilized when researchers investigate differences of ownership. However, these differences have become more apparent in more recent time due to the available data highlighting the reasons why rural hospitals are closing at higher rates; many of which are not presented in recent studies of the differences between rural and urban hospitals.

**Rural Hospitals and Number of Beds**

Medically speaking, number of beds can be defined as the total beds located in a hospital that are regularly maintained, staffed, and immediately available to the admitted patients (Wallace, Seymour, & Khan, 2017). Additionally, the number of beds correlates to a hospital's size; small hospitals typically have less than 100 beds, medium hospitals typically have 101 to 499 beds, and large hospitals typically have 500 or more beds (Holmes, Kaufman, & Pink, 2016). Wilson, Fitzgerald, and Mahon (2010) viewed hospital beds as a primer for counting and comparing and found that relative to population, in Australia, in comparison to the United States, there has been a decline in bed availability due to reductions in length of stay and the changing models of care that are utilized by hospitals. Due to patients staying longer in hospitals in Australia, there is congestion when it comes to bed availability, highlighting an important need to meet the growing demands of bed availability in the future. To compound the problem in the United States, critical care bed growth has not increased exponentially (Wallace, Angus, Seymour, Barnato, and Kahn, 2015). In their study comparing regional and national trends of

critical care bed growth, Wallace et al. (2015) found that between 2000 and 2009, critical care beds increased by 15%, which mirrored population growth; however, the authors cautioned that national trends in critical care bed growth may not be represented on a regional level because the majority of critical care bed growth occurs in cities that have larger populations. This is an important element because this limitation could easily impact regional growth levels due to differing levels of population found between urban and rural areas.

To highlight how the variable of number of beds differed between different geographical regions, Mercille (2018) discussed how privatization has transformed hospitals over the past 2 decades. A strong example of this is Ireland, where the number of beds was calculated differently than that of other countries, viewing number of beds in terms of capacity versus that of availability (Keegan et al., 2019). Between 1980 and 2015, the total number of beds in Irish hospitals decreased by 25.5% (Mercille, 2018). Additionally, the author found that bed numbers in private, for-profit hospitals increased from zero to 1,075, while decreasing from 9,601 to 5,216 in private, not-for-profit hospitals and 7,028 to 6,092 in public hospitals. This finding encouraged many hospitals in Ireland to move towards privatization over the past 2 decades. To highlight these differences in the United States, from 1975 to 2017, the number of beds has been decreasing: In 1975 there were approximately 1.5 million hospitals compared to that of 931,000 in 2017 (Halpern & Pastores, 2010). The manner in which Ireland is accounting for number of beds may provide an unrealistic account of patients, simply because the number of beds that are marked as available can aid in understanding the need that hospitals may experience. When not taking into account the number of beds that are available, statistics could be skewed, and hospitals could be missing out on important financial summaries about client need and demands when it comes to services.

To better understand issues that relate to the number of beds needed in a rural hospital, Olafson, et al. (2015) investigated surge capacities by analyzing census fluctuations that can aid in estimating the total number of beds needed in a rural intensive care unit. The authors completed a retrospective analysis from a population-based data set from April 1, 2000 to March 31, 2007. Using three different methods during their analysis, the authors examined Method 1 (yearly patient days) in comparison with Methods 2 and 3 (day-to-day fluctuations in patient census). Olafson et al. (2015) drew three main conclusions; estimations that were based on yearly patient usage were generally underestimated regarding the number of beds needed; 4 to 29% fewer beds were needed for demand to exceed supply; and 13 to 36 % fewer beds were needed if hospitals in a region could effectively share intensive care unit beds. The authors concluded that analyzing day-to-day fluctuations regarding patient census provides a more accurate snapshot of the number of ICU beds needed in rural hospitals. By concentrating more on yearly census, can promote rural hospitals to experience a demand that exceeds a supply for patient beds and alternatively effective treatment regimens.

**Rural General and Surgical Hospitals and Number of Staff**

The number of staff located in a hospital can affect many different areas including that of levels of care and hospital behavior. From a historical standpoint, Pauly (1978) discussed medical staff characteristics in relation to hospital costs. The author explained how measured characteristics of the staff included the different specialties of attending physicians, their board-certified status, and the concentration of hospital output amongst the attending physicians. The author concluded that these staff variables were extremely important when it came to explaining different cost variations throughout different hospitals. To understand the importance of staff characteristics and hospital behaviors from a rural perspective, it is important to highlight the

average number of staff (physicians, nurses, allied health professionals, etc.) per hospitals within the U.S. The American Hospital Association (2019) stated that on average, small and rural hospitals could have anywhere between 98 to 278 full-time staff members and between 49 to 128 part-time employees. In comparison, medium-sized hospitals could average between 637 to 2,479 full-time employees and 263 to 809 part-time employees; large hospitals could average 4,911 full-time employees and 1,303 part-time employees.

Lasala (2017) discussed many challenges when it came to rural hospitals in terms of staff, stating that many variables could affect the number of staff per rural hospitals. For example, in their study, the author examined the difference in recruitment, retention, and distribution of hospital registered nurses in both rural and urban areas. The author found that when concentrating on rural hospitals, salaries, changes in local economies, military closures, and changes in nursing position allocations determined the strength of number of staff. It is important to note that the author also reported that rural healthcare settings reported the lowest vacancies; however, when vacancies did exist, they were greater in rural settings; these vacancies determined the levels of quality and access of healthcare to the patients within the community, providing a healthy snapshot of robust healthcare.

Bradley et al. (2015) discussed how few staff and many patients occurred frequently in rural hospitals, impacting quality of care. The authors completed a qualitative study that focused on a rural hospital's obstetric unit. Completing 84 open-ended interviews, Bradley et al. (2015) found that 40% of the participants wanted to leave their posts due to heavy workloads in conjunction with staff shortages. Although they recognized that these shortages occurred within rural general and surgical hospitals, they concluded that maternity units experienced higher difficulties, due to higher demands during patient care. Additionally, the authors discussed how system failures and inadequate human resource management were gaps in the literature that

needed to be addressed in terms of efficiently running a rural hospital. There appeared to be some limitations to the authors' study, with that being the participants themselves. Because they concentrated on individuals who currently worked in rural hospitals, they failed to better understand the qualitative data in relation to their urban counterparts. Many hospitals experience heavy workloads, especially in maternity wards; therefore, completing a qualitative case study that could synthesize information from both types of hospitals could aid in a stronger understanding of differences between the experiences of staff at both rural and urban hospitals. Based upon the authors' research, it was clear that it was important that rural hospitals offered an adequate supply of staff in conjunction with the demand that they faced.

When it comes to number of staff working in rural hospitals, it is also important to understand a patient's point of view in receiving adequate care. Bradley and Mott (2014) completed a study that focused on how rural hospitals could effectively adopt a patient-centered approach, especially when it came to the challenges of the number of staff that were available per patient. In their study, the authors utilized ethnographic interviews of patients and staff in three different rural hospitals in conjunction with having them complete a 7-point Likert scale. The study's results concluded that both patients and staff perceived the importance of an appropriate bedside handover approach, highlighting the importance of patient-centered treatment. It was highlighted that not only was it important to understand the constraints regarding the number of staff that rural hospitals faced, they also must ensure quality handover procedures at the end of each shift, which could aid in increasing patient treatment and care. This is relevant in the discussion on staff per bed as a variable, simply because it demonstrated the need for adequacy in the supply and demand of patient services in rural hospitals and the effects it could have on both financial and treatment aspects for both the patients and administration.

**Rural General and Surgical Hospitals and Occupancy Rate**

The occupancy rate of a hospital is a metric that is used to highlight the portion of a hospital's inpatient capacity that is being utilized for patient care. This metric is not only calculated via the above equation; more so it also considers a hospital's size, the number of patient facilities, the percentage of beds, the number of hospitals within a given geographical area, and demand for services (Phillip, Mullner, & Andes, 1984). From a more recent standpoint, hospital occupancy rates within the state of California were 59.95 bed days in urban hospitals, compared to that of 49.55 in rural hospitals (American Hospital Directory, 2018). Rural hospitals are typically only half full in terms of their occupancy rates, indicating that they will have to reduce the number of available beds to survive within the healthcare market (Kaufman et al., 2016). However, the average occupancy rate for rural hospitals in 2016 was 52.2%, experiencing an increase of 14.4% compared to their acute occupancy rate counterparts, creating an argument that rural hospitals had occupancy rates that were not utilizing long-term, lower-acuity care. Therefore, to view occupancy rates at a healthy level within rural hospitals, when using a 75% occupancy rate benchmark, 55,095 of the rural hospitals' 129, 566 acute care-beds will allow for a 42.5% surplus (Kacik, 2018).

Thomas et al. (2016) also discussed rural hospital occupancy rates in alignment with community characteristics and hospital closures. The authors found that in comparison with other rural hospitals that were still in operation, closed hospitals tended to demonstrate a smaller market share, despite being in geographical areas that had a higher population density. The authors' study highlighted three interesting conclusions; rural hospital closures affected racial and ethnic minorities; community characteristics made it seem possible that rural hospital closures would continue; and rural hospitals must be mindful of finding new ways to be reimbursed amid

new ways to deliver healthcare services to community members. The implications of this study highlighted the challenges that rural hospitals faced when it came to occupancy rates when they were experiencing financial challenges; the authors reported that between January 2005 and December 2015, only 105 rural hospitals closed, which appeared to be on the smaller size compared to other studies that had been completed that focused on rural hospital closures amid occupancy rates.

To demonstrate how low occupancy rates, effect the efficiency of a rural hospital and the determination of the likelihood of it closing, Wishner, Solleveld, Rudowitz, Paradise, and Antonisse (2016) completed a case study that examined three rural hospitals that closed in the year 2015. There were many different factors that contributed to the rural hospitals closing, and among them was low occupancy rates. Combined with low occupancy rates, the three hospitals additionally experienced high uninsured rates and a payer mix that was dominated by Medicare and Medicaid, along with economic difficulties within the community, and outdated payment and delivery system models. To understand the size of these rural hospitals in relation to the norms experienced in smaller communities, the three hospitals had bed sizes that ranged between 45 and 102 and less than 1,000 admissions per year. Throughout their case study, Wishner et al. (2016) found that the three rural hospitals that closed suffered lower occupancy rates due to privately insured patients deciding to obtain medical treatment elsewhere; hurting the hospital's revenue base and highlighting a perception that they offered sub-standard treatment. It should be noted that the results of this study could not be generalized outside of the geographical area, as there were many differing components that rural hospitals faced. For example, in different geographical areas, rural hospitals could all be affected differently when it came to patient demographics, hospital offerings, and their payment and delivery system models.

**Rural General and Surgical Hospitals Staff per Bed**

Within the United States, there is an average of 5.4 hospital staff per acute bed. In comparison, Canada had 4.3 staff per hospital bed; Switzerland had 3.9; and Australia had 2.9, with a median of 3.0 (Organization for Economic Cooperation and Development, 2008). Staff per bed does relate to patient satisfaction as depicted in Hockenberry and Becker's (2016) study that focused on nursing staff strategies and patient satisfaction. Within the state of California, the researchers completed a quantitative study of 311 hospitals and found that higher levels of registered nurses per bed increased patient satisfaction. Among the higher levels of RNs per bed, the authors also found that this also increased communication between staff and patient while increasing the hours that highly skilled nursing staff were available to the patients. This appeared to increase patient care and satisfaction levels combined. It was important to note that this study did not fully concentrate on rural hospitals alone, where further investigation should be warranted as to whether higher ratio of nurses to patients would increase patient satisfaction. However, it should additionally be noted that the results of this study is in alignment with the study of Bradley and Mott (2014) where they focused on how rural hospitals could effectively adopt a patient-centered approach, especially when it came to the challenges of the number of staff that were available per patient. Their results indicated that the higher ratio of nurse per patient, increased handover responsibilities at the end of the shift that increased patient satisfaction.

Davidson, Belk, and Moscovice (2010) discussed nursing staff in relation to rural hospital performance and improvement and found that the relationship between registered nurse staffing and quality measures did not differ between rural and urban hospitals. Additionally, the authors highlighted that there was no correlation between registered nurse staffing and the number of staffed beds or medical school affiliation when examining rural and urban hospitals.

**Rural General and Surgical Hospitals, Efficiency, and Environmental Factors**

In general, hospitals across the board throughout the United States are being forced to become more efficient, by improving quality of care and removing as much waste as possible out of their processes. There are many factors that must be examined when discussing hospital efficiency, with a main factor being that of controlling patient flow through a patient's LOS. Efficiency in rural hospitals is also paramount to survival, simply because research has demonstrated that although rural hospitals are more efficient than their urban counterparts, they need to work harder at removing as much wasteful processes as possible to ensure that they receive the most financial benefits from the limited number of patients that they cater to (Khushalani & Ozcan, 2017).

From a historical standpoint, Ozcan and Lynch (1992) studied rural hospital closures in relation to efficiency. In their study, the authors compared the efficiency of non-government, short-term general rural hospitals that were closed during the year 1988 between their counterparts who remained open. The conclusions of the study highlighted that there was no relationship between the efficiency of open and closed rural hospitals; however, it was noted that closed hospitals that were inefficient, closed due to a lack of demand for inpatient services. On the flip side, the authors found that a threshold value of 22 discharges per year was identified as being related to closing, whether or not the rural hospital was inefficient.

There were other environmental factors that need to be considered when studying rural general and surgical hospitals, including that of low reimbursement rates, increased regulation, and uncompensated care. These factors could aid in the experience of financial woes and struggles. To better understand these factors, Grant (2016) examined a prospective payment reimbursement system for critical access hospitals and implications that rural hospitals could

experience when utilizing these reimbursement systems. A prospective payment reimbursement system is a method of reimbursement where a Medicaid payment is made based upon a fixed and predetermined amount. Grant discussed how some rural hospital administrators fear that this form of payment system would cripple rural hospitals; however, reported that evidenced demonstrated that this payment system would accentuate cost-efficient care without lessening the quality of treatment or patient outcomes. In turn, the author warned that rural hospitals must ensure that they are following critical and efficient steps in order to reduce the chances of closing, enforcing steps that will ensure survivability and profitability through appropriate and responsible healthcare spending.

Dranove, Garthwaite, and Ody (2016) also discussed rural hospitals and uncompensated care by exploring the Affordable Care Act (ACA) and how its expansions affected uncompensated care costs at large hospitals. The authors reported that under the ACA, uncompensated care costs decreased from 4.1 to 3.1 percentage points of operating costs, further stating that more research needs to be completed in this area. This study is important to examine, simply because of Wishner et al. (2016) case study that examined three rural hospitals that closed in the year 2015. The three hospitals under their study experienced high uninsured rates and a payer mix that was dominated by Medicare and Medicaid, including that of uncompensated care. This in turn, influenced whether a rural hospital would close or remain in operation.

**Data Envelopment Analysis and Hospital Operating Performances**

DEA had been used in previous studies that had highlighted hospital operating performances. For example, Cheng et al. (2015) used DEA to examine the technical efficiency and productivity of Chinese county hospitals located in Henan Province. The authors collected their data from 114 county hospitals from 2010 to 2012, using an instrument such as Malmquist

index that is used to calculate productivity changes over periods of time. Additionally, the authors also used regression to examine environmental and institutional factors that effected technical efficiency. The results of the study highlighted that over 90% of the county hospitals ran inefficiently between the years of 2010 and 2012, as well as variables of hospital size, government subsidy amounts, and the average length of stay effected the county hospitals' level of technical efficiency; however, bed occupancy rates, ratio of beds to nurses, and ratio of nurses to physicians effected the county hospitals' level of technical efficiency from a positive standpoint.

Additionally, Barnum, Walton, Shields, and Schumock (2011) measured hospital efficiency in the United States using DEA. The authors used a sample of 87 community hospitals to determine the effectiveness of DEA when measuring hospital efficiency and found that in order for DEA to be effective, it is important for researchers to clearly define the input and output variables, including that of an appropriate weighting scheme. In order to obtain these results, the authors found that if variables are not clearly defined, DEA can substantially overestimate hospitals' efficiency levels, as well as reporting many inefficient hospitals to be that of efficient. Therefore, in this current study, the researcher clearly identified both inputs and outputs and how they would be measured when completing the analysis. This aided in ensuring that a DEA and multiple linear regression approach would provide appropriate results to the data that had been collected.

Chowdhury, Zelenyuk, Laporte, and Wodchis (2014) used DEA to evaluate productivity, efficiency, and technological changes in hospital services in Ontario, Canada. Examining all Ontario hospitals throughout the years of 2002 to 2006, the authors used the Malmquist Productivity Index and DEA to study productivity, efficiency, and technological changes. The

results of their study concluded that productivity growth was driven by improvements in technology versus increases in efficiency, making it important for hospitals to study the technological aspects of their healthcare systems and hospitals.

## Literature Review Summary

The purpose of this literature review was to highlight both historical and recent research that addressed the operating performance of rural general and surgical hospitals, while addressing the gap in the literature that focused on adding to the investigation of elements such as ownership, number of beds, number of staff, and the impact of census. This literature review also highlighted literature that discussed service quality and price in relation to other variables found in rural hospitals, such as admission per bed, occupancy rate, and staff per bed. This literature highlighted the different variables that were utilized within the study and discussed both recent and historical elements of occupancy rates and the impact of census, and other variables such as service quality and price in relation to admission per bed, occupancy rate, and staff per bed. The literature highlighted the struggles that rural hospitals faced in relation to the fear of closing; quality of service needed to be high due to the limited treatment options that could be found within rural communities, versus struggles that were experienced in terms of staff retention, staff affordability, and payment options. This highlighted the gap in the literature which determined that limited studies had focused on all rural hospitals in the United States, examining different variables in relation to operating performance and control, which this study was aiming at completing. Additionally, a gap also existed regarding whether rural hospital efficiency had been changing over time, which this current study aided in answering.

## Gaps in the Literature Review

The literature review based on the key variables important to rural hospitals did not highlight or summarize ownership, number of beds, number of staff, and the impact of census change in the rural health setting. As such, the existing literature that had previously been conducted did not summarize the key variables together, which included occupancy rate, admissions per bed, staff per bed, or length of stay related to operating performance in rural general medical and surgical hospitals. This is of paramount importance, especially since rural hospitals have begun closing at alarming rates.

## Definitions

*Admission per bed*: Admission per bed is a metric used in this study that determined the number of beds in a hospital that were occupied. Admission per bed was used to measure a hospital's bed demand to assess the number of patients requiring healthcare in comparison to the number of beds in the hospital (Harrison, Wasserman, & Goodman, 2018). In this study, admission per bed was calculated by the equation: Admission per bed = admission/#of beds.

*Hospital ownership***:** Hospital ownership was a metric used in this study that determined how the hospital was owned and operated (Morris, McNamara, & Morton, 2017). There were many variables of ownership found within the medical field, with hospitals being that of for-profit or not-for-profit. In this study, hospitals were referred to as for-profit or not-for-profit.

**Length of stay (LOS).** According to the American Hospital Association (2012), LOS was a metric used by hospitals that was determined by the average number of days that patients spent in the hospital. The LOS was calculated by dividing the total number of days stayed by all inpatients during a year by the number of admissions or discharges.

**Number of beds.** Number of beds was defined as the total beds located in a hospital that were regularly maintained, staffed, and immediately available to the admitted patients. Additionally, the number of beds correlated to that of a hospital's size; small hospitals typically had less than 100 beds, medium hospitals typically had 101 to 499 beds, and large hospitals typically had 500 or more beds (Holmes et al., 2016).

**Number of staff.** From a historical standpoint, Pauly (1978) discussed medical staff characteristics in relation to hospital costs. The author explained how measured characteristics of the staff included the different specialties of attending physicians, their board-certified status, and the concentration of hospital output amongst the attending physicians. However, in this study, the number of staff was measured by the total number of all hospital staff working in the hospital, not just the attending physicians. The American Hospital Association (2019) stated that on average, small and rural hospitals could have anywhere between 98 to 278 full-time staff members and between 49 to 128 part-time employees. In comparison, medium-sized hospitals averaged between 637 to 2,479 full-time employees and 263 to 809 part-time employees; large hospitals averaged 4,911 full-time employees and 1,303 part-time employees.

**Occupancy rate.** The occupancy rate of a hospital was a metric that was used to highlight the portion of a hospital's inpatient capacity that was being utilized for patient care. This metric was not only calculated via the above equation; more so it also considered a hospital's size, the number of patient facilities, the percentage of beds, the number of hospitals within a given geographical area, and demand for services (Phillip et al., 1984). In this study, the formula for occupancy rate was as follows: Occupancy rate = (total admission/365) / 100).

**Rural.** The U.S. Census Bureau (2017) defined rural as any population, housing, or territory that is not located in an urban area. Rural areas had a population of less than 50,000 people and rural clusters had a population less than 2,500.

**Rural hospital.** According to the American Hospital Association (2012), a rural hospital was defined as a hospital located in a rural, medically underserved area in the United States that had a separate reimbursement structure from the standard medical office under the Medicare and Medicaid programs.

**Staff per bed.** Within the United States, there was an average of 5.4 hospital staff per acute bed. In comparison, Canada had 4.3 staff per hospital bed; Switzerland had 3.9; and Australia had 2.9, with a median of 3.0 (Organization for Economic Cooperation and Development, 2008). Staff per bed was a metric used at hospitals that measured the number of staff via ratio per patient bed. In this study, staff per bed was computed by the equation: Staff per bed = Staff/Beds.

## Assumptions

There were some assumptions that must be discussed in this study. Firstly, it was assumed that the data being used was appropriate for the aims, the study's purpose, being in alignment with the problem being studied and the research questions that were posed (Hartas, 2015). Secondly, another assumption was that of the topic being studied. For example, it was assumed that analyzing the efficiency of rural general medical and surgical hospitals in the United States by identifying measures of improvement in relation to the measure of operating performance, that this could be completed in and objective manner by the researcher (Albert, Friesen, Rowland, & Laberge, 2019). It was assumed that the researcher would remain distant to and independent of the topic that was being collected. By using precollected data from rural

general medical and surgical hospitals, the researcher was able to demonstrate objectivity by ensuring that the data were in alignment with the purpose of the study, the variables being investigated, with the ability to answer the research questions and hypotheses in full.

## Scope and Delimitations

Research is oftentimes limited in scope by sample size, time, and geographical area. Therefore, this study was delimited to 394 rural hospitals located throughout the United States. Data were gathered from the American Hospital Association that provided admissions and outpatient visits between the years of 2012 and 2019 in relation to the operating performance of rural hospitals within this geographical area. Data were gathered from 197 hospitals from the year 2012 and 197 hospitals from the year 2019. The inputs that were studied in this research included number of beds and number of staff. The unit of analysis included general medical and surgical hospitals located in the geographical area of the United States.

## Significance, Summary, and Conclusions

This study generated significance not only to the healthcare field but to that of the area of business and the patients that they served. In regard to the healthcare field, the results of this study allowed for a broader understanding of how administrators could evaluate the operating performance of rural general medical and surgical hospitals in the United States by identifying measures of improvement in relation to the objective measure of operating performance. Therefore, the administrators would be able to understand how the variables of ownership, number of beds, and number of staff affected operating performance. Additionally, patients could benefit from this study in the fact that it could allow rural hospitals to better understand operating performance and continue working in the field of healthcare without the fear of closing- as many rural hospitals have closed over the past decade. This would in turn better serve patients of rural

communities, strengthen treatment regiments, and allow for a stronger connection between rural healthcare workers and patients.

The purpose of this quantitative study was to analyze the operating performance of all rural general medical and surgical hospitals in the United States by determining if performance had changed during 2012 and 2019. A secondary purpose of this study was to determine if any predictors of performance had changed during 2012 and 2019 by using a two-step method of analysis that included both DEA and linear regression. Through this methodology, data were gathered from the American Hospital Association that provided admissions and outpatient visits between the years of 2012 and 2019. In this section I discussed the foundation of the study, highlighting the problem statement, the purpose of the study, the research questions and hypotheses, and a brief overview of the methodology. Additionally, a strong review of the literature was completed that discussed relevant research that has focused on rural hospitals and the different variables being studied. This section was concluded with a discussion on the assumptions of the study and the scope and delimitations. The next section will include the research design and data collection, providing an in-depth overview of the methodology.

# Section 2: Research Design and Data Collection

## Introduction

Currently, the determination of medical output in terms of services to patients in rural hospitals is primarily based on consumer sovereignty and the application of pricing competition in producing services and goods-desired assumptions. The purpose of this quantitative study was to analyze the operating performance of all rural, general, medical and surgical hospitals in the United States by determining if their performance had changed between 2012 and 2019. A secondary purpose of this study was to determine if any predictors of performance had changed between 2012 and 2019 by using a two-step method of analysis including both DEA and linear regression. In this section, I discuss the research design, data collection methods, data analysis plan, threats to validity, and ethical assurances.

## Research Design and Rationale

In this study, I employed a quantitative methodology and utilized a two-step analysis comprised of DEA and multiple linear regression. I first used DEA to calculate a rural hospitals' performance score, then employed a regression analysis to estimate the relationship between hospital characteristics and operating performance. In practice, DEA does not focus on testing hypotheses about individual variables but instead focuses on the overall fit of the model using an optimization algorithm (Mardani et al., 2017). Using DEA and linear regression aided in meeting the research objectives of this study when examining the inputs of number of beds and number of staff in relation to ownership and the influence they had on hospital operating performance in rural health settings. DEA was appropriate for this study because it is a nonparametric method in operations research that measures productive efficiency in decision-making (Kohl et al., 2019). Many other researchers have used DEA to analyze hospital efficiency and productivity both in the

United States and around the world (Barnum et al., 2011; Cheng et al., 2015; Chowdhury et al., 2014; Ferrier & Valdmanis, 1996). Nonparametric methods of analysis were beneficial to this study because they did not require me to make any assumptions regarding the distribution of the population being studied (see Henderson & Parmeter, 2015). I used a dummy variable to estimate the change in efficiency between the years of 2012 and 2019. This design approach was consistent with the aims of this study because it allowed me to determine whether the dynamics of operating performance in rural hospitals had changed over a period of time. In this study, I collected data from 2012 and 2019.

## Methodology

### Population

According to the Health Resources and Services Administration (2019), the United States has 1,875 hospitals in rural areas. In this study, I included data from 394 rural hospitals located in the United States. G*Power was used to determine an appropriate sample size. Using an effect size of 0.02, an error of probability of .90, and a power of .9, a minimum sample size of 394 rural hospitals was recommended; therefore, data were gathered from 197 hospitals from the year 2012 and 197 hospitals from the year 2019.

I used the random sampling technique as the sampling strategy in this study. Participants were randomly chosen for inclusion from a list of U.S. rural hospitals in the United States from both the years of 2012 and 2019. I used the random function of Microsoft Excel, to create a list of 197 random numbers. I reviewed the 2012 American Hospital Association (AHA) guidebook and identified the first random number, then counted down the number of rural hospitals that met the criteria of participating in the study. Once the rural hospital had been identified, I recorded the hospital's information. This pattern was continued with 2012 data until 197 rural hospitals were

randomly selected. This process was then repeated with 197 rural hospitals from the 2019 data set. When obtaining the precollected data, I used the following criteria to ensure that the data collected matched the sample:

- Each hospital was located in the United States.
- Each hospital was considered a rural hospital as per the American Hospital Association.
- Each hospital had data from the years 2012 and 2019.
- Each hospital had outputs that included: admissions and outpatient visits.
- Each hospital had inputs that included number of beds and number of staff.

These criterion ensured that the precollected data set from the AHA was aligned with the problem being studied, the purpose statement, the research questions, and the hypotheses. Any hospitals that did not meet these criteria were excluded from the study.

**Sampling and Sampling Procedures Used to Collect Data**

I used the aforementioned methodology to gather data regarding admissions and outpatient visits between the years of 2012 and 2019 of rural hospitals. The unit of analysis included general medical and surgical hospitals located in rural areas of the United States. Rural areas were defined as geographical regions located outside of towns or cities, typically having low population density and small settlements (Pato & Teixeira, 2016).

By comparing the data from 2012 and 2019, I obtained significant tests that aided in assessing whether the dynamics of operating performance in rural hospitals had changed. The

forthcoming conclusions are directed towards establishing the best practices that, if adopted, would present better patient outcomes in rural general medical and surgical hospitals.

I used secondary data sources in this study to answer the posed research questions. The secondary data were collected from the AHA guide that contained data from rural hospitals and their levels of utilization. The data included information on the outputs of general medical and surgical hospitals that were examined in this study: admissions and outpatient visits. The data also included inputs that include number of beds and number of staff. I accessed the AHA guide from the University of California-San Diego Library. The AHA guide identified each rural county in the United States with a set code, allowing, me to ensure that I was obtaining accurate hospital information from only rural areas throughout the United States.

In order to determine an appropriate sample size for this study, I completed a power analysis using G*Power. G*Power is a software program used to calculate statistical power. When calculating the sample size, I used an effect size of 0.02, an error of probability of .90, and a power of .9. The results recommended a minimum sample size of 394 rural hospitals; therefore, the sample size of 197 hospitals in 2012 and 197 hospitals in 2019 was sufficient for statistically relevant results.

Because live participants were not used, I was not required to obtain consent forms. Instead, I used publicly available data located on the website of the AHA that were available to all members of the public. In order to obtain the data set, I visited the AHA's website (www.aha.org) and found the relevant data set using the criteria listed above. Permission to collect, download, or use this data was not needed because they were available to the public on a public website on the Internet.

**Instrumentation and Operationalization of Constructs**

Although I did not use any instruments to collect the data, it was important to understand how the different constructs would be measured when examining and utilizing the precollected data. In this study, the outputs included admissions and outpatient visits. In terms of outputs, admissions were measured by the number of patients that were admitted to a hospital and who occupied a bed (Admission per bed = admission/#of beds), and outpatient visits were measured by the number of patients that were admitted to a hospital on an outpatient basis (Outpatient visits = admission/#of outpatient visits).

In terms of inputs, number of beds and number of staff were also defined. Number of beds was measured by the total beds located in a hospital that were regularly maintained, staffed, and immediately available to the admitted patients. The number of beds also correlates to a hospital's size; small hospitals typically have less than 100 beds, medium hospitals typically have 101 to 499 beds, and large hospitals typically have 500 or more beds (Holmes et al., 2016). Number of staff was measured by the total number of all hospital staff working in the hospital, not just the attending physicians. The AHA (2019) stated that on average, small and rural hospitals could have anywhere between 98 to 278 full-time staff members and between 49 to 128 part-time employees; in comparison, medium-sized hospitals averaged between 637 to 2,479 full-time employees and 263 to 809 part-time employees, while large hospitals could average 4,911 full-time employees and 1,303 part-time employees. Because I analyzed 2 years of data from the year of 2012 and the year of 2019, the year was another variable for which I used a dummy variable, scoring 2012 as a 0 and 2019 as a 1.

**Data Analysis Plan**

In this study, I used a two-step analysis approach of DEA and multiple linear regression. DEA was first used to calculate a rural hospitals' performance score, then a linear regression

analysis was employed to estimate the relationship between hospital characteristics and operating performance. The software used for this analysis was Data Envelopment Analysis Program (DEAP), Version 2.1. To prepare the data for analysis and increase its validity, I cleaned it to increase the validity of the data. When cleaning the data, I completed the following:

1. Identified incorrect values for the specific variables that were being studied.
2. Checked to ensure that the data represented the inclusion criteria of the study. If I found any hospitals that did not meet the inclusion criteria, they were deleted.
3. Checked and deleted duplicate cases in the data set.
4. Checked for any missing data and outliers.
5. Identified any skip patterns or logic breakdowns.

After identifying and correcting any of these issues, I began the data analysis. During data analysis, I kept the following research questions and hypotheses in mind:

RQ1: Does ownership explain variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2012?

$H_0$1: Ownership explains variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2012.

$H_a$1: Ownership does not explain variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2012.

RQ2: Does ownership explain variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2019?

$H_0$2: Ownership explains variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2019.

$H_a2$: Ownership does not explain variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2019.

RQ3: Do the performance scores of general medical and surgical hospitals in the United States change between the years of 2012 and 2019?

$H_0 3$: Performance scores of general medical and surgical hospitals in the United States changed between the years of 2012 and 2019.

$H_a 3$: Performance scores of general medical and surgical hospitals in the United States have not changed between the years of 2012 and 2019.

In this current study, I used hypotheses, even though I was initially completing a DEA analysis, which utilized a set of linear programming algorithms, such as optimization, which was a deterministic method (Cooper, Seiford, & Tone, 2006). From a historical standpoint, Bertsimas and Tsitsiklis (1997) discussed only three possible outcomes from utilizing linear programming algorithms; one solution existed, many solutions existed, or no solutions existed. Essentially, linear programming assumed certainty of the data being used; it was deterministic in nature as there was no randomness and, therefore, no assumption of error. Power analysis was 1-Beta error or the ability to reject the null when the alternative was true (Park, 2015). Therefore, there were no hypothesis in linear programming; instead, sensitivity analysis substituted the use of any hypotheses to investigate any slight deviations of the data in terms of the analysis. However, because I was completing an analysis that was a two-step process, a linear regression analysis was completed after the DEA, and after obtaining operating performance numbers in order to determine any relationships between the variables being examined (Chowdhury & Zelenyuk, 2016).

The linear regression analysis was completed by using the Statistical Package for the Social Sciences, version 23. When completing the linear regression analysis, the researcher followed these steps:

1. Conducted a preliminary analysis that examined any descriptive statistics of the continuous variables.
2. Checked the normality assumption by examining histograms of the variables.
3. Checked the linearity assumption by examining correlations and scatter diagrams of the variables.
4. Conducted a regression analysis by running a model with the variables.
5. Checked the model (check for multicollinearity, examine normality and homogeneity of variance).
6. Checked for outliers.
7. Examined significance of coefficient estimates to trim the model.
8. Revised the model.
9. Wrote the final regression equation and interpreted the coefficient estimates (Gunst, 2018).
10. Completed a t-test from the multiple regression and determined the p-value.
11. If $p$-value $<0.05$, significance was determined.
12. If $p$-value $>0.05$, no significance was determined.

When addressing the third research question on whether performance scores of rural hospitals had changed between the years of 2012 and 2019, I assigned a dummy variable that acted as a numerical indicator that represented the years being studied. In this instance, the dummy variable took on only two quantitative values; 1 and 0. The value of 1 indicated the year of 2019, whereas the value of zero indicated the year of 2012 (Bohl, Diesteldorf, Salm, & Wilfling, 2016). When assigning the dummy variable and completing the regression analysis, I merged both sets of data together to determine any changes in hospital performances over the course of 2012 and 2019. When completing the analysis on the third research question, the researcher used the same linear regression method, only she merged the data from the 2 years while including the dummy variable (Konietschke, Bathke, Harrar, & Pauly, 2015).

## Threats to Validity

Threats to external validity can be defined as any factors within a study that limit the generalizability of the results. There were two main threats to external validity that needed to be addressed for this study, which included selection biases and the constructs of the study. Because this study was limited to rural general medical and surgical hospitals located throughout the United States, the sample may not necessarily represent the general population outside of this country (Allcott, 2015). However, to reduce the effect of selection bias in this study, the researcher collected data from rural hospitals throughout all regions of the United States, to provide a broader representation within the geographical area being studied. In terms of the constructs used in this study, the researcher identified different variables that would be studied within this research. For example, this study focused on ownership, number of beds, and number of staff, in relation to ownership. Because these variables could be defined differently by different

hospitals and different geographical regions, I clearly defined these variables for this study (Mohajan, 2017).

Additionally, it was also important to highlight any threats to internal validity, which could be defined as the degree of control that was exerted over potential extraneous variables (Flannelly, Flannelly, & Jankowski, 2018). History is one of the main threats to internal validity which could occur if any of the samples differed in any way. Any differences in the sample that were not accounted for in the research could affect the outcome of the study. In order to limit this threat to internal validity, the researcher selected sites that had the same outputs. The outputs that I utilized were clearly defined in the study so that the same measurements could be taken from each sample.

## Ethical Procedures

Because this study used pre-collected data (secondary data), no human participants joined the study and no permissions were needed due to this. However, before completing the analysis, I received permission from my university's Institutional Review Board (IRB). (#XXX). Additionally, to ensure that this study remained ethical, the researcher also ensured that the data collected was from the AHAs website, which provided public data that required no permission to download. I did not amend or change the data in any form, completing the analysis with the data as is, in order to ensure that the decision-making units (DMUs) were appropriately represented in the data set.

After completing the analysis and the subsequent study, I will store the data for a period of 7 years, which was recommended by the university's IRB, at which stage the data will be deleted. Although the data were publicly available at the time of the study, the data will be stored for a period of 7 years, due to it being the data set used in the analysis of this study. The data were

stored and will continue to be stored on a flash drive and kept in a locked filing cabinet that is located inside my personal residence.

## Summary

The purpose of this quantitative study was to analyze the operating performance of all rural general medical and surgical hospitals in the United States by determining if performance had changed during 2012 and 2019. A secondary purpose of this study was to determine if any predictors of performance had changed during 2012 and 2019 by using a two-step method of analysis that included both DEA and linear regression. Through this methodology, data were gathered from the AHA that provided ownership, number of beds, and number of staff of 2012 and 2019. This section discussed the study's population and sampling procedures, how the data were collected, the data analysis plan, threats to validity, and ethical assurances. The next section is Section 3 that will provide a presentation of the results and a robust discussion of the findings.

## Section 3: Presentation of the Results and Findings

### Introduction

The purpose of this quantitative study was to analyze the operating performance of all rural, general, medical and surgical hospitals in the United States by determining if their performance had changed between 2012 and 2019. A secondary purpose of this study was to determine if any predictors of performance had changed between 2012 and 2019 by using a two-step method of analysis that included both DEA and linear regression. Using this methodology, I gathered data from the AHA that provided ownership, number of beds, and number of staff from both 2012 and 2019.

When completing the data analysis, it was important for me to keep the following research questions and hypotheses in mind:

RQ1: Does ownership explain variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2012?

$H_0$1: Ownership does not explain variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2012.

$H_a$1: Ownership explains variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2012.

RQ2: Does ownership explain variation in performance scores in rural general medical and surgical hospitals in the United States in 2019?

$H_0$2: Ownership does not explain variation in performance scores in rural general medical and surgical hospitals in the United States in 2019.

$H_a2$: Ownership explains variation in performance scores in rural general medical and surgical hospitals in the United States in 2019.

RQ3: Do the performance scores of general medical and surgical hospitals in the United States change between the years of 2012 and 2019?

$H_0 3$: Performance scores of general medical and surgical hospitals in the United States have not changed between the years of 2012 and 2019.

$H_a 3$: Performance scores of general medical and surgical hospitals in the United States changed between the years of 2012 and 2019.

## Data Envelopment Analysis (DEA)

DEA provides an absolute efficiency measure to evaluate DMUs with multiple inputs and outputs. In DEA, a DMU is efficient when $h0 = 1$, meaning that the constraint for that DMU is active, and therefore, its slack is zero. The basic assumption of the model is to use the slack as an efficiency measurement (Ruiz & Sirvent, 2016) The goal of this DEA model is to find a target of a DMU that maximizes the performance score in relation to ownership of hospitals.

### 2012

I broke down the data for each year into four parts for each year to allow for visualization. Figures 1 through 4 provide data visuals for the hospitals, giving the DMU and efficiency plots. In Figure 1, there are seven efficient DMUs and 42 inefficient DMUs, while Figure 2 had six efficient DMUs and 44 inefficient DMUs. There were 10 efficient DMUs and 40 inefficient DMUs in in Figure 3, while Figure 4 had five efficient DMUs and 43 inefficient DMUs. In the year 2012, there were a total of 28 efficient DMUs and 169 inefficient DMUs.

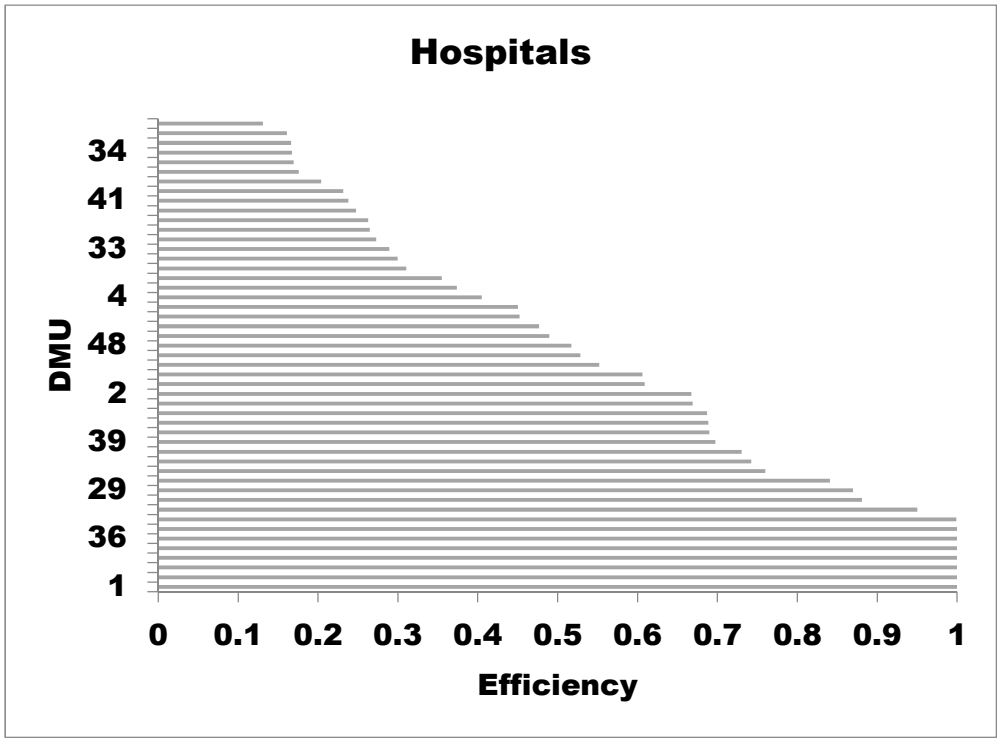


Figure 1 *Histogram of hospital DMUs and efficiency: Part 1 of 2012.*

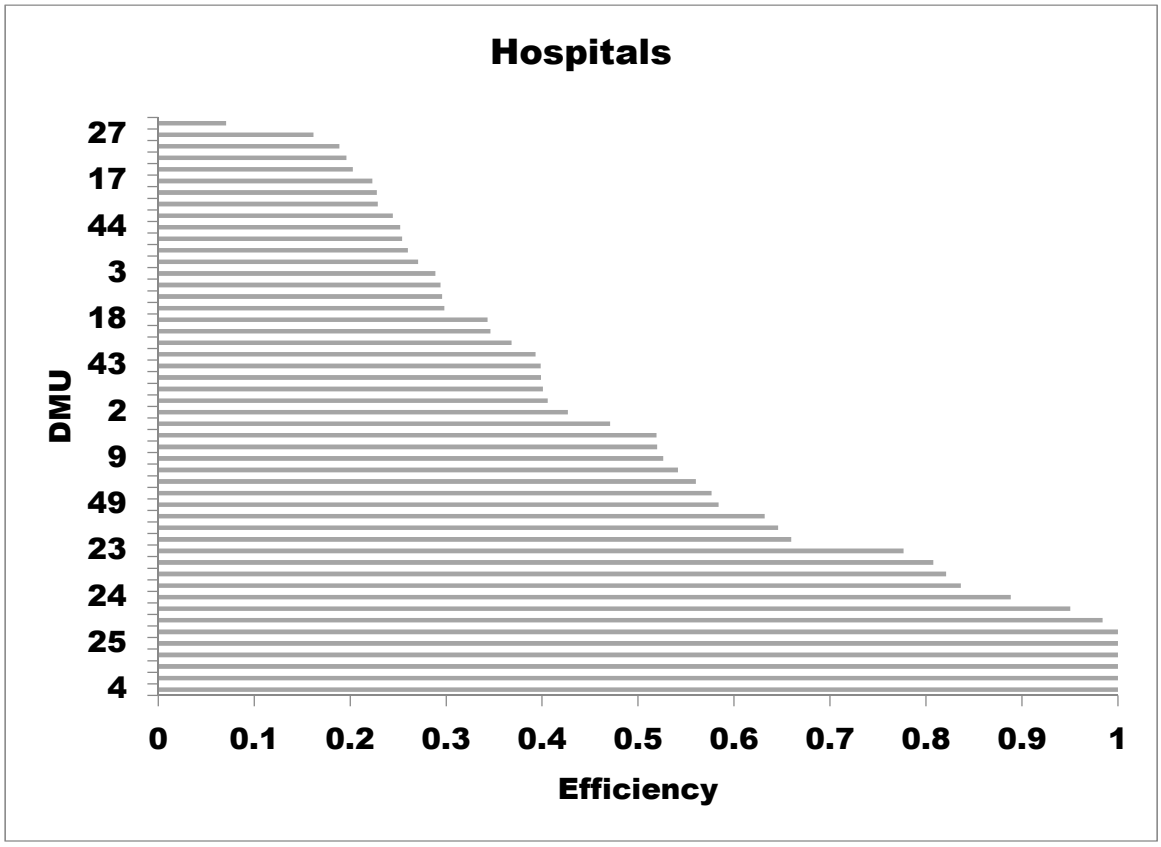


Figure 2 *Histogram of hospital DMUs and efficiency: Part 2 of 2012.*

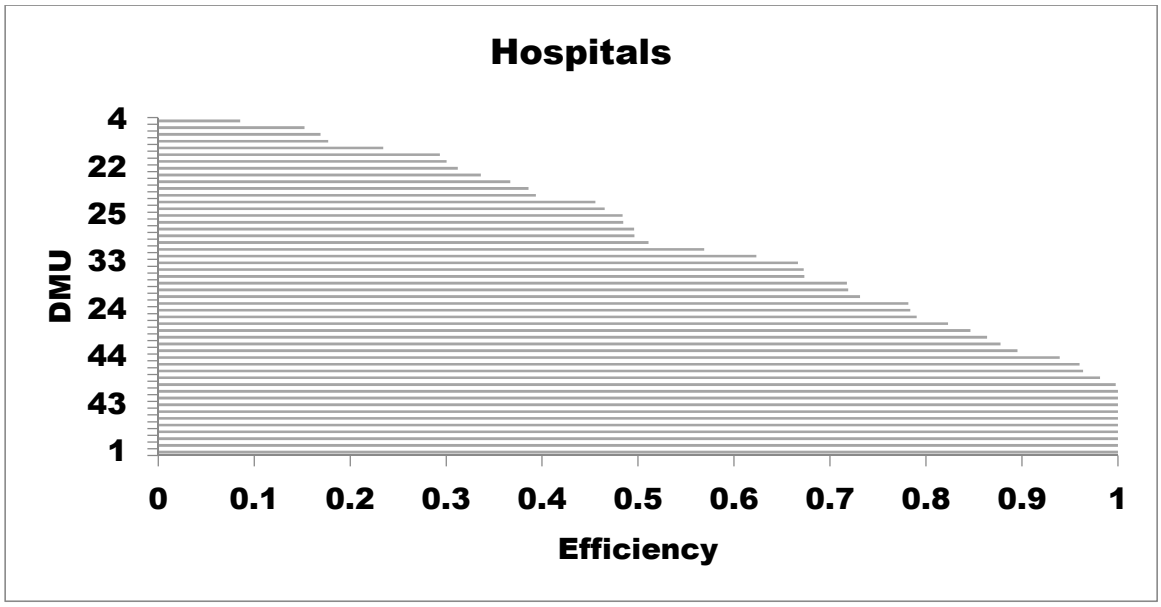


Figure 3 *Histogram of hospital DMUs and efficiency: Part 3 of 2012.*

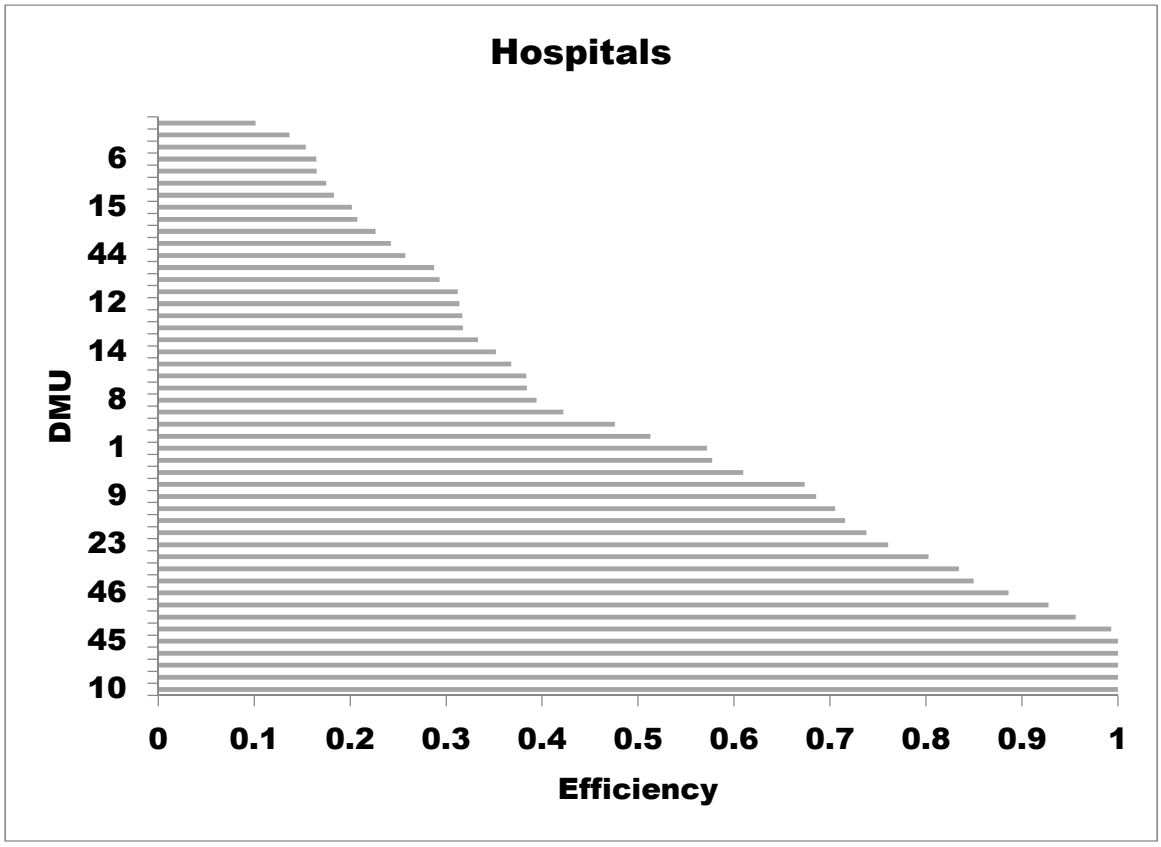


*Figure 4 Histogram of hospital DMUs and efficiency: Part 4 of 2012.*

**2019**

The breakdown on the data for 2019 shows Figure 5 has nine efficient DMUs and 40 inefficient DMUs, Figure 6 has three efficient DMUs and 47 inefficient DMUs, Figure 7 has four efficient DMUs and 46 inefficient DMUs, and Figure 8 has seven efficient DMUs and 41 inefficient DMUs. In the year 2019, there were a total of 23 efficient DMUs and 174 inefficient DMUs.

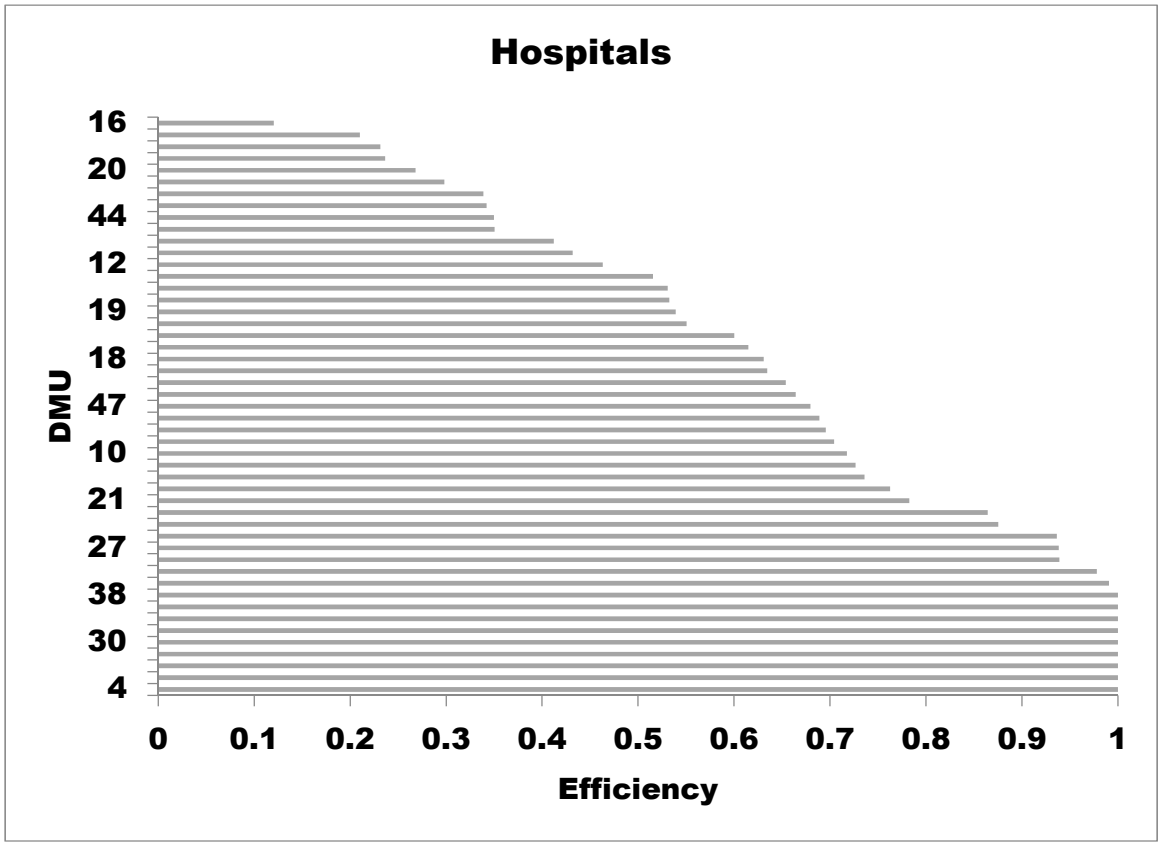


Figure 5 *Histogram of hospital DMUs and Efficiency: Part 1 of 2019.*

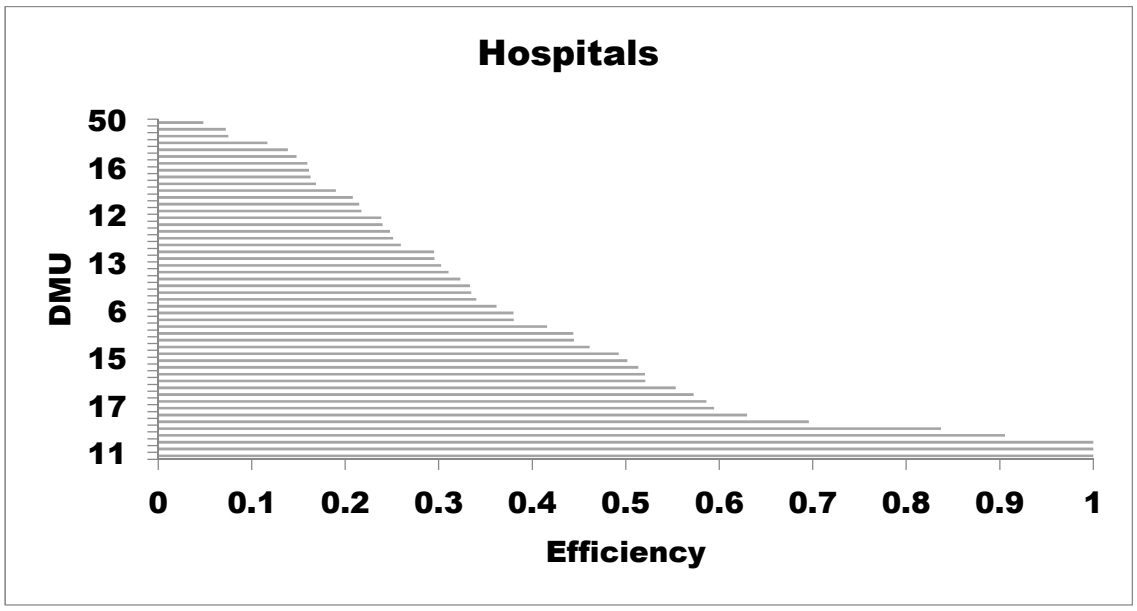

Figure 6 *Histogram of hospital DMUs and efficiency: Part 2 of 2019.*

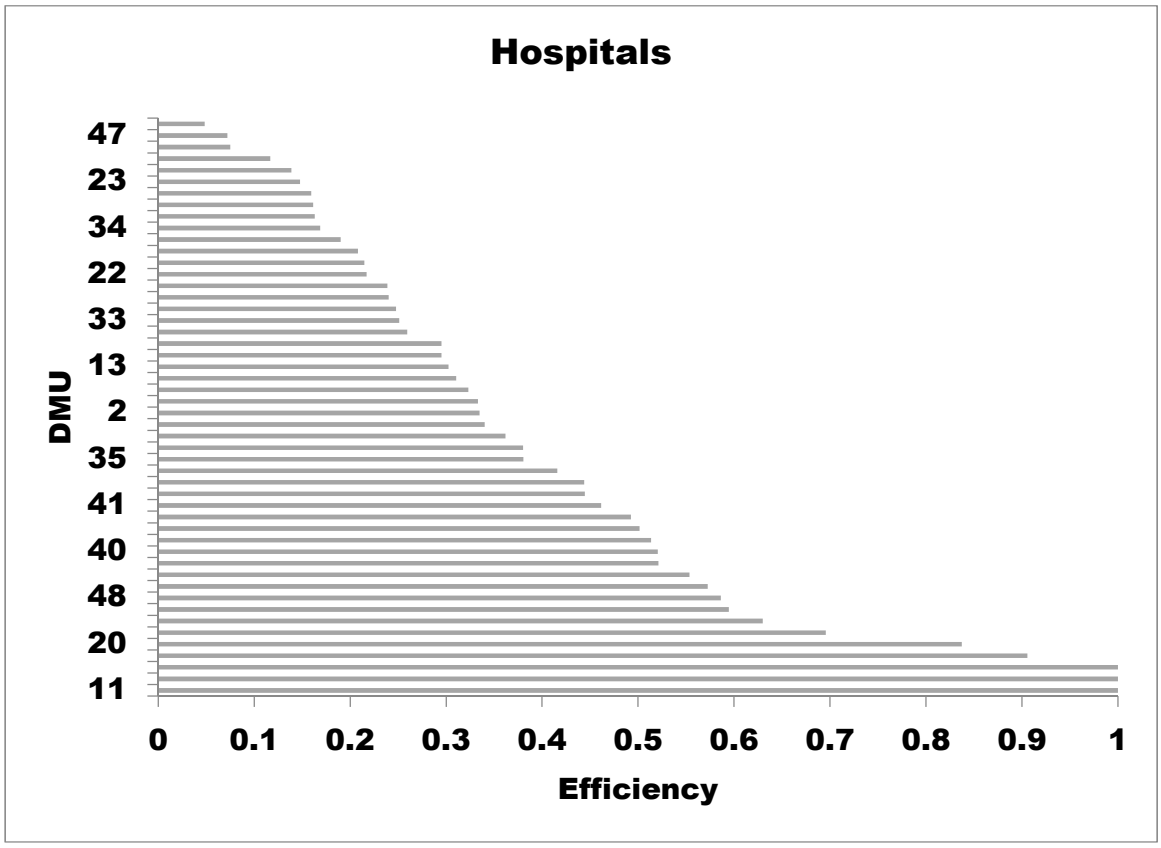


Figure 7 *Histogram of hospital DMUs and efficiency: Part 3 of 2019.*

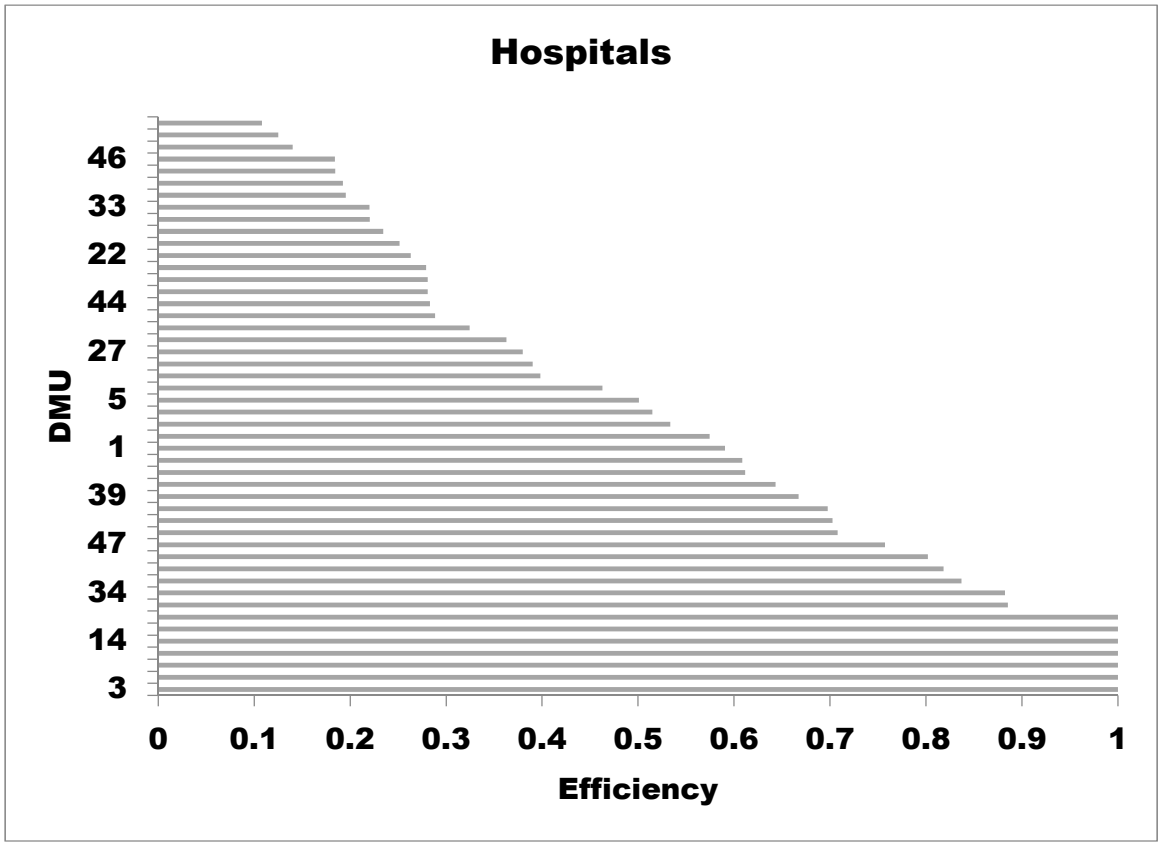


Figure 8 *Histogram of hospital DMUs and efficiency: Part 4 of 2019.*

## Descriptive Statistics

Within the first two sections of this study, I was able to highlight descriptive statistics within the analysis. Table 1 highlights the descriptive statistics of the variables (i.e., number of beds, number of staff, admissions, outpatient visits, and performance score) for the year 2012. The means for number of beds, number of staff, admissions, outpatient visits, and performance score are 92.84; 520.34; 3,321.32; 100,308.20; and 0.565816, respectively. The standard deviations were 1,108.931; 758.994; 5,030.048; 162,710.085; and 0.2958432, respectively. Based on these standard deviations, a wide spread of the data points was recorded only for the outpatient visits and admissions. The skewness greater than one (Skew > 1) for the variables of number of beds, number of staff, admissions, and outpatient visits were 2.592, 4.075, 2.847, and 4.944,

respectively, which signifies that there are indications of substantially skewed distribution, while performance score with skewness less than one (skew < 1) signifies no skew at 0.167. The kurtosis for the variables of number of beds, number of staff, admissions, outpatient visits, and performance score were 7.884, 22.466, 9.436, 32.123, and -1.374, respectively, which suggests that the distribution is too peaked.

Table 1

*Descriptive Statistics for 2012*

| | Minimum | Maximum | *M* | *SD* | Skewness | Kurtosis |
|---|---|---|---|---|---|---|
| (I) Number of beds | 7 | 699 | 92.84 | 108.931 | 2.592 | 7.884 |
| (I) Number of staff | 39 | 6,307 | 520.34 | 758.994 | 4.075 | 22.466 |
| (O) Admissions | 42 | 29,248 | 3,321.32 | 5,030.048 | 2.847 | 9.436 |
| (O) Outpatient visits | 1,929 | 1,470,742 | 100,308.20 | 162,710.085 | 4.944 | 32.123 |
| Performance score | .0706 | 1.0000 | .565816 | .2958432 | .167 | -1.374 |

*Note.* $N = 197$. *I* = input; *O* = output.

Table 2 highlights the descriptive statistics of the variables (i.e., number of beds, number of staff, admissions, outpatient visits, and performance score) for the year 2019. The means for number of beds, number of staff, admissions, outpatient visits, and performance score were 105.79; 697.62; 4,141.19; 140,294.79; and 0.523933, respectively. The standard deviations were 186.164; 1,296.563; 10,152.620; 246,167.926; and 0.2749224, respectively. Based on these standard deviations, a wide spread of the data points was recorded only for the outpatient visits and admissions. The skewness greater than one (Skew > 1) for the variables of number of beds, number of staff, admissions, and outpatient visits were 4.568, 4.138, 4.734, and 4.926,

respectively, which signifies that there are indications of substantially skewed distribution, while performance score with a skewness less than one (skew < 1) signifies no skew at 0.366. The kurtosis for the variables of number of beds, number of staff, admissions, and outpatient visits were 26.674, 19.171, 25.705, and 31.796, respectively, which suggests that the distribution is too peaked, while performance score with kurtosis of -0.983 can be said to be slightly flat.

Table 2

*Descriptive Statistics for 2019*

| | Minimum | Maximum | *M* | *SD* | Skewness | Kurtosis |
|---|---|---|---|---|---|---|
| (I) Number of beds | 6 | 1599 | 105.79 | 186.164 | 4.568 | 26.674 |
| (I) Number of staff | 39 | 9254 | 697.62 | 1296.563 | 4.138 | 19.171 |
| (O) Admissions | 4 | 81129 | 4141.19 | 10152.620 | 4.734 | 25.705 |
| (O) Outpatient visits | 601 | 2141729 | 140294.79 | 246167.926 | 4.926 | 31.796 |
| Performance score | .0483 | 1.0000 | .523933 | .2749224 | .366 | -.983 |

*Note.* $N = 197$. *I* = input, *O* = output.

The descriptive statistics further included the frequency and percentage distribution for ownership as displayed in Table 3. The study targeted 394 hospitals, of which complete data was available for all of them. The 394 hospitals comprised 182 not-for-profit hospitals, 31 investors owned, for profit hospitals, 152 government hospitals, and 29 church operated, not for profit hospitals. This indicates that 46.2% of the sampled hospitals were not-for-profit, while only 7.4% of the hospitals are church operated, not for profit. The sample hospitals span 44 states, whereby 13.2% of the hospitals are located in the state of Texas.

Table 3

*Ownership Frequency Table for 2012 and 2019*

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Church operated, not for profit | 29 | 7.4 | 7.4 | 7.4 |
| Government | 152 | 38.6 | 38.6 | 45.9 |
| Investor owned, for profit | 31 | 7.9 | 7.9 | 53.8 |
| Not for profit | 182 | 46.2 | 46.2 | 100.0 |
| Total | 394 | 100.0 | 100.0 | |

*Note. Bivariate Analysis of Ownership and Performance Scores Variables for Year 2012 (N=197, p=0.190)*

Notably, for the year 2012, the mean values of the performance score within each ownership category are not significantly different ($p = 0.190$).

Table 4

*Ownership Report for 2012*

| Ownership | N | Mean | Std. Deviation |
|---|---|---|---|
| Church operated, not for profit | 12 | .706 | .345 |
| Government | 84 | .559 | .293 |
| Investor owned, for profit | 15 | .651 | .340 |
| Not for profit | 86 | .538 | .280 |
| Total | 197 | .566 | .296 |

*Note. Dependent variable: Performance Score for 2012*

*Bivariate Analysis of Ownership and Performance Scores Variables for Year 2019 (N=197, p=0.001)*

For the year 2019, the mean values of the performance score within each ownership category are significantly different ($p = 0.001$). Specifically, as shown in the table below, the sample comprises more not for profit hospitals ($n = 96$) than government (68), investor owned, for profit (16), and church operated, not for profit hospitals (17). The mean performance score for not for profit hospitals (0.59) is much higher compared to that of church operated, not for profit hospitals (0.52), government hospitals (0.47), investor owned, for profit hospitals (0.32). This indicates that in 2019, the investor owned, for profit hospitals had the lowest performance scores compared to the other hospitals, while the not for profit hospitals had the highest performance scores. However, the standard deviation of the not for profit hospitals is high compared to that of the other hospitals indicating that even though its average performance score is higher, it has a wider spread of performance scores among the hospitals in the category.

Table 5

*Ownership Report for 2019*

| Ownership | N | Mean | Std. Deviation |
|---|---|---|---|
| Church operated, not for profit | 17 | .522 | .309 |
| Government | 68 | .475 | .254 |
| Investor owned, for profit | 16 | .329 | .177 |
| Not for profit | 96 | .591 | .277 |
| Total | 197 | .524 | .275 |

*Note. Dependent variable: Performance Score for 2019*

**Multiple Regression Analysis**

A multiple regression analysis was conducted to examine the three research questions. To accomplish this, the ownership variables such as church operated, not-for-profit, government owned, and for-profit were first transformed into dummy variables. Investor owned was selected as the reference category for ownership.

**Multiple Regression Analysis to Ascertain Whether the Predictors Influenced Performance Score in 2012**

First, the assumption of undue influence was tested using the Cook's distance. Cook's distance that is equal to or greater than 1.0 shows that there exists a problem of undue influence (Allison, 1999). The maximum Cook's distance (6.05) exceeds 1, thus, there are some points in the dataset that might exhibit unwarranted influences on the model due to disproportionate numbers. Secondly, the assumption of multicollinearity of the independent variables, where they were highly related, was tested to ascertain if the predictors are intercorrelated. The variance inflation factor (VIF) was used to test for multicollinearity. Since all the VIFs of the independent variables are below 10, it can be concluded that there is no problem of multicollinearity in the model (Fox, 1991). In addition, the assumption for independence of errors was tested using the Durbin Watson test. Durbin Watson statistic close to 2 demonstrates no correlation among the residuals (Allison, 1999); thus, there were no correlation among the residuals since the Durbin Watson statistic was 1.719. At the same time, the assumption that the residuals are normally distributed was tested. The histogram below indicates that the residuals are almost normally distributed. It can, therefore, be concluded that the assumption of normal distribution of errors was not violated.

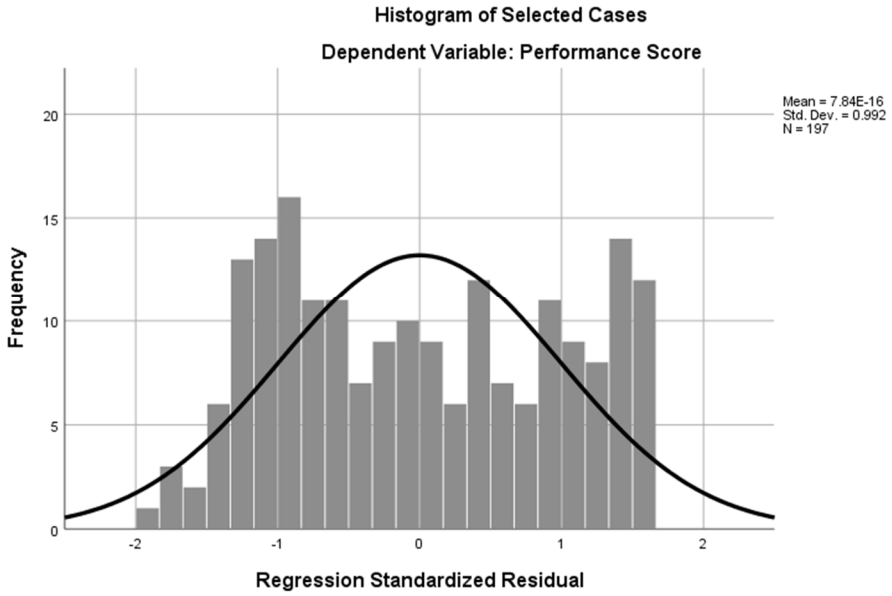


Figure 9 *Histogram of selected cases- performance score*

Lastly, the test for homoscedasticity was conducted. Based on the scatterplot shown below, the regression shows strong homoscedasticity as the dots do not form any specific pattern. Hence, it can be concluded that this regression analysis violated the assumption of undue influence. This could have been caused by the presence of outliers in the dataset.

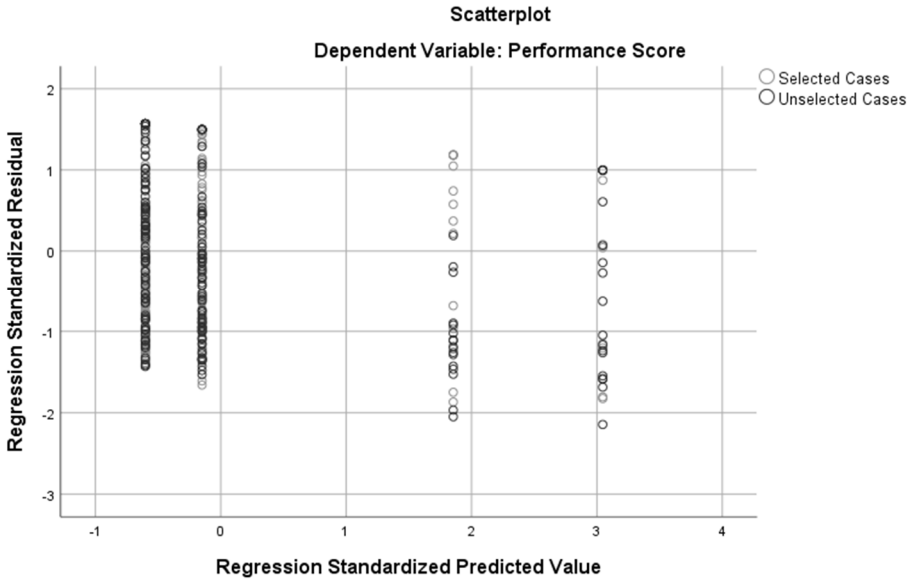


Figure 10 *Scatterplot- performance scores*

As shown in the regression results below, for the year 2012, ownership variables which includes church owned, government-owned, and for-profit hospitals suggested that there is no statistical significance at 0.05 level of significance. With an R-squared of 0.009, this implies that 0.9% of the variation in performance scores in rural general medical and surgical hospitals in the United States in 2012 was explained by the explanatory variables of ownership which are church operated hospitals, government owned and for profit owned hospitals, while the 99.1% is explained by factors not included in the analysis. In addition, these variables statistically significantly contributed to the explanation of the variation in performance scores in rural general medical and surgical hospitals in the United States in 2012. Investor, which signifies investor owned, for profit hospitals, was selected as the reference category for ownership, with $B = 1.0$. Notably, the mean performances of not-for-profit, church-owned, and government hospitals are not statistically significantly different from that of investor-owned hospitals. Thus, it cannot be concluded that ownership explained the variation in performance scores in rural general medical

and surgical hospitals in the United States in 2012. For this reason, we fail to reject the null hypothesis leading to the conclusion that Ownership does not explain variation in performance scores in rural general medical and surgical hospitals in the United States in 2012.

Table 6

*Result for Multiple Regression Analysis (Year 2012, N=197, adjusted r square = 0.009, p = 0.000)*

| | Unstandardized Coefficients | | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|
| Model | B | Std. Error | t | Sig. | Tolerance | VIF |
| (Constant) | .651 | .076 | 8.567 | .000 | | |
| not-for-profit | -.113 | .082 | -1.376 | .170 | .264 | 3.794 |
| church | .055 | .114 | .482 | .630 | .592 | 1.690 |
| government | -.092 | .083 | -1.121 | .264 | .264 | 3.786 |
| Investor | 1.000 | | | | | |

*Note. Dependent variable: performance score*

*Reference category: investor*

**Multiple Regression Analysis to Ascertain Whether the Predictors Influenced Performance Score in 2019**

Just like in the year 2012 analysis, several tests were first carried out to test whether the model satisfied various regression assumptions. Both the minimum (0) and maximum (0.054) Cook's distances are less than 1, thus, there are no points in the dataset that might exhibit undue influence on the model. Thus, the assumption of normal distribution of errors was not violated. At the same time, all the VIFs of the predictors are less than 10, hence, there is no problem of multicollinearity in the model. In addition, the histogram below indicates that the residuals are almost normally distributed. It can, therefore, be concluded that the assumption of normal distribution of errors was not violated.

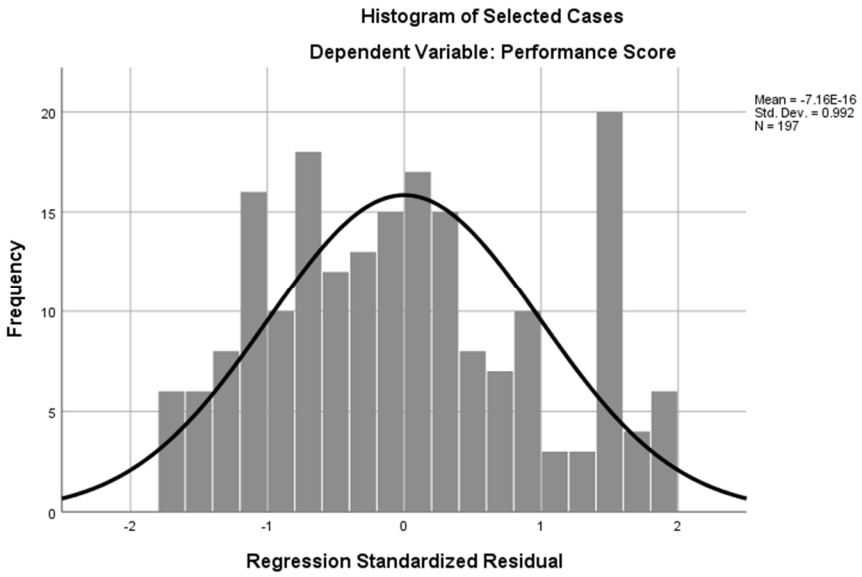


Figure 11 *Histogram of selected case- dependent variable*

There is also no serial correlation among the residuals since the Durbin Watson statistic is 1.585. Finally, the test for homoscedasticity was also conducted. Based on the scatterplot shown below, this regression displays some homoscedasticity as the dots do not form a specific linear

pattern. Thus, it can be concluded that the regression analysis violated the assumption of undue influence which could be influenced by outliers present in the dataset.

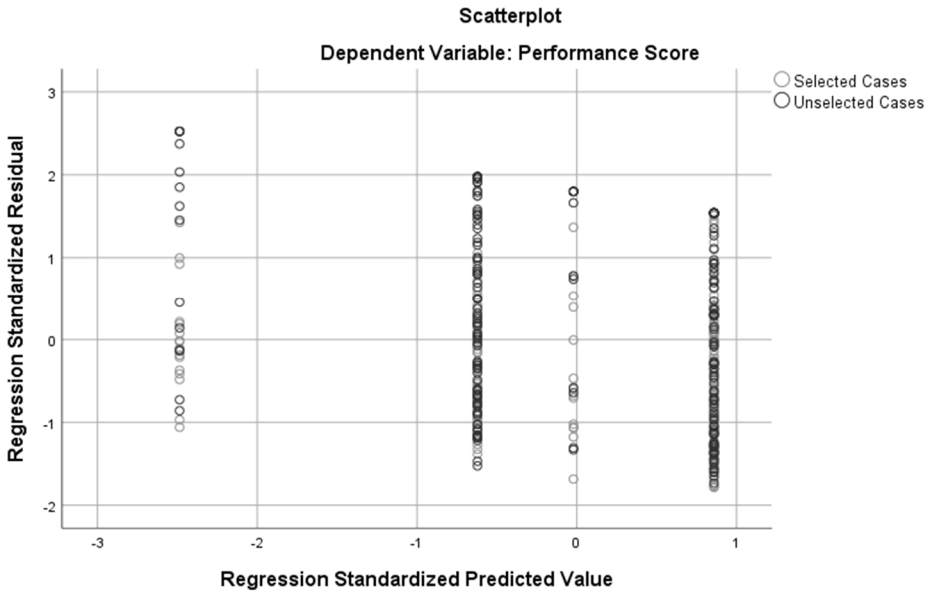


Figure 12 *Scatterplot of dependent variable- performance score*

As shown in the regression results below, for the year 2019, all the B regression coefficients were significant at the 0.05 level of significance. In addition, these variables statistically significantly contributed to the explanation of the variation in performance scores in rural general medical and surgical hospitals in the United States in 2019. Investor, which signifies investor owned, for profit hospitals, was selected as the reference category for ownership, with *B* = 1.0. Specifically, the mean performance is 0.262 higher for the not for profit hospitals than for the investor owned, for profit hospitals. Likewise, the mean performance is 0.193 higher for the church-owned hospitals than for the investor owned, for profit hospitals, whereas the mean performance is 0.146 higher for the government hospitals than for the investor owned, for profit

hospitals. For this reason, I rejected the null hypothesis and concluded that ownership explained the variation in performance scores in rural general medical and surgical hospitals in the United States in 2019. However, since the R-squared is 0.067, it implies that only 6.7% of the variation in performance scores in rural general medical and surgical hospitals in the United States in 2019 is explained by the explanatory variables of ownership which are church operated hospitals, government owned and for profit owned hospitals, whereas the 93.3% is explained by factors not included in the analysis.

Table 7

*Result for Multiple Regression Analysis (Year 2019, N=197, adjusted r square = 0.067, p = 0.000)*

| | Unstandardized Coefficients | | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|
| Model | B | Std. Error | t | Sig. | Tolerance | VIF |
| (Constant) | .329 | .066 | 4.962 | .000 | | |
| Not for profit | .262 | .072 | 3.647 | .000 | .279 | 3.589 |
| Church | .193 | .093 | 2.084 | .038 | .531 | 1.885 |
| Government | .146 | .074 | 1.976 | .050 | .291 | 3.438 |
| Investor | 1.000 | | | | | |

*Note. Dependent variable: performance score*

*Reference category: investor*

**Analysis to Ascertain If Performance Scores Changed Between the Years of 2012 and 2019**

To ascertain whether the performance scores of general medical and surgical hospitals in the United States changed between the years 2012 and 2019, a dummy variable was first assigned to the year variable. The coding for year is changed such that 2012 is coded as 1, while 2019 is coded as 0. Year 2012 in this case is the reference category.

The data set was tested to verify if it had outliers, whether the residuals are normally distributed, and if the independent variables are correlated. Both the minimum (0) and maximum (0.024) Cook's distances are less than 1, thus, there are no points in the dataset that might exhibit undue influence on the model. In addition, the histogram below indicates that the residuals are almost normally distributed. Thus, the assumption of normal distribution of errors was not violated. Also, all the VIFs of the predictors are less than 10, hence, there is no problem of multicollinearity in the model. The Durbin Watson statistic of 1.619 further shows that there is no serial correlation among the residuals. Lastly, the test for homoscedasticity was also conducted. Based on the scatterplot shown below, this regression displays some homoscedasticity as the dots do not form a specific pattern.

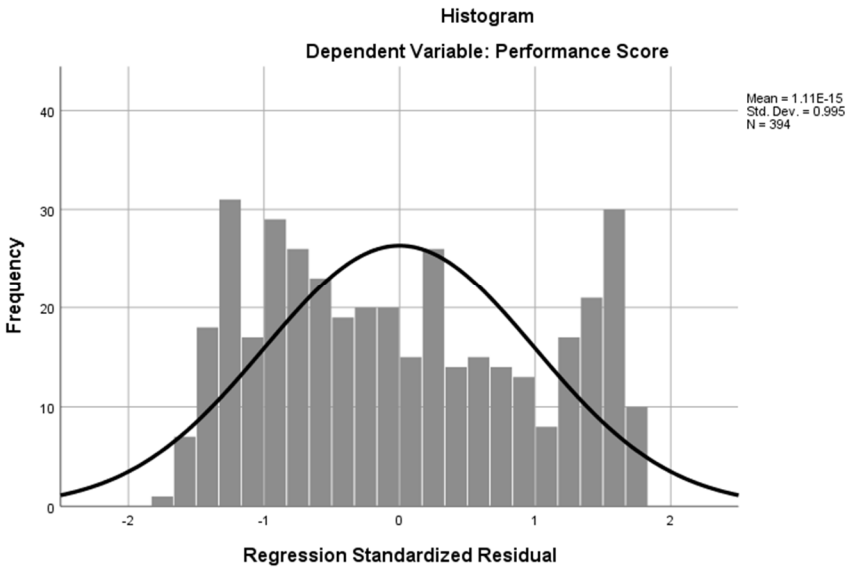


Figure 13 *Histogram- dependent variable*

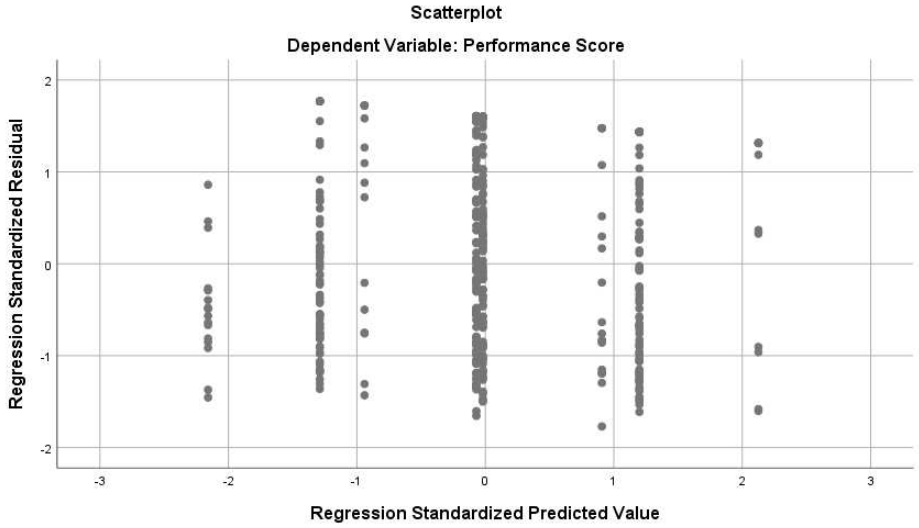


Figure 14 *Scatterplot- dependent variable*

As per the regression results below, all the B coefficients for ownership dummy variables as well as that for the year variable were not significant at the 0.05 level of significance. Herein, year 2012 and investor are the reference categories, with $B = 1.0$ for each. Notably, the mean performance for the year 2019 is not statistically significantly different from that of year 2012. This implies that a change of year from 2012 to 2019 did not lead to variation in performance scores of general medical and surgical hospitals in the United States. For this reason, I failed to reject the null hypothesis and concluded that performance scores of general medical and surgical hospitals in the United States did not change between the years of 2012 and 2019. With an R-squared of 0.008, this implies that 0.8% of the variation of performance scores of general medical and surgical hospitals in the United States between the years 2012 and 2019 is explained by a combination of the explanatory variables of ownership – church operated hospitals, government owned, for profit owned hospitals – and year, while the 99.2% is explained by factors not included in the analysis.

Table 8

*Result for multiple regression Analysis (Year 2012 to 2019, N=394, adjusted r square = 0.008, p = 0.000)*

| Model | Unstandardized Coefficients | | t | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|
| | B | Std. Error | | | Tolerance | VIF |
| (Constant) | .509 | .053 | 9.555 | .000 | | |
| Not for profit | .081 | .055 | 1.468 | .143 | .270 | 3.697 |
| Church | .116 | .074 | 1.582 | .115 | .557 | 1.794 |
| Government | .033 | .056 | .589 | .556 | .275 | 3.630 |
| Year 2019 | -.046 | .029 | -1.606 | .109 | .992 | 1.008 |
| Year 2012 | 1.000 | | | | | |
| Investor | 1.000 | | | | | |

*Note. Dependent variable: performance score*

*Reference category: year 2012, investor*

## Discussion of Findings

In summary, the results of this study confirm the null hypothesis that ownership did not explain variation in performance scores in rural general medical and surgical hospitals in the United States in 2012. Additionally, they point out that performance scores of general medical and surgical hospitals in the United States did not vary between the years of 2012 and 2019. This is not consistent with some of the studies (Dhar et al., 2016). However, the results show that ownership was associated with variation in performance scores in rural general medical and surgical hospitals in the United States in 2019 but the explained variation was very low (0.9%).

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

## Introduction

The purpose of this quantitative study was to analyze the operating performance of all rural, general, medical and surgical hospitals in the United States by determining if performance had changed between 2012 and 2019. A secondary purpose of this study was to determine if any predictors of performance had changed between 2012 and 2019 by using a two-step method of analysis that included both DEA and linear regression. Using this methodology, I gathered data from the AHA that provided information on the ownership of hospitals by not-for-profits, churches, and the government during the period of 2012 and 2019. The results of this study confirmed the null hypotheses that ownership did not explain variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2012 and that performance scores of general medical and surgical hospitals in the United States did not change between the years of 2012 and 2019. Nonetheless, the results demonstrated that ownership explained the variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2019, though the variables explained only 0.9% of this variation.

In this section, I conclude the study by providing a robust discussion on the interpretations of the findings and the limitations that were experienced during the research. This section also includes a discussion of recommendations and implications for professional practice and social change.

## Interpretation of the Findings

There are some important findings that need to be discussed in relation to previous literature collected within the field. The first finding of this study is that the results confirmed the null hypothesis that ownership did not explain variation in performance scores in rural, general,

medical and surgical hospitals in the United States in 2012. However, for 2019, the results demonstrated that ownership was weakly associated with variation in performance scores in rural, general, medical and surgical hospitals in the United States in 2019. In addition, the results confirmed the null hypothesis that performance scores of general medical and surgical hospitals in the United States did not change between the years of 2012 and 2019. This finding is in alignment with those of Leleu, Al-Amin, Rosko, and Valdmanis (2018), who analyzed U.S. not-for-profit and for-profit hospital efficiency and factors that affected variability. Following a DEA model, the authors examined mortality and readmission rates as negative outputs and admissions, surgeries, emergency room visits, and other visits as positive outputs. They concluded that for-profit hospitals that were located in more competitive markets appeared to be more efficient than not-for-profit hospitals located in noncompetitive markets, such as rural areas. Their findings highlighted similar responses to this current study, in which hospitals in noncompetitive markets, such as rural areas, need to improve their efficiency scores. The authors reported that this can be achieved by increasing instances of physician integration. Physician integration allows for an improved hospital management system that increases alignment between hospitals and physicians. In turn, physician integration can increase both patient care and patient satisfaction levels.

Physician integration has been problematic in rural hospitals in both historical and recent times. For example, Cutchin (1997) reported that rural hospitals struggle in their attempts to recruit and retain physicians despite administrators understanding the importance of retaining physicians to improving both patient care and satisfaction levels. More recently, Shabnam Asghari et al. (2017) reported that effective strategies are required to increase physician recruitment to rural communities, with many rural hospitals failing to follow through with

physician integration. This could be a key interpretation of why efficiency scores are lower in rural hospitals and are not improving over time.

Alongside physician integration, there could be other issues that decrease efficiency levels in rural hospitals, such as having limited resources that promote higher quality levels of care. In the current study, I found that the performance of rural hospitals had not improved since 2012 and no meaningful difference was found for hospitals of different ownership, and this could be attributed to a number of rural regions still having few registered healthcare practitioners and limited resources that aid in quality improvement initiatives. This could make it difficult for rural hospitals to consistently monitor their levels of quality of care. In essence, this means that rural hospitals that are struggling are likely to continue doing so; therefore, they may be prompted to merge with large healthcare systems to avoid closure.

In 2019, the results demonstrated that ownership had a weak association with the variation in performance scores in rural, general, medical and surgical hospitals in the United States. Dalton and Warren (2016) also discussed different results related to how ownership could explain variation or lack of variation because they reported that of a panel of California hospitals, nonprofits were more interested in controlling physician-intensive services, whereas public hospitals were more interested in labor-intensive services. This highlights a difference for hospital-based medical doctors because they provide the majority of their services in a hospital setting, using the hospital's equipment and facilities. These instances could potentially explain the differences in variation throughout the different years. By attempting to survive in a decreasing market, rural hospitals may have decreased areas of both physician-intensive and labor-intensive services or an increase of hospital-based medical doctors, which could explain a variation between the 2 years examined in this study.

Another highlight of ownership in relation to performance scores can also be explained by Horwitz and Nichols (2011) who reported that rural, nonprofit hospitals were more likely to offer unprofitable services, increasing the amount of underprovided services, which could, in turn, affect efficiency, especially between 2012 and 2019. For example, this effect on efficiency could be seen in hospitals taking on patients in rural settings that had no other choice as to where they sought treatment or care, placing financial stressors on different hospitals. Finally, in alignment with current research, Comondore et al. (2009) analyzed data for not-for-profit nursing homes and compared them for-profits. Their findings suggested that not-for profit homes had high quality staffing (i.e., ratio of effect 1.11; 95% CI 1.07–1.14), which was significant with a probability value less than 0.001(< 0.001). Their study also revealed again that there were less deficiencies in governmental regulatory assessments and the practice of physical restraints in not-for profit homes, but these differences were statistically insignificant. They went further to explore heterogeneity by separating public from private, not-for-profit nursing homes and comparing the latter with public, for-profit homes, finding the same results as earlier. This could indicate that hospitals experience greater performance scores and efficiency due to the increased staffing and funds, which can provide more individualized treatment and greater patient communication and rapport. Therefore, ownership plays a significant role in terms of funding, which is the most paramount reason for an improved performance in hospitals.

The Federal Office of Rural Health Policy (2020) provided a list of suggestions on how rural hospitals can improve efficiency. One of their recommendations is for rural hospitals to convert from operating as regular general and surgical hospitals to that of critical access hospitals, which allows them to remain in operation but with fewer beds.

In this study, I also determined that there were no significant differences among the coefficients of the dummy variables of ownership in explaining the variation in performance score of rural and general hospitals in 2012. For example, I found that church-operated hospitals had a greater or positive effect on the performance score of the hospitals in comparison to that of not-for-profit and government hospitals. This finding is in agreement with previous research because Mullner et al. (1989) found three major variables influenced the poor performance scores of hospitals and placed them at additional risk of closing: the hospital being under a profit ownership, the presence of a skilled nursing and long-term care unit, and the number of other hospitals within the county. The findings of this study also highlighted the importance of the effect of performance scores of general medical and surgical hospitals in the United States.

One of the other factors that could also affect the performance of hospitals is hospital beds. Wallace et al. (2015) completed a study that compared regional and national trends of critical care bed growth. The authors found that between 2000 and 2009, critical care beds increased by 15%, which mirrored the population growth; however, the authors cautioned that national trends in critical care bed growth may not be represented on a regional level because the majority of critical care bed growth occurs in cities that have larger populations. This could potentially explain how smaller hospitals are more efficient, especially in rural areas, because at times, patients are transported to larger hospitals in order to receive treatment via patient migration.

Although the regression analysis did not contain variables on locality of hospitals and the amount of bed space, it should be noted that the demand for rural hospital services cannot be undermined. Rural communities often have the greatest number of people who require services,

so hospitals have to walk the fine line of being charitable and yet profitable. Usually, trying to stay profitable despite very low margins has led to compromised health services (Kim, 2017).

This study was guided by the x-efficiency theory that was selected for use because it deals with the efficiency of firms under imperfect conditions and was used to determine the degree of efficiency maintained by not-for-profit, church, and government-owned hospitals under imperfect competition. This theory was useful when examining the results of the current study because it provided valuable insights when evaluating the operating performance of for-profit (i.e., church-owned) and not-for-profit (i.e., government-owned) general medical and surgical hospitals throughout the United States by identifying measures of improvement in relation to the objective measure of efficiency. The x-efficiency theory aligned with the factors under study.

## Limitations of the Study

There were some limitations that had to be addressed in the current study, including the way that data were collected. A strong limitation of this study was how low the explained variations were, and this was a resultant effect from not including enough relevant variables in the study. Although I was able to provide measurements of all variables used in this study, it should be noted that the hospitals that provided the data set may have potentially used different calculation methods. An example of this could be the variable of number of beds. The variable of number of beds can be calculated differently based upon geographical regions. For example, Mercille (2018) discussed how privatization has transformed hospitals over the past 2 decades, giving the example of Ireland, where number of beds is calculated differently than in other countries. Ireland's bed numbers are calculated as number of beds in terms of capacity versus availability. Between 1980 and 2015, the total number of beds in Irish hospitals decreased by

25.5% (Mercille, 2018). Therefore, it could be possible that some hospital participants in the current study may have calculated some of the variables differently than that of others.

Although some of the variables collected from rural hospitals throughout the United States may have been calculated differently, another limitation that may have been experienced concerns the actual variables that were studied in this research. For example, future research could study all rural hospitals in the United States by examining other variables identified in prior research such as Leleu et al.'s (2018) use of mortality and readmission rates operating as bad outputs, and admissions, surgeries, emergency room visits, and other visits as good outputs. This would allow researchers to determine a rural hospital's efficiency level via the quality of services and satisfaction levels that they are producing. This can then aid researchers in better understanding how hospital efficiency can improve through recommendations set forth by the Federal Office of Rural Health Policy (2020), who recommended that rural hospitals convert from operating as regular general and surgical hospitals to that of critical access hospitals, which allows them to remain in operation but with fewer beds.

Finally, another limitation that could have been experienced was within the research design itself. For example, because the researcher completed a data envelopment analysis, Berg (2010) discussed how the results can be sensitive to the selection of inputs and outputs, while researchers are unable to test for the best specification. This is because the number of efficient hospitals on the frontier tends to increase with the number of input and output variables. Other limitations of completing DEA is that the design ignores statistical errors and does not provide information on how to improve the efficiency, which is why an additional analytical method was completed.

## Recommendations

There are some recommendations for future research that should be discussed. A first recommendation is to focus future research on specific geographical areas other than the entire country in addition to relevant explanatory variables being included. Factors such as size, cost of running a hospital, revenue generated, locality can be explored to improve the study knowledge as these factors might be helpful to hospitals in the United States. This could aid in collecting data that could be better validated; for example, future researchers would be able to have better control over the variables being investigated, ensuring that the data uses the same calculation methods when aligning the variables. Another recommendation for future research is to complete a qualitative study that can obtain hospital administrators' perceptions and lived experiences of hospital efficiency that could collect data outside of variables not considered in this research. Other environmental factors could be assessed by having participants discuss their perceptions and experiences of a particular phenomenon and how it can affect hospital performance or efficiency.

Outside of future research, rural hospitals themselves should be examining their mission statement and restructure them differently, as their mission statements over the past eight years has not served them in increasing efficiency scores (Futrell & Clemons, 2017). Restructuring rural hospitals' mission statements should occur after future research has been completed as it would be important to understand how variables such as mortality and readmission rates operating as bad outputs, and admissions, surgeries, emergency room, and other visits as good outputs can aid in following the Federal Office of Rural Health Policy's (2020) recommendation where they encourage rural hospitals to convert from operating as regular general and surgical

hospitals to that of critical access hospitals. This allows rural hospitals to remain in operation, but with fewer beds, with increased efficiency scores.

## Implications for Professional Practice and Social Change

The first implication that needs to be discussed focuses on the findings and how they point out that there were no significant differences among the coefficients of the dummy variables of ownership in explaining the variation in performance score of general hospitals in 2012. This can be seen as funding could be made available to not-for-profit owned hospitals in loans or grants. Jihwan and Steven (2020) discussed the intersection between the largest U.S. industry health care system and the nonprofit sector. The study employed analytical and empirical approach and revealed that the marketing strategies employed by the nonprofit hospitals achieve higher output, prices, and profits than for-profit hospitals. They also discovered that nonprofit hospitals who focused on both profits and output, could obtain great outcomes by expanding its delivery of service with high-priced premium specialty medical services, while for-profit hospitals could be more profitable with higher prices for basic services.

Additionally, it was observed that competition increased the differences between not-for-profit and for-profit hospitals in output, and prices. Not-for-profit hospitals lose their competitive advantage when competing with other not-for-profit; that is, presence of a for-profit competitor broadens available not-for-profit premium specialty medical services. With wide-ranging service mixes, not-for-profits focus more on national advertising than for-profits because premium specialty medical services. An example is in pediatric trauma, neurosurgery, heart transplants, and oncology medical services which require larger geographic markets than services such as diagnostics, laboratory, nursing, and pharmaceutics.

Finally, this study's results could aid in implementing improved policies and procedures that can have improved financial outcomes for hospitals. For example, hospitals may be able to better understand the importance of controlling physician-intensive services, labor-intensive services, and medical-based doctors. Some hospitals may benefit from examining the different services, as they could be spending unnecessary monies on one particular service. By designing and implementing improved policies and procedures, the hospitals could follow the needs of the patients in areas that are more economically sustaining (Graban & Swartz, 2018). These implications are in alignment with the Federal Office of Rural Health Policy (2020), where they recommended that rural hospitals convert from operating as regular general and surgical hospitals to that of critical access hospitals, which allows them to remain in operation, but with fewer beds. However, future research should be directed towards this shift, as rural hospitals appear to struggle with physician integration while having access to limited resources that promote higher quality levels of care. Therefore, future research should be directed towards this venture for all rural hospitals in the United States by studying different variables such as that of mortality and readmission rates operating as bad outputs, and admissions, surgeries, emergency room, and other visits as good outputs. This can aid in determining specific ways in which rural hospitals can begin improving their efficiency scores.

## Conclusion

Before this study, it was unclear how ownership (profit and not-for-profit) affected the operating performance of general and surgical hospitals. Also, performance is declining and most of the variation in performance remains unexplained, so we do not know why performance is declining. This is an urgent problem requiring more investigation. While some literature has evaluated these variables in their impact on

operational performance, they generally focused on other factors. This study is therefore timely, given how much information it can provide to the different types of hospital.

Nonprofit hospitals are presently struggling. They are at risk of closure, which affects not only the hospitals but also the populations that they are serving. Some of the nonprofit hospitals however find it more convenient to sell themselves to for-profit chains or private equity firms or surrendering to the regional consolidations taking place. The present study's findings are crucial to the future of not-for-profit owned hospitals that are still presently opened but at risk of being closed for their lackluster performance, which might include lack of budget.

Reviews have time and time again pointed out that there are several factors and mechanisms that affects ownership of hospitals and there impacts in health and health care related performance (Frank, 2000). Most times it is seen that for-profit organizations have efficient results when it comes to profit maximization, there are also no fences or barriers to entry in the market (Jaspen, 1998; Gray, 1986; Rosenthal & Newbrander, 1996;). Nevertheless, this is not certainly valid when it comes to the healthcare industry. Factors such as profits are one of many struggles in the health sector, some of such problems as patient welfare, prestige, research, teaching, technological improvement, high capital investment requirements, regulations such as certification and accreditation, among others. This goes to show that other factors that affect hospital performance other that ownership abound.

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