2020

Comparison of Diagnosis and Hospital Referral Rates Between Physician and Non-Physician Practitioners

Joshua Alan Fisher
Walden University

Walden University

College of Health Sciences

This is to certify that the doctoral study by

Joshua Alan Fisher

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

Review Committee
Dr. Suzanne Richins, Committee Chairperson, Health Sciences Faculty
Dr. Melissa Green, Committee Member, Health Sciences Faculty
Dr. Ronald Hudak, University Reviewer, Health Sciences Faculty

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

Walden University
2020

Abstract

Comparison of Diagnosis and Hospital Referral Rates Between Physician and Non-Physician Practitioners

by

Joshua Alan Fisher

MS, Saint Joseph's University, 2015

BS, North Carolina State University, 2011

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Healthcare Administration

Walden University

February 2020

Abstract

Physician extenders as support in healthcare facilities has been increasing in the United States and has the potential to help in currently underserved communities. This study evaluated the quality of care provided by physician extenders through the examination of average diagnosis and referral rates that may inform healthcare leaders and policymakers in future decisions. The literature review pointed to a gap in the research related to the quality of care based on patient diagnosis and referral rates by physicians and physician extenders. The conclusions were based on a quantitative analysis of secondary data from the National Ambulatory Medical Care Survey (NAMCS) with a sample size of 13,165 observations. A cross-sectional research design and quantitative analysis were used to undertake empirical investigations. The main statistical methods used for analyzing the data as well as testing the research hypotheses were descriptive analysis (i.e., statistics), linear regression, and Pearson correlation. The results of the empirical analysis indicated several things. First, a positive correlation between physicians and patient diagnosis and referral rates and a lack of correlation between these rates and physician extenders is seen. Also, a positive correlation between diagnosis rate and physicians and lack of significant correlation between diagnosis rate and physician extenders is noted. Lastly, the data indicating that a positive correlation exists between all providers and patient referral rates allows for the use of physician extenders to be eliminated as a possible constraint to quality of care. One implication for positive social change is to expand the use of regional or hub facilities managed and run by these physician extenders.

Comparison of Diagnosis and Referral Rates Between Physician and Non-Physician Practitioners

by

Joshua Alan Fisher

MS, Saint Joseph's University, 2015

BS, North Carolina State University, 2011

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Healthcare Administration

Walden University

February 2020

Dedication

I dedicate my dissertation work to my family and many friends. A special feeling of gratitude to my loving parents, Rodger and Teresa Fisher, whose words of encouragement pushed me through. My husband, Wade McAdams, has never let me forget that each step of this process was part of the journey and something to be embraced and enjoyed, especially when it was not easy.

Acknowledgments

I want to express my deepest appreciation to my committee, Dr. Suzanne Richins, Dr. Melissa Green, and Dr. Ronald Hudak. This group of amazing professionals has helped me to learn and grow more than I could have ever imagined.

Table of Contents

List of Tables

List of Figures

Section 1: Foundation of the Study and Literature Review

Introduction

Background Information

According to King and Wheeler (2016), the development of physician extenders (PEs) as a profession started in the United States around 1961 through a direct recommendation by Doctor Charles Hudson. In this study, PEs are defined as physician assistants and nurse practitioners. In 1961, Hudson recommended the American Medical Association (AMA) create two new groups, one from non-nursing personnel and the other non-medical personnel to assist doctors (Buerhaus et al., 2015; Hooker, Brock, & Cook, 2016; Jiao et al., 2018; Tipirneni et al., 2015). Following this recommendation, the first group of PEs was assembled in 1965 by Duke University Medical Center in North Carolina (Solomon et al., 2015; Xue et al., 2016; Xue et al., 2017). As explained by Schoenfeld et al. (2016) and Brixey et al. (2016), this group was composed mainly of former U.S. Navy Hospital Corpsmen. In the early 1970s, contributors developed the curriculum for the PEs program and their number began to increase (Schoenfeld et al., 2016).

Rapid development followed in the sector, and subsequently, the U.S. Army created eight classes of physician assistants (PAs) at the beginning of January 1971 (Berben et al., 2017; Chao et al., 2017; Kleinpell et al., 2015; Morgan et al., 2016). As explained by Tierney et al. (2017), 30 students were registered per class with classes offered by the U.S. Army's Academy of Health Sciences and clinicals occurring in the

Brooke Army Medical Center at Fort Sam Houston, Texas (Hooker et al., 2016; Hooker, Cawley, & Everett, 2017; Jiao et al., 2018). Yawn et al. (2016) and Drennan et al. (2015) explained that the first group or cadre of PAs was trained in the 1960s in the United States under the direction of Doctor Charles Hudson to reduce the shortage of doctors in the primary care in the nation.

Mehta et al. (2018) indicated that by 2016, there were more than 44,000 PEs in the United States. Goold et al. (2018) noted that in 2015, nearly 63% of practicing PEs in the United States were women. The role of PEs was initially spread to countries including Canada, Germany, the United Kingdom, and others (Benson et al., 2016; Yeh et al., 2018). There are similar professional programs in India as well (Benson et al.,2016). Bonewit-West, Hunt, and Applegate (2016); King and Wheeler (2016); and Schoenfeld et al. (2016) stated that the profession has rapidly expanded globally and now it is found in countries, such as New Zealand, Afghanistan, Ghana, Saudi Arabia, Israel, Liberia, the Netherlands, and Australia.

While the number of practicing PEs in the United States is rapidly increasing, the healthcare industry may still be in trouble (Tipirneni et al., 2015). Over the past 2–3 decades, some researchers have noted an overwhelming increase in demand for doctors in the United States (Berben et al., 2017; Chao et al., 2017). Representatives for the Association of American Medical Colleges (2018) stated that citizens of the United States could see a shortage of 120,000 physicians by 2030.

Need for the Study

The number of PEs increased rapidly, not only in the United States, but in other countries as well. There is a need for an improved understanding of the correlation between the type of healthcare practitioner (i.e., physician, physician assistant, or nurse practitioner) and practitioners' diagnosis and referral rates.

Given the already high demand for healthcare services and understanding that the trends show the need for healthcare providers is expected to rise even further to meet this demand, it is of paramount importance that the existing workforce is effectively utilized (Kleinpell et al., 2015; Lovink et al., 2017; McDaniel, Hildebrandt, & Russell, 2016). With proper utilization of the current workforce, high-quality service delivery is achievable while remaining cost-effective. Across different countries in the world, statistics show that 50% of the total healthcare expenditure goes to a healthcare provider's wages and salaries (Gadbois et al., 2015; Jiao et al., 2018; Ray et al., 2017). It is, therefore, necessary to develop cost containment strategies given the massive demand for healthcare, not only in first-world countries, but also the acute need for healthcare in both second- and third-world countries (Chao et al., 2017; Grabenkort et al., 2017; Hing & Hsiao, 2015).

The World Health Organization, in conjunction with the governments of various other countries, developed measurements geared towards enhancing productivity by increasing the healthcare workforce capacity (Kahn et al., 2015; Lovink et al., 2017; Morgan et al., 2017). One of the actions implemented was the full utilization of all nurses

in advanced practice given that the number of nurse practitioners across the world is estimated to be around 9 times that of physicians (Benson et al., 2016; Berben et al., 2017; Ray et al., 2017). Pope and Deer (2017) and Murphy (2015) explained that the relevant health policymakers found it necessary to make maximum use of practicing nurses and extend the scope of PEs to increase access to healthcare services. However, as the increase in access takes place, the impact of increased PEs on patient diagnosis and referral rate is not being investigated extensively.

Researchers have found that the practice of using PEs began in the 1960s after the realization that there was an acute shortage of physicians and that some areas, especially rural ones, were underserved (Grabenkort et al., 2017; Solomon et al., 2015; Woo, Lee, & Tam, 2017). Since its inception in primary care, the role of advanced nursing practice has been increasingly adopted in other healthcare settings (e.g., acute care; Woo et al., 2017). Pope and Deer (2017), Weinstock et al. (2016), and Martinez-Gonzalez et al. (2015) explained that acute healthcare providers, whose service can be enhanced through the increased use of PEs, are vital for stabilizing patients, especially those who are suffering from terminal or otherwise critical illnesses.

Potential Positive Social Change Implications

The results of this study can lead to positive social changes if used as designed. For instance, this study may lead to a positive difference in PEs' work, thereby improving the impact they have on patients. The practice of medicine may improve with the ability of the PEs to expand their direct effects.

The findings of this study may also create positive awareness amongst PEs, enabling them to improve their patient diagnosis ability and creating a positive social change in the healthcare system overall. This positive awareness may cause positive attitudes towards PEs and their clinical practices, which could enhance the satisfaction of the patient, thereby leading to the establishment of a positive relationship between a more significant number of patients and PEs.

The results of this study may also lead to positive social change by requiring adequate health education as well as health maintenance for PEs, which substantially improves the continuity of care shortfalls within the healthcare sector. This would lead to PEs receiving the necessary knowledge and training that enables them to enhance their ability to diagnose patients effectively. It may also allow PEs to free physicians from undertaking some of the more routine primary care tasks.

Problem Statement

Research Problem

Due to the aging of the baby boomer generation, healthcare leaders in the United States are experiencing a drastic increase in the number of patients without the corresponding increase in the number of physicians (Jacelon, 2017). For this reason, these leaders have increased the usage and responsibility of PEs (i.e., PAs and nurse practitioners) to help in meeting the demand (Jacelon,2017). In utilizing practitioners that received less cumulative education than physicians, there are no data to show if there are differences in referral rates, diagnosis, or financial penalties.

Gaps in Current Research

Despite the increasing number of empirical studies, no researchers have investigated the effect of PEs on diagnosis and referral rates. Little empirical evidence are available in the literature as to whether an increased number of PEs will impact the patient diagnosis and hospital referral rates; however, the Centers for Disease Control and Prevention (CDC) collected data through the National Ambulatory Medical Care Survey (NAMCS), which allowed for assessment of physician extender quality of care metrics in this study (see Ambulatory Health Care Data, 2019). I found no extant empirical study conducted to determine the relationship between patient diagnosis and PEs.

There are possible barriers to the use of PEs, but there is not sufficient empirical evidence of the same. Only a few researchers, such as Hooker and Muchow (2015) and Reiter, Wen, and Allen (2016), have investigated and discussed the possible barriers to the use of PEs. Additional cross-sectional and longitudinal studies are needed to provide sufficient empirical evidence of such obstacles.

Purpose of the Study

With an increased focus placed on diagnosis and referral rates in combination with the implementation of financial penalties assessed to institutions with increased readmission rates, quality of care is something that healthcare agencies can ill afford to sacrifice now more than ever (Rau, 2014). An evaluation of quality of care provided by PEs through examination of their diagnosis and referral rates may inform healthcare leaders and policymakers in future policy and staffing decisions.

Research Questions and Hypotheses

RQ1: Based on the type of practitioner treating a patient (including physician, nurse practitioner, and PA), to what extent do they differ in the diagnosis rate and hospital referral rate as it relates to the type of practitioner?

$H_0$1: The rate of diagnosis versus the rate of hospital referral has no significant difference based on the type of practitioner seen.

$H_1$1: The rate of diagnosis versus the rate of hospital referral has a significant difference based on the type of practitioner seen.

RQ2: To what extent does the diagnosis rate change with the use of PEs (including nurse practitioners and PAs) as compared to physicians?

$H_0$2: The rate of diagnosis between PEs and physicians has no significant change.

$H_1$2: The rate of diagnosis between PEs and physicians has a significant change.

RQ3: To what extent does the hospital referral rate change with the use of PEs (including nurse practitioners and PAs) as compared to physicians?

$H_0$3: The rate of hospital referral between PEs and physicians has no significant change.

$H_1$3: The rate of hospital referral between PEs and physicians has a significant change.

Theoretical Foundation for the Study

Theoretical Foundation

In this section, I present a discussion of the chosen theoretical foundation of this study, which is an essential part of any study because it provides the lens through which the research problem and questions are evaluated (see Bruni & Porta, 2016; Neumayer et al., 2017; Pruzan, 2016; Teater et al., 2016). Brixey et al. (2016) and Neumayer et al. (2017) stated that a theoretical framework is a typical requirement for any quantitative research study. A theoretical framework involves identifying a theory to explain the outcome of the study (Bruni & Porta, 2016). Denker (2017) noted that a theory is a scientific explanation of a given natural phenomenon, constructed based on the facts presented (Mellinger & Hanson, 2016; Pruzan, 2016). Many theories could have been used; however, the theory of constraints (TOC) was chosen to form the basis of the theoretical framework for this study. Most organizations broadly apply the TOC in the management of their business operations.

The Theory of Constraints (TOC)

The TOC, also known as the management philosophy, is a management paradigm postulating that every manageable system has many constraints that limit its ability in achieving its specified goals (Aguilar-Escobar & Garrido-Vega, 2016; Almeida et al., 2018; Huang et al., 2014; Mabin & Mirzaei, 2016). Woeppel (2016), Mauergauz (2016), and Galbács (2015) explained that every manageable system has at least one constraint and the theory purposes to identify the constraint(s). The organization is then structured

around the identified constraint (Almeida et al., 2018; Huang et al., 2014; Pereira et al., 2014). According to Brim (2017) and Mohammadi et al. (2015), the TOC is useful in identifying the greatest limiting factor or constraints in the system and systematically improving it until its effects are no longer felt (Costas et al., 2015; Pereira et al., 2014). The theory was initially developed by a management philosopher called Eliyahu Goldratt (Mabin & Mirzaei, 2016; Mohammadi et al., 2015). To develop the TOC, Goldratt essentially adopted the concept of project management (Almeida et al., 2018; Mabin & Mirzaei, 2016; Mohammadi et al., 2015).

Key assumptions. Mauergauz (2016) and Galbács (2015) explained that the underlying assumption of the TOC is that throughput and inventory can be used to measure and control an organization. As defined by Costas et al. (2015) and Mohammadi et al. (2015), inventory is the total amount of money invested (in the case of the current study, the amount of money spent on testing/treatments of a patient), while operational expense includes the amount of money spent in turning the inventory into final products for sale (in the case of this study, the focus of operational expenses is the cost difference between PEs and physicians). Lastly, the throughput is the rate at which the money is generated mainly through sales of the products (Aguilar-Escobar & Garrido-Vega, 2016; Huang et al., 2014; Pereira et al., 2014).

Another assumption upholding the TOC relates to the goal of the business or organization. Goldratt (2017) and Brim (2017) explained that before the goal can be

reached, the necessary conditions must be met. Galbács (2015) and Woeppel (2016) identified these conditions to primarily include legal obligations, quality, and safety.

The Five Focusing Steps. The TOC provides a methodology for identifying as well as eliminating the constraints through the Five Focusing Steps (Aguilar-Escobar & Garrido-Vega, 2016; Pereira et al., 2014). The Five Focusing Steps are: (a) Identify the Constraint, (b) Exploit the Constraint, (c) Subordinate & Synchronize to the Constraint, (d) Elevate the Performance of the Constraint, € Repeat the Process (Pereira et al.,2014).

The steps start by defining the current constraint, then exploiting and synchronizing it (Pereira et al., 2014). Finally, the process is repeated until achieving the optimal outcome (Pereira et al., 2014). The current obstacle identified should be the single part of the process that inherently limits the rate at which its goal is met (Almeida et al., 2018; Goldratt, 2017; Mohammadi et al., 2015). As explained by Pereira et al. (2014), Costas et al. (2015), and Mohammadi et al. (2015), the second step should involve using existing resources to make quick improvements of the constraint identified. Next is to review the process activities to ensure that they support the needs of the constraint (Brim, 2017; Costas et al., 2015). The fourth step considers further actions to be taken if the constraint still exists (Goldratt, 2017; Mohammadi et al., 2015). Finally, the process is repeated to identify if another constraint exists and then eliminated in a similar process (Goldratt, 2017; Mohammadi et al., 2015).

Why the TOC? I selected the TOC as the theoretical framework for this study because it is designed to help various organizations achieve their intended goals (see

Galbács, 2015; Mabin & Mirzaei, 2016; Mauergauz, 2016). Because of its design, it can help the healthcare system achieve the goal of reducing referral rates, improving patient diagnosis through PEs. The choice of the TOC as the theoretical framework was rational because it helps in the identification of factors that hinder the achievements of set goals of healthcare systems to ensure they perform optimally (see Aguilar-Escobar & Garrido-Vega, 2016; Brim, 2017; Galbács, 2015). In addition, the theory helps provide solutions on how the healthcare operations can be improved through a focus on mitigating and eliminating the hindering factors (Costas et al., 2015; Goldratt, 2017; Mohammadi et al., 2015).

Relation to the present study. According to the TOC, when one constraint is eliminated, with time another obstacle arises (Brim, 2017; Costas et al., 2015; Huang et al., 2014). Almeida et al. (2018) and Pereira et al. (2014) explained that the organization, therefore, shifts its attention to the new inhibiting factor with the aim of maximum utilization of resources and maximum yield. According to Mabin and Mirzaei (2016), Costas et al. (2015), and Mohammadi et al. (2015), various issues limit the maximum potential of the PEs in providing quality healthcare. Cost of care is one of the major inhibiting factors in the provision of quality healthcare (Costas et al., 2015; Goldratt, 2017). There was a need for an investigation into the quality of healthcare that is offered by the PEs. The TOC relates to the present study by helping understand the impact of a high number of PEs by identifying the limiting constraints. It also helps explain the interaction between the number of PEs and patient diagnosis rates and referral rates.

Relation to the study approach. The TOC relates to the quantitative approach taken in this study because it involves logical and mathematical measurements to identify and improve operations (see Mohammadi et al., 2015). As explained by Mabin and Mirzaei (2016), Almeida et al. (2018), and Pereira et al. (2014), the TOC focuses on determining and measuring limitations, which is done using quantitative techniques.

In this study, I explored constraints in the healthcare systems quantitatively and examined the correlation between referral rates and diagnosis in healthcare facilities. The theory was applied where the constraint is taken to be the increased number of PEs used in healthcare facilities as a way of reducing the costs of operations. The use of PEs serves as an excellent opportunity for evaluating how healthcare management is improving the overall quality of services extended to patients. Other external factors (e.g., healthcare facility size and the geographical area) were also taken into consideration.

Nature of the Study

Research Design

Quantitative analyses can be used for managing and determining the number of PEs, patient diagnosis rate, and hospital referral rate. According to Mellinger and Hanson (2016), a research design is a framework for analyzing the data to provide empirical evidence. Bruni and Porta (2016), Mellinger and Hanson (2016), and Denker (2017) asserted that the key of a research design is to outline various sets of techniques adopted for collecting and analyzing data.

I chose a cross-sectional design to complete the current empirical investigations; however, the model was only focused on the use of quantitative methods. The plan was suitable because it provided the best description of characteristics of the research phenomenon and outcomes, thereby making the results easy to understand and interpret (see Neumayer et al., 2017; Teater et al., 2016). Furthermore, Teater et al. (2016) and Denker (2017) explained that the design can be applied alongside the construct of the TOC, which was used as the theoretical framework for analysis and interpretation of results. The study involved the analysis of quantitative metrics of healthcare, including the rates of referrals and diagnosis, which were quantitative data obtained from a secondary source.

Key Study Variables

To elucidate the impact of increased usage of PEs, I used and examined several variables obtained from nationally reported data across time and location. The independent variable was the type of practitioner, while the dependent variables included patent diagnosis and referral rates. These variables collectively helped establish how the increased use of PEs affects the diagnosis and referral rates in the given healthcare facilities.

Data Source and Type

Data for the study came from NAMCS, which is a national survey created to provide credible data for the United States (NAMCS, 2016). The data in the NAMCS are from physicians directly in contact with patients in hospital emergency rooms, outpatient

facilities, and locations of ambulatory surgery (NAMCS, 2016). The data obtained from NAMCS may deliver critical insights into the number of PEs and the quality of service they produce.

I analyzed the data using quantitative techniques, with the primary methods consisting of both regression and correlation analysis. Hierarchical linear regression was the primary technique used in determining how the increased number of PEs affects both referral and diagnosis rates. As explained by Bernard (2017), Mellinger and Hanson (2016), and Brannen (2017), this type of analysis establishes a relationship between the chosen variables of interest. In this study, I determined if a correlation exists between the type of provider seen, such as Physicians, Physician Assistants, and Nurse Practitioners, and the outcome of that visit expressed as referral and diagnosis rates.

Literature Search Strategy

I conducted this literature search using the PubMed database and the Google Scholar search engine, accessed through the Walden University Library. The search terms were only English words, and sometimes these search terms were combined. The primary search term used was *physician Assistants or extenders*, combining with other keywords, such as *midlevel, practitioner, non-physician, referral rate,* and *diagnosis rate*. Other search terms used included *a nurse practitioner or NP, nurse or RN,* and *extended or advanced practice*.

To include the article in my review of the literature, it was required that the author discussed PEs or PAs, hospital referrals, and patient diagnosis. I kept the articles for

review if they discussed physicians and PEs. Articles were excluded if they were not found to meet the aforementioned inclusion criteria. The scope of the literature search in the databases chosen was limited to articles published between 2014 and 2018.

Literature Review: Key Variables and Concepts

Physician Shortage

In the recent past, the multimorbidity and prevalence of chronic diseases increased, especially with the aging population (Hing & Hsiao, 2015; Kahn et al., 2015; Ray et al., 2017). As a result, members of the federal government sought methods of increasing the acuity of care among the aging population (McDaniel, Hildebrandt, & Russell, 2016; Morgan et al., 2017). According to Liddy, Drosinis, and Keely (2016); Weinstock et al. (2016); and Liu et al. (2017), members of the government as well as other healthcare stakeholders have identified the existing gap demanding of critical care services and emergency services. Members of the government and stakeholders in the health sector conducted a study to assess the situation and determine the action plan needed to remedy the situation, discovering that there had been an acute shortage of physicians (Gudbranson, Glickman, & Emanuel, 2017; Kahn et al., 2015).

Members of the government and healthcare provider agencies tasked with the duty of forecasting the requirements identified the need to strengthen the existing workforce to mitigate the continued shortage (Gudbranson et al., 2017). They recommended that nurses and PEs be part of the care system (Meisenberg & Michtalik, 2016). Across the United States and the world at large, the same situation is being

replicated, where the leaders of major healthcare systems are experiencing a considerable shortage of physicians (Hing & Hsiao, 2015; Morgan et al., 2017; Ray et al., 2017). Many countries are suffering from an acute shortage of physicians (e.g., the healthcare situation in third-world countries is critical and calls for immediate action).

There is an acute shortage of healthcare facilities as well, delaying the healthcare providers making the diagnosis and referral of terminal illnesses (Hing & Hsiao, 2015; Kahn et al., 2015; McDaniel et al., 2016). Practitioners within healthcare facilities also suffer from insufficient equipment, small facilities caring for large populations, and poor management (Hing et al., 2015; Kahn et al., 2015; McDaniel et al., 2016). In second-world countries, the situation on the ground is equally as alarming, with practitioners struggling with insufficient medical care providers, lack of proper equipment, and inadequate medications (Drennan et al., 2015; Hooker & Muchow, 2015; Liu et al., 2017). Providers within medical care facilities are experiencing strain due to the increasing number of patients demanding healthcare services (Drennan et al., 2015; Hooker et al., 2015; Liu et al., 2017). Poor management of the facilities is identified as a problem likely resulting from inadequate funding by the national government.

Role of Physician Extenders (PEs)

From an empirical survey, Liddy et al. (2016) indicated that healthcare systems in many parts of the world are suffering from the ever-rising cost of operation as well as an insufficient physician population to meet demand. Other researchers who have argued that same include Van Such et al. (2017), Drennan et al. (2015), Tierney et al. (2017),

Weinstock et al. (2016), and Martinez-Gonzalez et al. (2015). These findings support the need for an increased physician pool or alternative measures to address the research problem. The use of PEs is a lasting cure wherein PEs step up and assist in filling the gap resulting from the physician shortage (Grabenkort et al., 2017; Lovink et al., 2017; Morgan et al., 2017; Ray et al., 2017). According to Tierney et al., Van Such et al., and Liu et al. (2017), the PEs help by extending the services the physicians could offer.

According to Goold et al. (2018), Mehta et al. (2018), Van Such et al. (2017), and Liddy et al. (2016), one of the critical roles of PEs is expanding the services that physicians would offer to patients. Yawn et al. (2016), Martinez-Gonzalez et al. (2015), and Weinstock et al. (2016) established that PEs play a vital role in relieving physicians from some activities while simultaneously increasing the revenues of healthcare facilities. This service expansion is possible only when the PEs are productive in their work (Grabenkort et al., 2017; Morgan et al., 2017). Tierney et al. (2017) also noted that through PE services, the satisfaction of patients has the potential to increase significantly.

According to Martinez-Gonzalez et al. (2015), patients in most places in the world are now more receptive to alternative healthcare providers because they receive faster treatment compared to when they are to be attended only by a physician. The increasing number of PEs have improved the service delivery in healthcare, especially concerning diagnosis time (Benson et al., 2016; Chao et al., 2017; Grabenkort et al., 2017). A physician working closely with PEs tends to warm up to the idea of turning less critical issues and care duties over to support staff (Benson et al., 2016; Berben et al., 2017;

Lovink et al., 2017; Solomon et al., 2015). Although in some states, PEs must work under the supervision of physicians, most develop autonomy due to the considerable amount of experience acquired over time and can work with minimal supervision; however, their work must always meet or exceed quality standards (Berben et al., 2017; Grabenkort et al., 2017; Solomon et al., 2015).

Past Studies

Yawn et al. (2016) indicated that most patients prefer to be seen by a doctor; however, when doctors are absent, some patients are happy to be seen to be PEs (Berben et al., 2017; Benson et al., 2016). Different opinions have been given in different polls on the perceptions of PEs and the extent they should be involved in healthcare delivery. Turf wars exist between midlevel providers (another term for PEs) and physicians considering that each has his or her professional reputation at stake (Chao et al., 2017; Lovink et al., 2017). Some of these conflicts are related the level at which each practice, while others are based on the terminology used to describe one another (Stanik-Hutt et al., 2013). Many midlevel practitioners and physicians have varying opinions regarding their roles in the healthcare spectrum.

The University of Phoenix College of Health Professional were surveyed to determine who among the healthcare providers has a significant role in managing patients (Knowles, 2018). From the investigation, 8 out of 10 registered healthcare providers believed that PEs account for anywhere between 82% and 87% of the management of patient care (Knowles, 2018). Given the ever-increasing demand in the healthcare

industry, PEs play a pivotal role in ensuring patients receive appropriate care. The PEs go the extra mile in providing the patient with full recovery and assisting in rebuilding their personal lives beyond the healthcare facility (Knowles, 2018)

According to Robeznieks (2013), the Association of American Medical Colleges conducted a poll where they established that patients welcome the role of PEs play in healthcare settings. In the survey, 50.4% of the patients interviewed confirmed they would prefer a PE the first time they visit a healthcare facility. Notably, when given the scenario of seeing a PE today for a worsening cough instead of a physician tomorrow, 59.6% of the respondents confirmed they would prefer the services of a PE (Robeznieks, 2013).

In another study, respondents were asked to give their opinion on the preparedness of the PEs seen, and the results showed that 74% of respondents felt PEs are moderately prepared, while 17% of the respondents held the opinion that they are incredibly prepared (Hooker et al., 2017). The respondents felt that the PEs are well rounded, well equipped with knowledge, and that their education is well structured (Hooker et al., 2017). PEs are, therefore, playing a significant role in alleviating the burden, not only in primary care, but also in surgical subspecialties (Grygotis, 2017). Mehta et al. (2018) showed that the increasing number of PEs reduced wait times in the emergency departments, which eventually leads to higher levels of patient satisfaction.

Methodological Approaches and Variables

In writing a literature review, a systematic review is conducted as part of a commonly used research methodology to ensure thorough evaluation for inclusion (Creswell & Creswell, 2017). Researchers, such as Mehta et al. (2018), Hooker and Muchow (2015), and Goold et al. (2018), used systematic review methodology to investigate their research problems. Using the systematic review methodology, Stange (2014) showed that the increased use of PEs significantly reduces the waiting time in hospital emergency departments. The author used four outcome measures or variables, including patient satisfaction, cost-effectiveness, wait times, and quality of care in their cross-sectional study.

In a study of whether generalist physicians met the increasing health demand and the aging population, Colwill, Cultice, and Kruse (2008) used ambulatory care visits as the variable measuring the workload, or the derived demand, using data provided by the NAMCS.

In another study, Petterson et al. (2015) used the prospective cohort study design to investigate a similar problem. They used the model to examine how PEs affect the expectations of various patients on medical tests, diagnosis, new medications, and referrals. Other researchers, such as Young et al. (2015) and Stange (2014), also used a prospective cohort to investigate the causal interaction between PEs and patients' medical expectations. The use of more PEs is systematically resulting in an increase in patients'

expectations by increasing the speed with which patients are being seen and the overall responsiveness of practitioners (Stange, 2014).

Many researchers (i.e., Xue et al., 2016; Morgan et al., 2016; Stange, 2014; Petterson et al., 2015; Young et al., 2015) have used quantitative methods to investigate a similar research problem. Schoenfeld et al. (2016) used quantitative methods to study the linkage between hospital-skilled PEs and nursing facility referral rates. In another study, Liu et al. (2017) used quantitative techniques to investigate whether PEs and midlevel providers have a significant impact on primary care. Quantitative methods are preferred because it is hard to argue with the results (i.e., the results speak for themselves; Bruni & Porta, 2016; Creswell & Creswell, 2017; Denker, 2017). Pruzan (2016) also asserted that quantitative methods make it easier to predict future outcomes.

Some researchers have also used Pearson chi-square statistics to test the association between the number or proportion of PEs and other variables of interest (Chao et al., 2017; Jiao et al., 2018; Solomon et al., 2015). For instance, Petterson et al. (2015) used the test to determine whether the association between PEs and patient expectations is significant; specifically, they focused on met and unmet expectations. Another researcher used the Wilcoxon rank test to compare the expectation and the median age of patients diagnosed by either physicians or PEs (McCunniff et al., 2017).

To compare the relationship between various variables understudy, many researchers have used Spearman's correlation coefficient (Hooker et al., 2016; Jiao et al., 2018; Kleinpell et al., 2015; Solomon et al., 2015). Young et al. (2015) used Spearman's

correlation technique to determine the comovement between the unmet expectation of the patients and the diagnosis rate. In another study, Petterson et al. (2015) used a similar technique to determine the correlation between diagnosis outcome and the professional qualification of the diagnosing attendant. Spearman's correlation is more suitable because it discovers both strength and direction of the association (Hooker et al., 2016; Hooker et al., 2017; Jiao et al., 2018). To determine the effects of physician assistants on the healthcare sector, Xue et al. (2016) used regression analysis. Various authors (i.e., Bryman, 2016; Nardi, 2018; Sekaran & Bougie, 2016) have strongly argued that regression is the best technique for determining the effect of a given variable on others.

Gaps in the Literature

A significant gap identified is the lack of empirical study, either longitudinal or cross-sectional, investigating the impact of the increasing number of PEs on the hospital referral rate and patient diagnosis rate. Most available past studies concentrated on discussing the general benefits of PEs in fulfilling the increasing demand of physicians in the population (Hooker, Brock, & Cook; 2016; Kleinpell et al., 2015; Jiao et al., 2018). Other researchers also discussed the educational qualifications of PEs and the required level of training (Buerhaus et al., 2015; Xue et al., 2017; Yeh et al., 2018).

Another essential gap identified is that past researchers do not attempt to establish a correlation between the number of PEs and hospital referral rate as well as between PEs and patient diagnosis rates. Many researchers such as Stange (2014), Gadbois et al.

(2015), and Morgan et al. (2016) discussed the variables independently without considering the real correlation and relationship.

Definitions

Diagnosis: is the process of examining the various signs and symptoms to identify the illness or disease that the patient has and therefore administering the appropriate treatment. Accurate diagnosis is key in maintaining the welfare of the patient. Therefore, the physician extenders should be able to conduct an accurate diagnosis (NAMCS, 2019).

Diagnosis rate: is a dependent variable, and it is the number of a patient diagnosed in each hospital divided by the total number estimated to have visited the facility (NAMCS, 2019).

Empirical**:** refers to something that is verified by experience and observations rather than pure logic (Penn State University Library, 2018).

Hospital**:** is defined for this study as a facility housing an office-based physician (NAMCS, 2019).

Hospital referral rate**:** is the number of patients referred to another physician or referred to the emergency department/admitted compared to the total number of patients seen by a given provider type. For this study, referrals to hospital and non-hospital-based physicians are included in the hospital referral rate (Roland et al., 1990).

A non-physician practitioner: is a healthcare provider not holding a medical doctorate or doctorate of osteopathic medicine. For the purpose of this study, non-physician extenders are limited to nurse practitioners and physician assistants (NAMCS, 2019).

A nurse practitioner (NP): is a licensed, autonomous clinician focused on managing people's health conditions and preventing disease (American Association of Nurse Practitioners, 2019).

A physician assistant: is a healthcare professional licensed, or credentialed, to practice medicine with physician supervision. (Department of Otolaryngology, 2018).

A physician extender: is a healthcare provider who can perform duties performed by a physician even though not a professional physician. The level of their training is not as advanced as that of physicians. Physician extenders are either nurse practitioners or physician assistants (Department of Otolaryngology, 2018).

Assumptions of the Study

An assumption is that the increasing number of PEs increases the patient diagnosis rate at every hospital facility. This assumption implies that the rising number of PEs significantly improves the diagnostic capacity of the hospital. This assumption is not stating that PEs are better or even equal diagnosticians when compared to physicians, but that the increased number of them by default increases the capacity for care/diagnostic capability of a facility. An assumption is that the hospital referral rate increases in a

parallel manner with an increasing number of PEs. Finally, the sample data is used as provided by NAMCS and assumed to be appropriate, that is, not too small nor too large.

Scope and Delimitations of the Study

The study's scope is limited to investigating the impact of the increasing number of PEs in hospital referral rates and patient diagnosis rate. This research problem is studied using secondary data retrieved from the NAMCS.

The delimitations of this study are established in that the empirical investigations and analysis focus on the three research questions specified in the above section. Other aspects were possible, however, the focus of the current study is limited to answering the three research questions, which are determining (a) the impact of increasing number of physician extenders on referral rate and patient diagnosis, and (b) changes in referral rates and diagnosis rate due to increasing use of PEs.

Another delimitation of the current study worth noting is that the analysis uses the methodological approach discussed herein namely correlation, regression, and hierarchical linear model. It is, however, a reality that other methodological approaches are possible. Therefore, the results are considered valid as to the extent of the methodology used in the empirical investigations.

Significance, Summary, and Conclusions

The study's significance is to establish the effect of increasing the ratio of PEs to physicians on the quality of care provided in hospitals. This study will enable the relevant stakeholders to take the appropriate actions to make healthcare affordable while

maintaining the same levels of quality. It may also open more employment opportunities in the healthcare sector resulting in economic growth.

This study is unique in that it explores not only the correlation between the use of PEs and diagnosis/referral rates but looks at this correlation as it relates to additional demographics such as facility size and location. The results from this study should aid the healthcare community in deciding the efficacy of increased PE use. Due to the decreased cost of physician extenders as compared to physicians, it is possible that this study may also have implications for access to care in certain communities. The study will fill the gap identified in the literature by providing up-to-date empirical evidence of the effects of PEs in referral and diagnosis rates. The next section provides a comprehensive discussion on the methodology chosen based on the result of the literature review presented above.

Section 2: Research Design and Data Collection

Introduction

In this section, I provide comprehensive details of the chosen research methodology, including a discussion of the research design, data collection, and methods of analysis. The purpose of this study was to determine how an increased number of PEs is affecting the rates of patient diagnosis and hospital referrals, which was assessed using quantitative techniques. The research problem and data were used to dictate the choice of methodology and analysis techniques.

The discussion is presented thematically under six main subtopics: (a) methodology, (b) data type and source, (c) sampling and sampling technique, (d) instrumentation and operationalization, (e) plan for data analysis, and (f) ethical procedures. The study variables are also stated and clearly defined in the section. I used the cross-sectional research design to answer the research questions.

Research Design and Rationale

The Research Design

I chose the cross-sectional research design to help determine the impact that PEs have on patient diagnosis and referral rates, which was the main objective of this study. This was possible, because, as discussed by Neumayer et al. (2017) and Bruni and Porta (2016), the cross-sectional design provides a snapshot of the characteristics associated with a given research phenomenon but at a specific point in time. The cross-sectional design also enabled me to investigate the impact of PEs within their natural environment

without alterations. This research design was suitable for the problem investigated because it enabled me to investigate the existing differences between the subjects or variables, which were mainly patient diagnosis rates and hospital referral rates (see Creswell & Creswell, 2017; Smith, 2015).

The cross-sectional design helped establish existing relationships between hospital referral rates, patient diagnosis rates, and the increasing number of PEs. This design was appropriate for this study because the focus of the design is to establish the existing relationship between various variables of choice (Bernard, 2017; Bryman, 2017). Variables for this study were also purposely selected to meet the prespecified objectives (see Brannen, 2017; Creswell & Creswell, 2017). Another reason the cross-sectional design was suitable for this study was that it can estimate the prevalence rate of the outcome of various measures.

The design was not associated with any time constraints given that the data were collected once at a specific point in time. However, the cross-sectional design requires a large volume of data that might have create some resource constraints if the amount of money needed to complete the collection of data is high. Nonetheless, the impact of the resource constraint was not significant in this study because I used secondary data downloaded directly from NAMCS website.

My choice of the cross-sectional design helped advance knowledge in the healthcare administration discipline. The results of this study enable researchers to investigate and provide additional and up-to-date empirical evidence on the impact and

usefulness of PEs in the healthcare sector. Several researchers in the healthcare administration discipline, such as Colwill et al. (2008), Schoenfeld et al. (2016), Weinstock et al. (2016), and Liddy et al. (2016), among others, have also used the cross-sectional research design.

Study Design

In this study, I used the cross-sectional design method to compare the difference in diagnosis and referral rates between physicians and PEs based on the data provided from the 2016 NAMCS. This cross-sectional study established whether a statistically significant difference exists between these two rates and the type of provider patients see in an effort to establish if increasing the use of PEs has an impact on quality of care.

Methodology

Data Type and Source

This section includes information on the data obtained from the 2016 NAMCS, including the format, key variables, and population information. I used this information to formulate the methodology of the analysis conducted for this study.

Data type. In this study, I used secondary data (i.e., data in numerical form) for quantitative analysis because of its suitability to the research design, the preferred method of analysis, and the availability of the data. These numerical data were obtained from the 2016 NAMCS in IBM Statistics Software (SPSS) form with key variables extrapolated out and analyzed, including patient diagnosis rate, provider seen, and visit disposition.

According to Brannen (2017) and Denker (2017), this type of data enables the research objective and can be quantified using statistical means.

Data source. For all the variables under consideration, the quantitative data required were retrieved directly from the NAMCS website. I chose NAMCS to provide the secondary data required for analysis because it has data compiled from a national survey based on findings from sample ambulatory medical care visits by various patients to office-based physicians in the United States. NAMCS was able to provide the entire data set needed for all the variables.

The ambulatory healthcare data were provided by the National Center for Health Statistics (NCHS), which is the leading principal agency for providing healthcare statistical information in the United States (Centers for Disease Control and Prevention, 2019). It is responsible for providing information for guiding actions and policies created for improving citizens' health positions (Centers for Disease Control and Prevention, 2019). Sample visits to healthcare facilities and physicians who are office based and not directly employed by the federal or state government but provide direct health services to patients provided the data for this study.

Research Variables

Bruni and Porta (2016) and Pruzan (2016) explained that variables are the main objects or units that research studies measure to provide empirical evidence. There are two types of variables: dependent and independent (Bernard, 2017). The former is the one believed to be affecting the latter (Bernard, 2017). For this study, the independent

variables were the number of PEs and type of practitioner (i.e., physician, NP, or PA). The dependent variables were patient diagnosis and hospital referral rates.

This study also included some covariates, which are essentially variables that have a direct relationship with the dependent variable (see Bryman, 2016; Sekaran & Bougie, 2016). A covariate is a predictive variable that influences the dependent variable (Bryman, 2016). For this study, the covariates were major reason for visit, providers seen (i.e., Medical Doctor, Doctor of Osteopathic Medicine, PA, and NP), and visit disposition. The covariates were used to increase the understanding of the relationship between the dependent variables and the independent variable through a ANCOVA to evaluate the difference of means.

Target Population

Pruzan (2016) defined the target population in a study as a collection of the individuals that are directly affected by the phenomenon. According to Mellinger and Hanson (2016), Bruni and Porta (2016), and Pruzan, the primary goal of any empirical study is to benefit the target population. In essence, data to be analyzed should come from the target population in its entirety but that might not be possible due to challenges of limited time and resources for collecting the data (Bryman, 2016; Nardi, 2018; Sekaran & Bougie, 2016). For this study, the research population consisted of patients who received care in office-based facilities via ambulatory medical visits in the United States in 2016.

Due to the challenges of collecting data from the entire population, NAMCS used samples to provide the needed data. The organization could not collect data on every hospital visit and PE from the entire population of ambulatory services in the United States. Collecting data from the entire population would also be costly and time consuming (Sekaran & Bougie, 2016; Smith, 2015). Therefore, as explained by Pruzan (2016), a sample was used to represent the entire population.

According to Teater et al. (2016), Mellinger and Hanson (2016), and Bruni and Porta (2016), a population sample is the subset of the target population that is selected to participate in the study by providing the required information. In essence, it consists of the individuals of the target population that are directly involved in the study because the entire population cannot be engaged (Brannen, 2017; Bryman, 2016). The role of the sample population is to provide the researcher with a manageable and representative subset of the population to aid data collection.

For the data collected by NAMCS, the sample population consisted of only patients visiting various ambulatory services in the United States who were attended by office-based physicians not employed directly by the federal state. The sample was collected from the entire nation. Such sample populations have similar characteristics as required for a good research study (Bryman, 2016; Sekaran & Bougie, 2016). The data were collected from various departments of ambulatory care services in the country, such as outpatient departments and emergency departments, among others.

Sampling and Sampling Procedures Used in Secondary Data

According to Pruzan (2016), a sample is a section or subset of the target population, and its purpose is to provide the data needed on behalf of the entire population by representing it. According to Mellinger and Hanson (2016) and Bruni and Porta (2016), a sampling strategy is a plan that the researcher adopts for selecting the appropriate composition and size of the sample from the target population to represent it in the data collection process.

The general procedures used by NAMCS to draw the sample consisted of five stages (Center for Disease Control and Prevention, 2019). The target population was first identified, which was the ambulatory services in the United States. After identifying the target population, the second step was to select the accessible population that can provide the samples. After that, they stated the eligibility or inclusion and exclusion criteria for the sample. In the fourth stage, NAMCS outlined the appropriate sampling plan they intended to use. The final step in the procedure involved the recruitment of the sample to participate in the study.

NAMCS used a general sampling plan with a three-stage, stratified, cluster sampling design (Center for Disease Control and Prevention, 2019). The first stage clustered the target population into counties, parishes, or independent cities to form the primary sampling unit. Each sample unit was then selected using probability proportional to the total size of the target population. In the second stage, ambulatory services from each sample unit were selected using probability inversely proportional to the total

physicians in each sample unit. A constraint was also placed to ensure that the product of the probabilities in the first and second stage was constant. The third stage involved the researchers visiting the physician offices within the ambulatory medical care centers to collect the data using the designed research instrument. The physicians were selected as determined by the number of patients they expected to see during a randomly selected day of the week. The sampling frame used yielded approximately 30 patients per physician.

NAMCS used simple random sampling strategy to select the appropriate patients to participate (Center for Disease Control and Prevention, 2019). In the simple random sampling strategy, a group of the subject for the study or sample is selected from the target population entirely by chance with equal probability (Mellinger & Hanson, 2016; Neumayer et al., 2017). According to Bernard (2017), Denker (2017), and Teater et al. (2016), the strategy is meant to provide an unbiased representation of the target population, which makes it a fair way of selecting samples. The strategy is also advantageous because it is easy to use and most suitable for selecting samples from large populations.

Sampling Strategy and Procedure Used

This section includes a review the methods of sampling and the procedures followed in this study to ensure appropriate sample restrictions without compromising the validity of the study. As explained by Brixey et al. (2016) and Neumayer et al. (2017),

before sampling, members of the research population achieve selection by constructing an appropriate sampling frame.

Sampling frame. The sample data used in this study is from the 2016 NAMCS dataset. In the NAMCS study, the sampling frame consisted of physicians listed in the master files of the American Osteopathic Association (AOA) and the American Medical Association (AMA) who were licensed and engaged in the office-based practice, this same general population will be used for the purposes of this study.

For the exclusion criteria, data from visits to specialists in pathology, anesthesiology, forensic pathology, radiology, as well as clinical pathology will be excluded as the focus for this study focus on physicians, PAs, and NPs. Also, additional data about the patients will be excluded including patient demographic information in order to limit the focus to readmission and referral rates. The last exclusion criteria are data from patients who visited non-office-based practicing physicians. No exclusion criteria will be based on the characteristics of patients but rather the type of practitioner.

Accessing the data set. A simple procedure will be employed to gain access to NAMCS data. The data was secondary data online; therefore, I only needed to access the website and download the appropriate file containing the required data. The NAMCS data sets are in user-friendly downloadable data files available free of charge on the website; that is, anybody can access the site and download the data required. The data comes in self-extracting compressed data files; thus after downloading the file, the data extraction is complete. To access the data, I visited the website and downloaded the 2016

survey data saved in the SPSS format. Because NAMCS provides their survey data freely, there was no need for me to seek permission before accessing the website and downloading the data.

Power analysis. As explained by McBride (2016) and Kraemer and Blasey (2016), power analysis is a mechanism for determining the appropriate sample size. According to McBride and Davey and Savla (2010), using too large sample requires lots of resources, time and efforts, which often leads to wastage and is unethical. However, it provides adequate data or information, which improves the reliability of the results. On the contrary, using too small sample even though it saves resources, time and efforts, produce unreliable data for testing the hypotheses, which is undesirable as it might lead to biased results (Card, 2016; McBride, 2016). In such a case, the research may lack power and miss important responses that could improve the results of the investigation leading to serious consequences.

Based on the secondary data provided by NAMCS, the sample size for the 2016 data, which is the lowest response year used, will consist of 13,165 observations, which is considered adequate for the study based on a comparison conducted by the NAMCS between over 30 tables of 2016 estimates and 2015 estimates (NAMCS, 2016). The observations translate to 13,165 patients who visited the ambulatory medical care services. However, considering that the target population consisted of all ambulatory services in the United States of America, the sample is small.

Instrumentation and Operationalization of Constructs

To complete the survey, NAMCS used a secondary questionnaire that was designed by the University of Chicago's National Opinion Research Center program. They developed the questionnaire in 1973, but several modifications were made since then. The key individuals responsible for the development of the survey instrument include Benjamin King, Dwight Brock, Martin Frankel, and Earl Bryant, all from the University of Chicago and NCHS. Both the University of Chicago through the National Opinion Research Center program and NCHS permitted NAMCS to use their survey instrument for collecting the required data.

Even though the survey instrument has been used several times by NAMCS in the same population, no measure of its reliability and validity is available. The literature accessed contains no information about its validity and reliability. Since it is repeated in the same population, researchers assume the survey instrument to meet the required level of validity and reliability.

Operationalization

This section contains an explanation of the variables from the NAMCS that were utilized in this study and provides operational definitions. An explanation for the measurement of each variable is explained.

Reason for visit. This variable is the major reason why the patient visited the ambulatory care service center. In essence, it determined the cause of the patient visit to the healthcare facility as stated by the data form. The reasons for visits are grouped into

several categories namely unintentional injury/ poisoning, intentional injury/poisoning, injury/poisoning with unknown intent, adverse effects of medicine/surgery care, and no injury.

Patient diagnosis rate. This variable is the rate at which the physician or PEs diagnosed patients who visited the facility. The NAMCS allows for up to five different diagnosis codes to be entered, with each being identified as either not applicable, probable/questionable/rule-out, or not probable/questionable/rule-out. The researcher will test to see if the number of diagnosis codes entered as probable/questionable/rule-out by physicians is significantly different than the number of diagnosis codes entered as probable/questionable/rule-out by PEs using an ANVOCA.

Provider seen. This variable indicated the type of diagnosis provider seen by the patients, which may be the physician, PA, or NP/midwife.

Visit disposition. This variable is the events or arrangements that end the patient's encounter with the medical provider such as physician and PEs. In this study, visit disposition is classified as return to referring physician, refer to other physician, return to this provider, refer to emergency department, or other.

Data Analysis Plan

This section contains an explanation as to how the software was used to complete this study as well as review the data parsing procedures conducted by researchers. I reiterated the research questions as well as indicate the analysis.

Software to be Used

The analysis of the quantitative data collected used SPSS software, which was used in the past by several researchers to investigate similar or related problems (Bryman, 2016; Smith, 2015). As explained by Mellinger and Hanson (2016), the software includes some basic statistical analysis techniques such as descriptive, bivariate, the prediction for outcomes, as well as simulation and geospatial analysis which makes it more suitable for a researcher in health sciences. Previously, it enabled researchers to develop various models such as regression as well as perform multiple statistical tests such as ANOVA, nonparametric tests, correlation, *t* test, and Bayesian. In this study, I used the software to conduct an analysis of covariance to evaluate the difference of means of the dependent variables across categorical independent variables as a method to compare the differences in diagnosis and referral rates between the types of provider seen and establish if there is or is not a statistical significance therein. This test allows for the control of the effects of other continuous variables that are not of primary interest.

Data Cleaning and Screening Procedure

For this study, the data cleaning was conducted by the NAMCS prior to publication. I parsed the previously cleansed data to remove variables not being analyzed, only leaving type of practitioner seen, probability of Diagnosis 1 through 5, and referral/return data.

Research Questions and Hypotheses

RQ1: Based on the type of practitioner treating a patient (including physician, nurse practitioner, and PA), to what extent do they differ in the diagnosis rate and hospital referral rate as it relates to the type of practitioner?

$H_0$1: The rate of diagnosis versus the rate of hospital referral has no significant difference based on the type of practitioner seen.

$H_1$1: The rate of diagnosis versus the rate of hospital referral has a significant difference based on the type of practitioner seen.

RQ2: To what extent does the diagnosis rate change with the use of PEs (including nurse practitioners and PAs) as compared to physicians?

$H_0$2: The rate of diagnosis between PEs and physicians has no significant change.

$H_1$2: The rate of diagnosis between PEs and physicians has a significant change.

RQ3: To what extent does the hospital referral rate change with the use of PEs (including nurse practitioners and PAs) as compared to physicians?

$H_0$3: The rate of hospital referral between PEs and physicians has no significant change.

$H_1$3: The rate of hospital referral between PEs and physicians has a significant change.

Statistical Tests to be Used

Sample *t* tests will be used to test the above hypotheses in this study. A standard comparison method for comparing referral and diagnosis rates between physician and PE providers was conducted. These rates will be calculated using SPSS and Microsoft Excel and then, compared side-by-side and percentage differences are calculated for the purpose of discussion and evaluation.

Threats to Validity

Threats to external validity

Given the use of secondary data in this study, a threat to validity is the responsiveness of providers. This survey used a stratified two-stage sample selecting physicians in the first stage and visits in the second, all of which were selected from the master files maintained by the *American Medical Association* and *American Osteopathic Association* (NACMS, 2016). This sampling does not in and of itself ensure that all physicians and physicians across the United States are included, it does however constitute a logical representation. Due to changes in the NACMS survey method between 2015 and 2016 only the 2016 data was used, which reduces the overall sample size, thereby threatening validity by potentially reducing representation.

Ethical Procedures

This data was from an open source government funded survey conducted by the *National Center for Health Statistics* causing no ethical concerns. Data cleaning was done prior to open source publication to ensure that individual patient identifiers were

published. No ethical concerns are noted to related to recruitment materials and processes as the data were secondary and open source. The Walden University IRB approval number for this study is 11-11-19-0657387.

Summary

The methods and procedures of this study were described in this section including sampling size, analysis plan, and threats to validity for the study. The study is based on the most recent NAMCS (2016) data provided through the NCHS. The results and findings of this study will be interpreted in the following chapter in the results and findings section.

Section 3: Presentation of Results and Findings

Introduction

The purpose of this research study was to evaluate the quality of care provided by PEs through the examination of diagnosis and referral rates that may inform healthcare leaders and policymakers in future policy and staffing decisions. The following research questions and corresponding hypotheses guided this study:

RQ1: Based on the type of practitioner treating a patient (including physicians, NPs, and PAs), to what extent do they differ in the diagnosis rate and hospital referral rate as it relates to the type of practitioner?

$H_0$1: The rate of diagnosis versus the rate of hospital referral has no significant difference based on the type of practitioner seen.

$H_1$1: The rate of diagnosis versus the rate of hospital referral has a significant difference based on the type of practitioner seen.

RQ2: To what extent does the diagnosis rate change with the use of PEs (including NPs and PAs) as compared to physicians?

$H_0$2: The rate of diagnosis between PEs and physicians has no significant change.

$H_1$2: The rate of diagnosis between PEs and physicians has a significant change.

RQ3: To what extent does the hospital referral rate change with the use of PEs (including NPs and PAs) as compared to physicians?

$H_0$3: The rate of hospital referral between PEs and physicians has no significant change.

$H_1$3: The rate of hospital referral between PEs and physicians has a significant change.

The decision to either reject the null hypothesis or fail to reject the null hypothesis was based on the statistical significance of the difference of means between the rates by practitioner type.

Section 3 contains the data set selected and a presentation of the results and the significant differences that occurred from the analysis plan presented in Section 2. In this section, I will also provide the descriptive statistics of the sample used in this study. The results of this study are presented to explain the primary conclusions as well as the statistical tests used to evaluate each research question.

Data Collection of the Secondary Data Set

The timeframe for data collection was 1 calendar year because these data were from the most recent data set provided using the newest NAMCS design. The response rate for the 2016 NAMCS sample was 46.0%; however, only 39.3% (i.e., 677 physicians) provided data for at least one sampled visit and, therefore, are the only ones included in the dataset (NACMS, 2016). This response rate is significantly higher than the 29.5% response rate from 2015 using a different collection method.

There were no discrepancies in the use of the secondary data set from the plan previously presented in Section 2. The baseline descriptive and demographic

characteristics of the sample included office-based or hospital-employed providers principally engaged in patient care; not federally employed; not in the specialties of anesthesiology, pathology, or radiology; and younger than the age of 85 years old (NAMCS, 2016). The sample is considered representative of the census regions as well as 15 broad physician specialty groups based on the 2080 in-scope (i.e., eligible) providers as 46.0% of groups polled responded as compared to 29.5% response rate from the previous year (NACMS, 2016)**.** The NAMCS (2016) adjusted the data to account for nonresponse bias by adjusting all estimates to account for 242 physicians whose eligibility remained unknown upon completion of the collection. The data set also took into account patient visit weights, which allowed for the 13,165 sample records to be used to reflect the estimated 883,725,126 visits in the United States in 2016 (NAMCS, 2016).

Results

The descriptive statistics from the data on the type of practitioner seen as well as the numbers and types of referrals and diagnosis per type are represented in Tables 1 and Table 2. The method in which these results were collected in 2016 changed from previous years to no longer target varying numbers of states but instead utilizing a stratified, two-stage sample with providers selected in the first stage and visits selected in the second stage (NAMCS, 2016). These changes affected the response rate and, therefore, restricted the current analysis to the most recent data set only including the calendar year 2016.

Table 1

Descriptive Statistics: Referral

Practitioner Seen	Referred to to other Physician	Referred to ER	Total Referred	Total Seen By Practioner
Physician	859	43	902	12911
PA	180	3	183	556
NP	24	0	24	214
Extenders Combined	204	3	207	770

Table 2

Descriptive Statistics: Diagnosis

Practitioner Seen	Total Diagnosis Probably/Ques/Rule Out	Total Seen By Practioner
Physician	126	12911
PA	77	556
NP	10	214
Extenders Combined	87	770

Table 1 indicates the number of patients seen by each practitioner type and, of that total number of patients, how many were referred to other physicians, how many were referred to the emergency room, and the total number referred. These numbers indicate that physicians have an overall average referral rate of 7% as compared to a 33% referral rate for PAs and 11% for NPs, resulting in an overall referral rate of 27% for PEs. Table 2 shows the total number of patients seen by each practitioner type as well as the total number of patients receiving a diagnosis from the given practitioner type. In Table 2, the total number of diagnoses given was calculated by combining the Diagnosis 1–Diagnosis 4 categories of the survey. These rates were analyzed to find that the average patient diagnosis rate for physicians is 1%, while PAs have an average diagnosis rate of 14% and NPs an average of 5% for a combined average diagnosis rate of 11% for PEs.

Table 3 shows the age ranges of each of the patients seen as part of this study. As suspected, a majority of the patients fall within the age range of 45–64 years old. This finding is consistent with the data compiled through the literature review, which indicated an increasingly aging population due to the balloon effect of the baby boomer generation. In Figure 1, the data are provided in graphical form with a trend line curve overlaid that also indicates the gaining population.

Table 3

Patient Age Ranges

Patient Age Ranges	# of Patients Seen
Under 15 Years	1515
15-24 Years	901
25-44 Years	2390
45-64 Years	3910
65-74 Years	2373
75 Years and over	2076

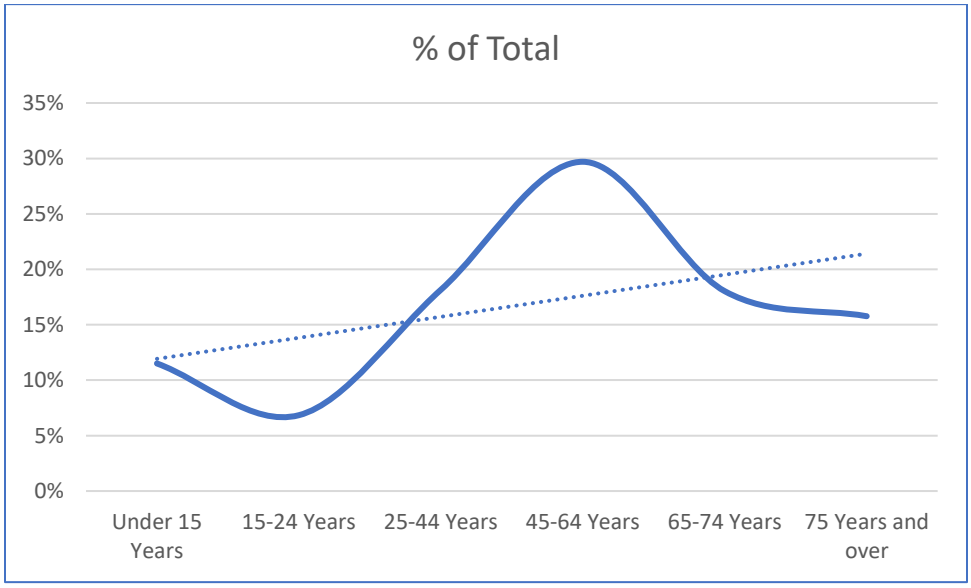

Figure 1. Patient age ranges.

Table 4 indicates the number of individual patients who self-identified their race/ethnicity. Patients were identified as 1 of 4 categories: White only, Black only, Hispanic, or Multiracial. Beginning in 2009, the NAMCS (2016) began allowing Hispanic patients to identify as any race. Depicted in Figure 2 are the ethnicity distributions that indicate an underserved minority population. Based on the 2010 U.S. Census, the racial distribution of this study had approximately 10% more White only patients seen and approximately 3.3% less of each other ethnicity than the true distribution of the U.S. population (U.S. Census Bureau, 2010). The data trend shown in Table 4 could point to an access to care issue but would require additional study to confirm.

Table 4

Race/Ethnicity

Race/Ethnicity	# of Patients Seen
White Only	9602
Black Only	1194
Hispanic	1744
Other Race/Multiple Race	625

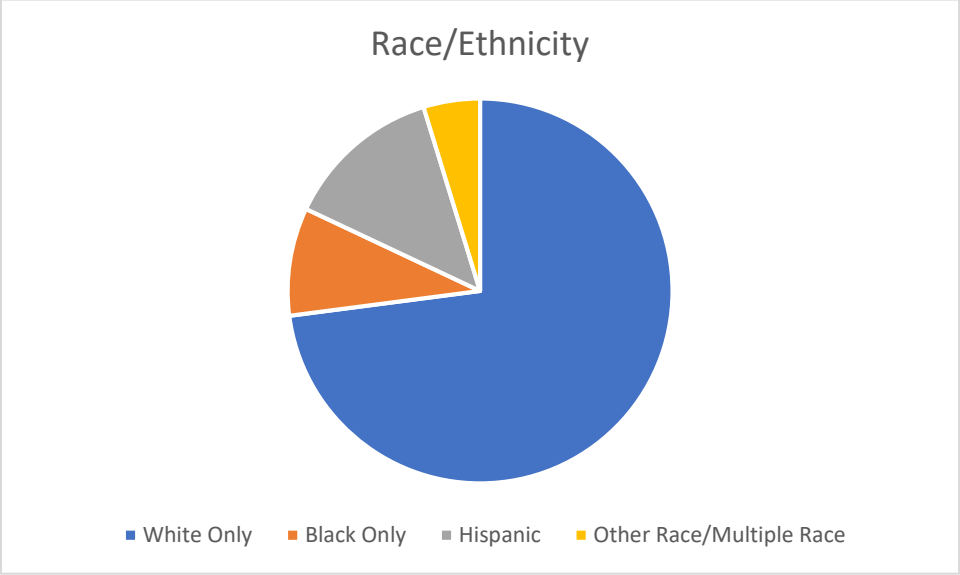

Figure 2. Race/ethnicity.

Table 5 displays the results of a Pearson Correlation analysis between the variables studied and the type of practitioner seen. Through this analysis, it is evident that there is a statistically significant positive correlation between the patient referral rates and patient diagnosis rates for physicians, and while both PAs and NPs have statistically significant positive correlations for patient referral rates, the patient diagnosis rates have an insignificant positive correlation of 0.018 for PAs and an insignificant negative correlation of -0.005 for NPs. The TOC postulates that every system has at least one constraint. In this study, the negative correlation, even though insignificant, between diagnosis rate and NPs as providers may indicate that these NPs provide a definitive, rule out, or theoretical diagnosis less frequently than physicians and PAs.

Table 5

Correlations

		Physician seen	Physician assistant seen	Nurse practitioner/midwife seen	Average Referral Values	Average Diagnosis Values
Physician seen	Pearson Correlation	1	-.102**	-.192**	0.015	0.042
	Sig. (2-tailed)		0.000	0.000	0.185	0.000
	N	13165	13165	13165	13165.000	13165
Physician assistant seen	Pearson Correlation	-.102**	1	-.027**	0.113	0.018
	Sig. (2-tailed)	0.000		0.002	0.184	0.050
	N	13165	13165	13165	13165.000	13165
Nurse practitioner/midwife seen	Pearson Correlation	-.192**	-.027**	1	0.008	-0.005
	Sig. (2-tailed)	0.000	0.002		0.202	0.543
	N	13165	13165	13165	13165.000	13165

The statistical assumptions appropriate to this study are that variances are homogeneous and that each sample is randomly selected and independent. The statistical analysis findings organized by practitioner type indicated that there was an overall decrease in referral rate by physicians as compared to PEs in 2016 but also an overall decrease in diagnosis rate by physicians as compared to PEs in 2016.

Research Question 1

$H_1$1 was the supported hypothesis with a 26% increase in referral rates by PAs as compared to physicians and a 4% increase in referral rates by NPs as compared to physicians. As well as a statistically significant positive correlation between physicians and patient diagnosis and referral rates and a lack of significant correlation between these rates and PEs being seen. The TOC postulates that every system has at least one constraint. In this study, the negative correlation, even though insignificant, between diagnosis rate and NPs as providers may indicate that these PEs provide a definitive, rule out, or theoretical diagnosis less frequently thank physicians and PAs.

Research Question 2

$H_1$2 was the supported hypothesis with an overall 10% increase in diagnosis rates provided by PEs as compared to physicians. $H_1$2 is also supported by the statistically significant positive correlation between diagnosis rate and physicians and lack of statistically significant correlation between diagnosis rate and PEs.

Research Question 3

$H_1$3 was the supported hypothesis, given a statistically significant positive correlation between all providers and referral rates. The TOC indicates that each system has at least one constraint. In this study, the data indicating that a statistically significant positive correlation exists between all providers and patient referral rates allows for the use of PEs to be eliminated as a possible constraint to quality of care. The use of the TOC as a framework for assessing this data provides implications that quality of care can be sustained of not increased with the increased use of PEs and therefore improving the overall access to care.

Figures 3 and 4 represent the percentage of patients seen that were either referred and diagnosed respectively. Both figures illustrate that the percentage of patients referred and diagnosed by PAs are greater than the percentage referred or diagnosed by either NPs or physicians. As shown in Table 5, the data indicating that a statistically significant positive correlation exists between all providers and patient referral rates which with an increase in diagnosis and referral rate as depicted in Figures 3 and 4, indicate that the quality of care is likely to increase with increased use of PEs.

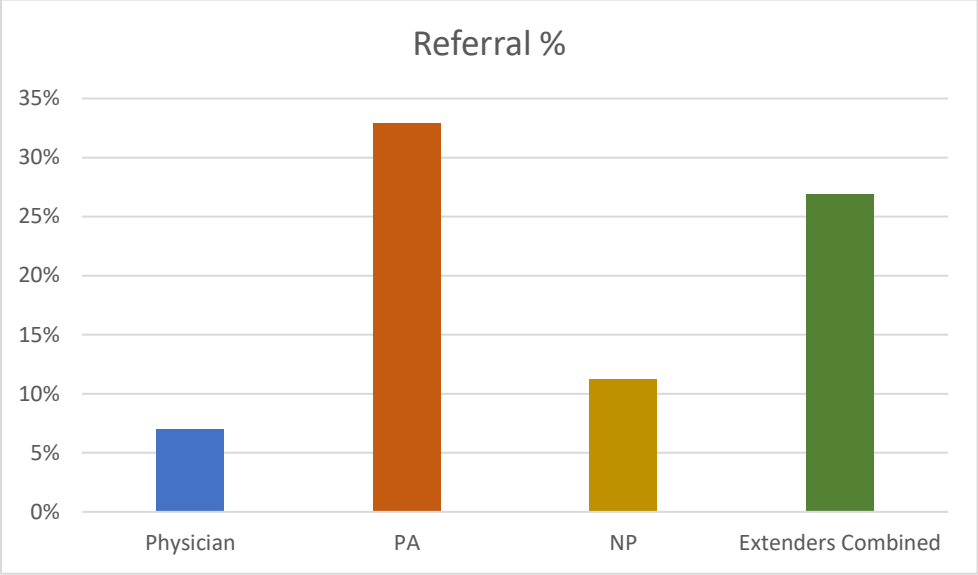

Figure 3. Referral %.

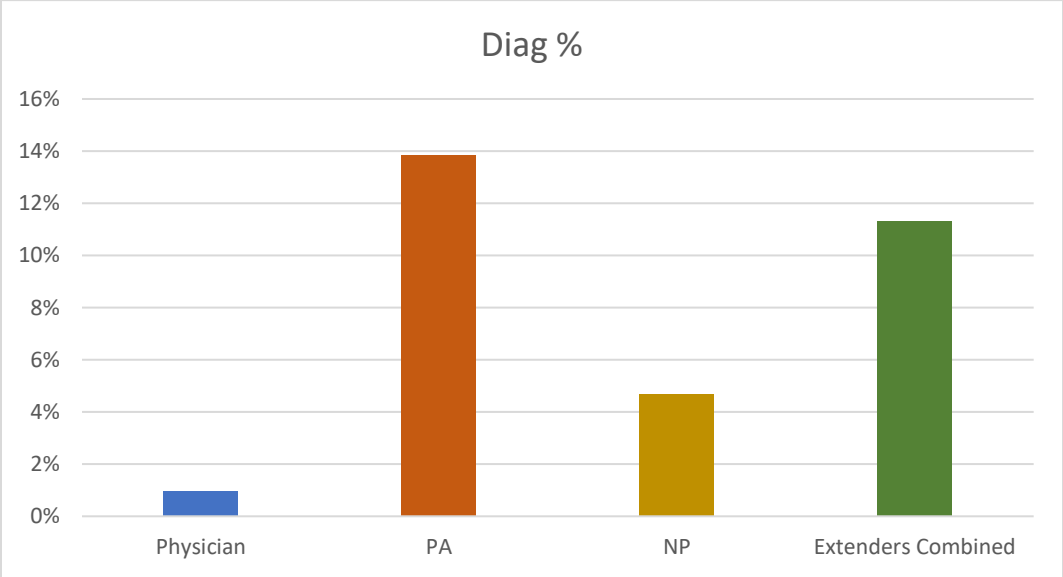

Figure 4. Diag %.

Summary

The methods and procedures described in this section culminate in the results of the study on the quality of care provided by PEs through the examination of diagnosis

and referral rates. In reference to RQ1, $H_1$1 was the supported hypothesis with a 26% increase in referral rates by PAs as compared to physicians and a 4% increase in referral rates by NPs as compared to physicians as well as a statistically significant positive correlation between physicians and patient diagnosis and referral rates and a lack of significant correlation between these rates and PEs being seen In reference to RQ2, $H_1$2 was the supported hypothesis with an overall 10% increase in diagnosis rates provided by PEs as compared to physicians and by the statistically significant positive correlation between diagnosis rate and physicians and lack of statistically significant correlation between diagnosis rate and PEs. Finally, in reference to RQ3, $H_1$3 was the supported hypothesis, given a statistically significant positive correlation between all providers and referral rates. The findings of the study indicate an overall decrease in diagnosis rates by physicians as compared to PEs while all provider types consistently have a positive correlation as it relates to patient diagnosis and a general reduction in referral rates by physicians as compared to PEs with a lack of statistically significant correlation. The decline in average referral rates and average diagnosis rates between physicians and NPs was only 4% each, while the difference between physicians and PAs was 26% and 13%, respectively. The application for professional practice, as well as the implications for social change, will be represented in Section 4.

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

Introduction

The purpose of this research study was to evaluate the quality of care provided by PEs through the examination of diagnosis and referral rates. The findings may be used to inform healthcare leaders and policymakers in future policy and staffing decisions.

Interpretation of the Findings

The decrease in average referral rates by physicians does not directly correlate with an increase in diagnosis rates; the opposite holds based on the results of this study. While the average referral rate is lower for physicians than PEs, the average diagnosis rate is also lower. The lower average for physicians may be indicative of the type of cases being managed by physicians versus PEs but is more likely to be the result of a variety of factors. The fact that NPs produce an average referral and average diagnosis rate consistently more in line with that of physicians may indicate that their scope of practice is more in line with that of a physician as compared to that of the PAs reviewed in this study. Due to the lack of studies evaluating the efficacy of PEs based on the quality of care metrics, such as average diagnosis and referral rates, there is little comparison that can be made between the findings of this study and previous works.

Limitations of the Study

There were limitations due to the overall variance of state legislative differences for the practitioners' data evaluated in this study. In many states, NPs are given considerably more latitude than PAs and, therefore, are able to practice more

independently in much the same way as physicians. Limitations may also have been encountered due to individual practice location policies, including the nature of cases each level of practitioner is assigned to see. Finally, the lack of control over the providers who participated in the study could have also been a limitation.

Recommendations

My recommendations for further research are based on the strengths and limitations of this study as well as additional literature reviewed. I recommend that research be conducted to assess the quality of care using diagnosis and referral rates as metrics by individual state to evaluate the impact that legislative differences have on these metrics.

Professional Practice

Based on the results of this study, my recommendations for professional practice include continuing to expand the use of PAs and NPs to aid in bridging access-to-care gaps. Based on the higher average diagnosis rate for PAs, recruitment of these practitioners to oversee and manage outpatient facilities may be warranted.

Positive Social Change

With access to care being a continued concern and both PAs and NPs demonstrating an increased average diagnosis rate as compared to physicians and with the average cost of employment for PEs being lower than that of physicians it stands to reason to increase the use of PEs to bridge this gap. One possible method for accomplishing this would be to expand the use of regional or hub facilities managed and

run by these PEs where it would be possible to provide essential medical services for acute care patients. Healthcare leaders and policymakers should consider providing satellite facilities to currently underserved regions through placing such facilities in strategic locations and providing patients with transportation to and from. Due to a potential lower overhead cost and an increase in average diagnosis rate, it is possible these clinics could reduce the number of patients lacking care as well as decrease the overall cost of patients seeking care in inappropriate ways, such as unnecessary emergency room visits.

Conclusion

In this study, I evaluated the quality of care provided by PEs through an examination of diagnosis and referral rates to inform healthcare leaders and policymakers in future policy and staffing decisions. The quality of care provided by PEs is different in statistically significant way from that provided by physicians based on the metrics assessed; however, with an increase in diagnosis rate, this quality of care is likely to increase and should be leveraged to improve the care provided and financial well-being of our industry.

References

Aguilar-Escobar, V. G., & Garrido-Vega, P. (2016). Applying the theory of constraints to the logistics service of medical records of a hospital. *European Research on Management and Business Economics*, *22*(3), 139-146.

Almeida, G. V. D., Souza, F. B. D., Baptista, H. R., Gupta, M. C., & Campos, R. D. (2018). Fundamental principles of the Toyota Way and the theory of constraints: Comparative analysis and synthesis. *International Journal of Services and Operations Management*, *30*(1), 51-71.

Centers for Disease Control and Prevention. (2019, December 2). Ambulatory health care data. Retrieved from https://www.cdc.gov/nchs/ahcd/ahcd_survey_instruments.htm

American Association of Nurse Practitioners. (2019, September 20). *All about NPs.* Retrieved from https://www.aanp.org/about/all-about-nps

Association of American Medical Colleges. (2018, April 11). *New research shows increasing physician shortages in both primary and specialty care* [Press release]. Retrieved from https://news.aamc.org/press-releases/article/workforce_report_shortage_04112018/

Bakhai, S. Y., Nigam, M., Saeed, M., Krishnan, A., & Reynolds, J. L. (2017). Improving OSA screening and diagnosis in patients with hypertension in an academic safety net primary care clinic: Quality improvement project. *Brisish Medical Journal Open Quality*, *6*(2), e000105.

Benson, M. A., Peterson, T., Salazar, L., Morris, W., Hall, R., Howlett, B., & Phelps, P. (2016). Burnout in rural physician assistants: An initial study. *The Journal of Physician Assistant Education*, *27*(2), 81-83.

Berben, S., Bloemhoff, A., Schoonhoven, L., de Kreek, A., van Grunsven, P., & Laurant, M. (2017). The difference between physician assistants and ambulance nurses as solo emergency care providers in EMS, a cross sectional study. *The Journal of Human Pharmacology and Drug Therapy*, *38*(4), 417-427.

Bernard, H. R. (2017). *Research methods in anthropology: Qualitative and quantitative approaches*. Lanham, MD: Rowman & Littlefield.

Bonewit-West, K., Hunt, S. A., & Applegate, E. J. (2016). *Today's medical assistant: Clinical & administrative procedures*. St. Louis, MO: Elsevier.

Brannen, J. (2017). *Mixing methods: Qualitative and quantitative research*. London, England: Routledge.

Brim, O. (2017). *The economic theory of representative government*. New York, NY: Routledge.

Brixey, J. J., Brixey, J. E., Saba, V. K., & McCormick, K. A. (2016). *Essentials of nursing informatics study guide*. New York, NY: McGraw-Hill Education.

Bruni, L., & Porta, P. L. (2016). *Handbook of research methods and applications in happiness and quality of life*. Cheltenham, England: Edward Elgar.

Bryman, A. (2016). *Social research methods*. Chicago, IL: Oxford University Press.

Buerhaus, P. I., DesRoches, C. M., Dittus, R., & Donelan, K. (2015). Practice characteristics of primary care nurse practitioners and physicians. *Nursing Outlook*, *63*(2), 144-153.

Chao, A. H., Yaney, A., Skoracki, R. J., & Kearns, P. N. (2017). The impact of physician assistants on a breast reconstruction practice: Outcomes and cost analysis. *Annals of Plastic Surgery*, *79*(3), 249-252.

Colwill, J. M., Cultice, J. M., & Kruse, R. L. (2008). Will generalist physician supply meet demands of an increasing and aging population? *Health Affairs*, *27*(3), 232–241.

Costas, J., Ponte, B., de la Fuente, D., Pino, R., & Puche, J. (2015). Applying Goldratt's theory of constraints to reduce the bullwhip effect through agent-based modeling. *Expert Systems with Applications*, *42*(4), 2049-2060.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Los Angeles, CA: Sage Publications.

Davey, A., & Savla, J. (2010). *Statistical power analysis with missing data: A structural equation modelling approach*. New York, NY: Routledge.

Department of Otolaryngology. (2018). Terminology. Gainesville, FL: University of Florida Health.

Denker, F. (2017). *The crucial role of domain knowledge in evaluating early-stage new product ideas*. Wiesbaden, Germany: Springer Gabler.

Drennan, V. M., Halter, M., Joly, L., Gage, H., Grant, R. L., Gabe, J.,... de Lusignan, S. (2015). Physician associates and GPs in primary care: A comparison. *Br J Gen Pract*, *65*(634), pp. 344-350.

Dutton, M. (2014). *Introduction to physical therapy and patient skills*. New York, NY: McGraw-Hill Education.

Everett, C. M., Morgan, P., & Jackson, G. L. (2016, December). Primary care physician assistant and advance practice nurses roles: Patient healthcare utilization, unmet need, and satisfaction. *Healthcare*, *4*(4), 327-333.

Frellick, M. (2018). Advanced practice provider influx will reshape primary care. Retrieved from https://www.medscape.com/viewarticle/898356

Gadbois, E. A., Miller, E. A., Tyler, D., & Intrator, O. (2015). Trends in state regulation of nurse practitioners and physician assistants, 2001 to 2010. *Medical Care Research and Review*, *72*(2), 200-219.

Galbács, P. (2015). *The theory of new classical macroeconomics: A positive critique*. Miskolc, Hungary: Cham Springer.

Goldratt, E. M. (2017). *Necessary but not sufficient: A theory of constraints business novel*. New York, NY: Routledge.

Goold, S. D., Tipirneni, R., Kieffer, E., Haggins, A., Salman, C., Solway, E.,... Lee, S. (2018). Primary care clinicians' views about the impact of medicaid expansion in Michigan: A mixed methods study. *Journal of General Internal Medicine*, *33*(8), 1307-1316.

Grabenkort, W. R., Meissen, H. H., Gregg, S. R., & Coopersmith, C. M. (2017). Acute care nurse practitioners and physician assistants in critical care: Transforming education and practice. *Critical Care Medicine, 45*(7), 1111-1114.

Grygotis, Lauren. (2017, June 2). Physicians perceptions of PAs' preparedness. *Clinical Pain Advisor,* 25-38.

Gudbranson, E., Glickman, A., & Emanuel, E. J. (2017). Reassessing the data on whether a physician shortage exists. *JAMA, 317*(19), 1945-1946.

Hing, E., & Hsiao, C. J. (2015). In which states are physician assistants or nurse practitioners more likely to work in primary care? *Journal of the American Academy of PAs*, *28*(9), 46-53.

Hooker, R. S., & Muchow, A. N. (2015). Modifying state laws for nurse practitioners and physician assistants can reduce cost of medical services. *Nursing Economics*, *33*(2), 88.

Hooker, R. S., Brock, D. M., & Cook, M. L. (2016). Characteristics of nurse practitioners and physician assistants in the United States. *Journal of the American Association of Nurse Practitioners*, *28*(1), 39-46.

Hooker, R. S., Cawley, J. F., & Everett, C. M. (2017). *Physician assistants: Policy and practice*. Philadelphia, PA: Davis Company.

Huang, S. Y., Chen, H. J., Chiu, A. A., & Chen, C. P. (2014). The application of the theory of constraints and activity-based costing to business excellence: The case

of automotive electronics manufacture firms. *Total Quality Management & Business Excellence*, *25*(5-6), 532-545.

Jacelon, C. S. (2017). The aging population. *Gerontological Nursing Competencies for Care*, 23.

Jiao, S., Murimi, I. B., Stafford, R. S., Mojtabai, R., & Alexander, G. C. (2018). Quality of prescribing by physicians, nurse practitioners, and physician assistants in the United States. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*, *38*(4), 417-427.

Kahn, S. A., Davis, S. A., Banes, C. T., Dennis, B. M., May, A. K., & Gunter, O. D. (2015). Impact of advanced practice providers (nurse practitioners and physician assistants) on surgical residents' critical care experience. *Journal of Surgical Research*, *199*(1), 7-12.

King, T. E., & Wheeler, M. B. (2016). *Medical management of vulnerable and underserved patients: Principles, practice, and populations*. New York, NY: McGraw Hill Education.

Kleinpell, R., Ward, N. S., Kelso, L. A., Mollenkopf, F. P., & Houghton, D. (2015). Provider to patient ratios for nurse practitioners and physician assistants in critical care units. *American Journal of Critical Care*, *24*(3), e16-e21.

Knowles, M. (2018). Survey: 8 in 10 nurses believe nonphysician practitioners play larger role in managing patient care. *Becker's Hospital Review*.

Liddy, C., Drosinis, P., & Keely, E. (2016). Electronic consultation systems: Worldwide prevalence and their impact on patient care—a systematic review. *Family Practice*, *33*(3), 274-285.

Liu, H., Robbins, M., Mehrotra, A., Auerbach, D., Robinson, B. E., Cromwell, L. F., & Roblin, D. W. (2017). The impact of using mid-level providers in face-to-face primary care on health care utilization. *Medical Care*, *55*(1), 12-18.

Lovink, M. H., Persoon, A., Koopmans, R. T., Van Vught, A. J., Schoonhoven, L., & Laurant, M. G. (2017). Effects of substituting nurse practitioners, physician assistants or nurses for physicians concerning healthcare for the ageing population: A systematic literature review. *Journal of Advanced Nursing*, *73*(9), 2084-2102.

Mabin, V. J., & Mirzaei, M. (2016, 9). Expanding the world of theory of constraints. Paper presented at the 14th TOCICO International Conference: Sustainability Moving from Common Sense to Common Practice, Leesburg, Virginia.

Martinez-Gonzalez, N. A., Rosemann, T., Djalali, S., Huber-Geismann, F., & Tandjung, R. (2015). Task-shifting from physicians to nurses in primary care and its impact on resource utilization: A systematic review and meta-analysis of randomized controlled trials. *Medical Care Research and Review*, *72*(4), 395-418.

Mauergauz, Y. (2016). *Advanced planning and scheduling in manufacturing and supply chains*. Moscow, Russia: Cham Springer International Publishing.

McCunniff, M., Liu, W., Dawson, D., & Marchini, L. (2017). Patients' esthetic expectations and satisfaction with complete dentures. *The Journal of Prosthetic Dentistry*, *118*(2), 159-165.

McDaniel, M. J., Hildebrandt, C. A., & Russell, G. B. (2016). Central application service for physician assistants ten-year data report, 2002 to 2011. *The Journal of Physician Assistant Education*, *27*(1), 17-23.

Mehta, D., McCombs, J., Gonzalez, Y. S., Marx, S., & Saab, S. (2018, April 11). Role of physician specialties to close gaps in the care cascade of hepatitis C: Evidence from paid claims in the United States from 2010 to 2016. Presented at the European Association for the Study of the Liver (EASL). Paris, France.

Meisenberg, B. R., & Michtalik, H. J. (2016). A comparison of conventional and expanded physician assistant hospitalist staffing models at a community hospital. *Journal of Clinical Outcomes Management*, *23*(10).

Mellinger, C. D., & Hanson, T. A. (2016). *Quantitative research methods in translation and interpreting studies.* New York, NY: Taylor & Francis Publications.

Mohammadi, H., Ghazanfari, M., Nozari, H., & Shafiezad, O. (2015). Combining the theory of constraints with system dynamics: A general model (case study of the subsidized milk industry). *International Journal of Management Science and Engineering Management*, *10*(2), 102-108.

Morgan, P., Everett, C. M., Humeniuk, K. M., & Valentin, V. L. (2016). Physician assistant specialty choice: Distribution, salaries, and comparison with physicians. *Journal of the American Academy of PAs*, *29*(7), 46-52.

Morgan, P., Himmerick, K. A., Leach, B., Dieter, P., & Everett, C. (2017). Scarcity of primary care positions may divert physician assistants into specialty practice. *Medical Care Research and Review*, *74*(1), 109-122.

Murphy, S. P. (2015). *Healthcare information security and privacy*. New York, NY: McGraw-Hill Education.

Nardi, P. M. (2018). *Doing survey research: A guide to quantitative methods*. New York, NY: Routledge.

Neumayer, Eric & Plümper, Thomas. (2017). *Robustness tests for quantitative research*. London, England: Cambridge University Press.

Pereira Librelato, T., Pacheco Lacerda, D., Henrique Rodrigues, L., & Rafael Veit, D. (2014). A process improvement approach based on the value stream mapping and the theory of constraints thinking process. *Business Process Management Journal*, *20*(6), 922-949.

Petterson, S. M., Liaw, W. R., Tran, C., & Bazemore, A. W. (2015). Estimating the residency expansion required to avoid projected primary care physician shortages by 2035. *The Annals of Family Medicine*, *13*(2), 107-114.

Penn State University Libraries. (2018, December 7). Empirical research in the social sciences and education. Retrieved from https://guides.libraries.psu.edu/emp

Pope, J. E., & Deer, T. R. (2017). *Treatment of chronic pain conditions: A comprehensive handbook*. New York, NY: Springer.

Pruzan, P. (2016). *Research methodology: The aims, practices and ethics of science*. Fredericksburg, Denmark: Cham Springer.

Rau, J. (2014). Medicare fines 2,610 hospitals in third round of readmission penalties. *Kaiser Health News, 2*.

Ray, K. N., Martsolf, G. R., Mehrotra, A., & Barnett, M. L. (2017). Trends in visits to specialist physicians involving nurse practitioners and physician assistants, 2001 to 2013. *JAMA Internal Medicine, 177*(8), 1213-1216.

Reiter, M., Wen, L. S., & Allen, B. W. (2016). The emergency medicine workforce: Profile and projections. *The Journal of Emergency Medicine, 50*(4), 690-693.

Robeznieks, A. (2013). More patients accepting treatment from nonphysicians. *Modern Healthcare*.

Roland, M. O., Bartholomew, J., Morrell, D. C., McDermott, A., & Paul, E. (1990). Understanding hospital referral rates: A user's guide. *British Medical Journal, 301*(6743), 98-102.

Schoenfeld, A. J., Zhang, X., Grabowski, D. C., Mor, V., Weissman, J. S., & Rahman, M. (2016). Hospital-skilled nursing facility referral linkage reduces readmission rates among Medicare patients receiving major surgery. *Surgery, 159*(5), 1461-1468.

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach*. West Sussex, United Kingdom: John Wiley & Sons.

Solomon, D. H., Fraenkel, L., Lu, B., Brown, E., Tsao, P., Losina, E., ... & Bitton, A. (2015). Comparison of care provided in practices with nurse practitioners and physician assistants versus subspecialist physicians only: A cohort study of rheumatoid arthritis. *Arthritis Care & Research*, *67*(12), 1664-1670.

Stange, K. (2014). How does provider supply and regulation influence health care markets? Evidence from nurse practitioners and physician assistants. *Journal of Health Economics*, *33*, 1-27.

Stanik-Hutt, J., Newhouse, R.P., White, K.M., Johantgen, M., Bass, E.B., Zangaro, G.,. . . Weiner, J.P. (2013). The quality and effectiveness of care provided by nurse practitioners. *Journal for Nurse Practitioners, 9*(8), 492-513.

Teater, B., Devaney, J., Forrester, D., Scourfield, J., & Carpenter, J. (2016). *Quantitative research methods for social work: Making social work count*. London, England: Palgrave.

Tierney, M. C., Charles, J., Naglie, G., Jaakkimainen, L., & Moineddin, R. (2017). The effects of computerized cognitive testing of older patients on primary care physicians' approaches to care. *Alzheimer Disease & Associated Disorders, 31*(1), 62-68.

Tipirneni, R., Rhodes, K. V., Hayward, R. A., Lichtenstein, R. L., Reamer, E. N., & Davis, M. M. (2015). Primary care appointment availability for new Medicaid patients increased after Medicaid expansion in Michigan. *Health Affairs, 34*(8), 1399-1406.

U.S. Census Bureau. (2010). *Population profile of the United States: 2000 (Internet release).* Retrieved from https://csrd.asu.edu/sites/default/files/pdf/Population%20Profile%20of%20the%20United%20States.pdf

Van Such, M., Lohr, R., Beckman, T., & Naessens, J. M. (2017). Extent of diagnostic agreement among medical referrals. *Journal of Evaluation in Clinical Practice, 23*(4), 870-874.

Weinstock, M. A., Ferris, L. K., Saul, M. I., Geller, A. C., Risica, P. M., Siegel, J. A., ... & Kirkwood, J. M. (2016). Downstream consequences of melanoma screening in a community practice setting: First results. *Cancer*, *122*(20), 3152-3156.

Woeppel, M, (2016). *Manufacturer's guide to implementing the theory of constraints*. New York, NY: CRC Press.

Wolf, L. A., Delao, A. M., Perhats, C., Moon, M. D., & Carman, M. J. (2017). The experience of advanced practice nurses in US emergency care settings. *Journal of Emergency Nursing*, *43*(5), 426-434.

Woo, B. F. Y., Lee, J. X. Y., & San Tam, W. W. (2017). The impact of the advanced practice nursing role on quality of care, clinical outcomes, patient satisfaction, and cost in the emergency and critical care settings: A systematic review. *Human Resources for Health*, *15*(1), 63.

Xue, Y., Goodwin, J. S., Adhikari, D., Raji, M. A., & Kuo, Y. F. (2017). Trends in primary care provision to medicare beneficiaries by physicians, nurse

practitioners, or physician assistants: 2008-2014. *Journal of Primary Care & Community Health*, *8*(4), 256-263.

Xue, Y., Ye, Z., Brewer, C., & Spetz, J. (2016). Impact of state nurse practitioner scope-of-practice regulation on health care delivery: Systematic review. *Nursing Outlook*, *64*(1), 71-85.

Yawn, B. P., Wollan, P. C., Textor, K. B., & Yawn, R. A. (2016). Primary care physicians', nurse practitioners' and physician assistants' knowledge, attitudes and beliefs regarding COPD: 2007 to 2014. *Chronic Obstructive Pulmonary Diseases: Journal of the COPD Foundation*, *3*(3), 628.

Yeh, I., Fairbrook, S., Cheng, D., & Tulsky, J. (2018). Improving the validity of MOLST (MA Medical Orders for Life-Sustaining Treatment) documentation for patients discharged from solid oncology and palliative care teams with physician assistants (FR419C). *Journal of Pain and Symptom Management*, *55*(2), 605.

Young, A., Chaudhry, H. J., Pei, X., Halbesleben, K., Polk, D. H., & Dugan, M. (2015). A census of actively licensed physicians in the United States, 2014. *Journal of Medical Regulation*, *101*(2), 7-22.