2021

Pulmonary Rehabilitation and Hospital Readmissions Among Individuals with Chronic Obstructive Pulmonary Disease

Nicholas Prush
Walden University

Walden University

College of Health Professions

This is to certify that the doctoral dissertation by

Nicholas Prush

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. Katie Callahan, Committee Chairperson, Health Services Faculty
Dr. Denise Rizzolo, Committee Member, Health Services Faculty
Dr. Mountasser Kadrie, University Reviewer, Health Services Faculty

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

Walden University
2021

Abstract

Pulmonary Rehabilitation and Hospital Readmissions Among Individuals with Chronic Obstructive Pulmonary Disease

by

Nicholas Prush

Bachelor of Applied Science, Siena Heights University, 2008

Master of Health Administration, Eastern Michigan University, 2014

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Health Services – Healthcare Administration

Walden University

May 2021

Abstract

Due to policies that penalize hospitals for chronic obstructive pulmonary disease (COPD) readmissions and the health problems faced by individuals who are readmitted due to COPD, it is critical to identify treatments and strategies that can help reduce the likelihood of readmission. The purpose of this study was to assess the association of pulmonary rehabilitation and demographic variables (age, gender, and BMI) on 30-day hospital readmissions for patients with COPD. Shearer's health empowerment theory was the theoretical framework for this quantitative study. Secondary data were obtained from a hospital and the sample was comprised of 253 COPD patients admitted between 2017 and 2019. Linear and multiple regression was used to analyze each research question. The results indicated age, gender, BMI, and pulmonary rehabilitation did not influence the readmission rate of COPD patients. These findings suggest less emphasis be placed on age, gender, BMI, and pulmonary rehabilitation when dealing with COPD readmissions. The results of this study provide information to healthcare organizations and patients with COPD around the use of pulmonary rehabilitation. Hospitals can invest in other methods of COPD treatment by developing various programs to lower hospital readmissions, reduce healthcare costs, and improve the quality of life for patients with COPD while contributing to a positive social change.

Pulmonary Rehabilitation and Hospital Readmissions Among Individuals with Chronic Obstructive Pulmonary Disease

by

Nicholas Prush

Bachelor of Applied Science, Siena Heights University, 2008

Master of Health Administration, Eastern Michigan University, 2014

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Health Services – Healthcare Administration

Walden University

May 2021

Dedication

I dedicate this dissertation to my entire circle of people in my life. First, my parents (Ron & Sheila Prush) for all their guidance in life. My children (Alexa, Ella, Nicholas II, and Alexander) for giving me inspiration to complete. Most important, my wife, Angela, for your patience and understanding during the long hours I spent on schoolwork. I am extremely blessed to have you by my side and the life you have given me.

Acknowledgment

I would like to express my sincere gratitude toward everyone who assisted in making this a reality. Especially, Dr. Katie Callahan, the chair of my committee for her expertise and guidance throughout the dissertation process. Also, I am grateful for Dr. Denise Rizzolo for serving as the committee member while providing her time and support. Special thanks to my wife and children throughout all these years. I could not have done this without all of you.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Introduction

Pulmonary rehabilitation is a promising treatment for individuals suffering from Chronic Obstructive Pulmonary Disease (COPD); this treatment includes physical and dietary components, among others. Due to policies that penalize hospitals for COPD readmissions and the health problems faced by individuals who are readmitted due to COPD, it is critical to identify treatments and strategies that can help reduce the likelihood of readmission. Currently, there is a lack of research comparing the readmission rates of individuals with COPD that complete pulmonary rehabilitation compared to those who do not. I examined the benefits of pulmonary rehabilitation on hospital readmissions for patients with COPD. The study was guided by Shearer's (2009) health empowerment theory. The health empowerment theory refers to the process of individuals purposefully participating in changing their environment and self-change, where individuals can engage the resources available to them and recognize avenues for the best well-being (Shearer, 2009). Specifically, I first determined whether there was a difference between readmission rates of COPD patients who participate in 30 days of pulmonary rehabilitation compared to those who do not participate. Then, I identified whether there was a relationship between age and 30-day readmission rates for patients admitted with COPD.

This study has the potential to create positive social change for COPD patients and hospitals. Furthermore, the results from this study may be able to help identify risk factors for readmission among COPD patients; in turn, this could ultimately help

hospitals identify COPD patients that may need outpatient treatment or rehabilitation and avoid monetary fines for readmission, which benefits both patients and hospital administration. In Chapter 1, I outline the research gap, problem, and significance for this study. I also present the research questions and describes the theoretical framework used to guide the study.

Background

Patients with COPD face many health issues and frequent hospital readmission (Feemster & Au, 2014). Shah et al. (2015) performed a large study with over 27 million patients admitted into the hospital; the researchers found 3.5% had COPD and were readmitted within 30 days post discharge with unknown reasoning. Common factors related to readmission for COPD patients include a longer length of stay, older age, comorbidity, and COPD complexity (Candrilli et al., 2015). Additionally, Kim et al. (2016) related nursing staffing levels to COPD readmissions and found that there was a significant correlation between staffing and readmissions where fewer staff was indicative of greater readmissions. The researchers also concluded that there is a need to provide patient education about COPD protective and risk factors, prior to being discharged from the hospital (Kim et al., 2016).

There are many benefits of pulmonary rehabilitation. Alshabanat et al. (2017) developed a comprehensive case management plan for COPD patients, which was implemented and shown to decrease hospitalizations by 30% and decrease readmissions from 30.2% to 15.7%. Kargiannakis et al. (2017) utilized telehealth medicine to patients discharged from the hospital with a COPD exacerbation. This intervention was effective,

in that it reduced readmissions from 20% down to 9%. Casaburi (2018) also suggested that benefits of pulmonary rehabilitation for COPD patients include improvements in exercise tolerance, dyspnea, and quality of life. Other research by McCarthy et al. (2015) showed that pulmonary rehabilitation was related to decreased dyspnea and fatigue, greater emotional function, and greater feelings of control over patients' COPD condition. There is still a gap in the literature, however, regarding pulmonary rehabilitation's impact on COPD readmissions.

This research is needed because pulmonary rehabilitation may benefit COPD patients, but it may or may not be a key factor in COPD readmissions; if it is not related to COPD readmissions, additional research is needed to identify treatments that can help to reduce COPD readmissions. Casaburi (2018) cited that pulmonary rehabilitation is only offered to a small percentage of COPD patients. This is problematic because pulmonary rehabilitation could potentially decrease readmissions. Additionally, COPD readmission is critical to study because it can be costly to the hospitals and indicate poor health of the patient (Crisafulli et al., 2008; Pruitt, 2018). Pruitt discussed the loss of Centers for Medicare and Medicaid Services (CMS) reimbursement as a result of COPD readmissions, which can then negatively impact hospitals, particularly those with narrow profit margins. There is a need to improve care and reduce readmissions (Pruitt, 2018). Additionally, studying readmissions of COPD patients is particularly important because COPD patients tend to have comorbid conditions, such as congestive heart failure (CHF) and metabolic disease (Crisafulli et al., 2008). In one study, the researchers found that over half (51%) of COPD patients who were going through pulmonary rehabilitation had

at least one other chronic disease, with metabolic disease and heart disease being the two most common comorbidities (Crisafulli et al., 2008). The lack of understanding regarding factors impacting COPD readmissions among pulmonary rehabilitation patients is significant because COPD is a leading cause of both hospitalizations and hospital readmissions in the United States (Baker et al., 2013).

Problem Statement

In 2017, CMS implemented the Hospital Readmission Reduction Program (Lau et al., 2017). This includes financial penalties for readmissions among patients with COPD (Rinne et al., 2017). Readmission penalties result from any COPD patient who is readmitted within 30 days of being discharged (Feemster & Au, 2014). Feemster and Au (2014) explained that in October 2014, Medicare and Medicaid began to restrict payments to hospitals for patients with COPD if they were readmitted within 30 days postdischarge. More than 2,000 hospitals paid a total of $280 million in penalties for the fiscal year 2013 (Feemster & Au, 2014).

Presently, in the United States, 2 million emergency room (ER) visits are associated with COPD exacerbations, with over 700,000 admissions annually, costing approximately $60 billion (Feemster & Au, 2014). Of the 700,000 admissions in the United States annually, 22.6% have a readmission within the 30-day period (Feemster & Au, 2014). COPD patients are at a further disadvantage because a major complication faced by COPD patients is comorbidity with other diseases, increasing the likelihood of readmission and poorer health outcomes among these patients (Crisafulli et al., 2008). According to Rinne et al. (2017), hospitals were estimated to be penalized more than

$500 million in 2017 due to these readmission policies. Furthermore, there is a need to improve care and reduce readmission rates for COPD patients after they are discharged from the hospital (Pruitt, 2018).

Although more research on pulmonary rehabilitation is needed, its impact on patients' health is promising. Pulmonary rehabilitation can be used to prevent readmissions in patients with COPD and is considered an intensive service that can include behavior change, education, and exercise (Postolache et al., 2015). The purpose of pulmonary rehabilitation is to improve the physical and emotional burdens faced by patients with respiratory diseases so they can experience long-term health improvements (Maddocks et al., 2016; Postolache et al., 2015). Length of pulmonary rehabilitation can vary from 4 to over 50 weeks but is typically between 8 and 12 weeks (Maddocks et al., 2016; McCarthy et al., 2015). In addition, researchers have indicated that comorbidities in COPD patients going through pulmonary rehabilitation may impact the quality of life (Crisafulli et al., 2008). Further quantitative research is needed in order to understand whether comorbidities impact the likelihood of readmission for these patients. Scholars have suggested that age may play a role in readmission rates of COPD patients in the inpatient setting (Candrilli et al., 2015), but it is unknown whether age is correlated with readmission rates for COPD patients that participate in a pulmonary rehabilitation program. The lack of understanding regarding factors impacting COPD readmissions among pulmonary rehabilitation patients is significant because COPD continues to be a concern for hospital readmissions and pulmonary rehabilitation is a widely used method of treatment for COPD patients (e.g., Apps et al., 2016; Rochester et al., 2015). The

concern is that pulmonary rehabilitation is not being administered on a regular basis for COPD patients following discharge from the hospital. The lack of usage is problematic because of the likelihood of COPD-related readmissions and other risk factors related to COPD.

Purpose of the Study

The purpose of this quantitative study was to examine the benefits of pulmonary rehabilitation on hospital readmissions for COPD patients. To do this, 30-day readmissions for COPD patients who completed a pulmonary rehabilitation program were compared to those who did not complete a pulmonary rehabilitation program. Age and other relevant demographics—such as gender, weight, BMI, and other health conditions—were included in the analysis to determine their impact on the likelihood of readmission. The American Thoracic Society and European Respiratory Society have defined pulmonary rehabilitation as a comprehensive intervention that involves a thorough patient assessment and patient-tailored therapies (Man et al., 2015). Pulmonary rehabilitation can involve exercise training, education, and behavior changes, designed to improve the physical and psychological conditions of people with chronic respiratory disease (Man et al., 2015). There is a significant need to research COPD to identify factors that could reduce readmissions because of the penalties being assessed to hospitals and identify opportunities to impact COPD readmissions.

Research Questions and Hypotheses

Overall, the primary focus of this study was to identify whether the length of pulmonary rehabilitation treatment is significantly related to hospital readmission for

COPD patients. Furthermore, because age may impact treatment and care received (Candrilli et al., 2015), I also examined whether age is significantly related to hospital readmission for COPD patients at McLaren Lapeer Regional Medical Center in Michigan. Demographic variables such as gender and BMI were statistically controlled for if they were associated with the predictor or criterion variables. The guiding research questions and their associated hypotheses were as follows:

Research Question 1: Is there a difference between readmission rates of patients with COPD who participate in 6 weeks of pulmonary rehabilitation compared to those who do not?

$H1_0$: There is no difference in the readmission rates of patients with COPD who participate in at least 6 weeks of pulmonary rehabilitation compared to those who do not.

$H1_a$: There is a difference in the readmission rates of patients with COPD who participate in at least 6 weeks of pulmonary rehabilitation compared to those who do not.

RQ2: Is there a relationship between age and 30-day readmission rates for patients admitted with COPD?

$H2_0$: There is no relationship between age and 30-day readmission rates for patients admitted with COPD.

$H2_a$: There is a relationship between age and 30-day readmission rates for patients admitted with COPD.

Theoretical Framework

I employed Shearer's (2009) health empowerment theory to guide this study. This theory describes how patients use personal and social resources to enhance their well-being. Health empowerment theory involves the integration of personal resources as well as social-contextual resources (Shearer, 2009). Additionally, it involves the process of individuals purposefully participating in self-change and changing their environment by utilizing the resources available to them (Shearer, 2009).

Addressing factors that impact patients' likelihood of readmission can also help to identify ways to empower patients, thus improving their health and reducing the risk of readmission. For instance, if older patients are shown to be more likely to be readmitted, this could highlight the importance of empowerment interventions to those patients, resulting in them taking a more prominent role in their own health and being less likely be hospitalized. If patients who are more at risk and are more in need of empowerment interventions can be identified, the patients' health outcomes may improve, and hospitals may be able to save money. Empowerment has been shown to be critical for reducing length of stay and readmission rates (Gonya et al., 2014), improving mental health and coping outcomes (Melnyk et al., 2004), and increasing self-efficacy among patients (Kashani et al., 2015). Gonya et al. (2014) worked with parents of premature infants, finding that parent empowerment reduced the length of stay for these infants and decreased their readmission rates. Additionally, Melnyk et al. (2004) worked to evaluate an empowerment program that targeted parents of critically ill young children; this program was shown to decrease stress, improve mental health (including depression), and

increase parent participation in their child's treatment. Moreover, pulmonary rehabilitation may be an empowering treatment for COPD patients; therefore, the empowerment theory guided this study.

The importance of empowerment has been demonstrated among COPD patients' health outcomes as well. Specifically, empowerment has been shown to increase the self-efficacy of COPD patients (Ansari et al., 2017), help COPD patients live optimally and feel more in control (Fotoukian et al., 2017), and help COPD patients succeed in pulmonary rehabilitation (Meis et al., 2014). Ansari et al. (2017) highlighted the need for COPD patients to be educated on COPD risks and treatments because self-management was an empowering way to increase self-efficacy. Fotoukian et al. (2017) found that empowerment was critical for COPD patients to manage their life with their disease and helped them to live optimally. Meis et al. (2014) studied the empowering impact of pulmonary rehabilitation; after conducting interviews and focus groups, the researchers found that pulmonary rehabilitation helped patients to succeed during the treatment. Specifically, patients were able to focus on the positives and better accept their COPD diagnosis, had increased motivation, and improved exercise abilities (Meis et al., 2014).

This theory can be aligned with the goals of the current study because pulmonary rehabilitation may help to empower COPD patients. Furthermore, I used the empowerment theory to examine the impact of pulmonary rehabilitation and age on hospital readmissions of COPD patients. As Shearer (2009) noted, empowerment is crucial for treatment of older adults, which was relevant to my evaluation of the role of

age in COPD patient readmissions. In the next section, I describe the nature of the study and the rationale behind the use of a quantitative methodology.

Nature of the Study

A quantitative methodology with a cross-sectional design was used for this study. Quantitative methods were appropriate because this study aimed to identify relationships between age, patient demographics, and readmission rates among COPD patients in the pulmonary rehabilitation setting. The key variables in this study were gender, age, comorbidity rates, length of stay at a pulmonary rehabilitation program, and readmission rates. This study involved both continuous and categorical data. Additionally, the data in this study were secondary data. Data were gathered from the Electronic Medical Record (EMR) from a medical facility.

A staff member from the facility sent the data for this study to me for analysis. All participant responses and demographics were deidentified; to do this, unique identifiers were assigned to each participant. The first component of data analysis was descriptive analyses. This resulted in information related to the means, standard deviations, and ranges of demographic variables, readmission rates, readmissions fees, and comorbidity rates. Then, simple regression and multivariate regression were used to address the study's research questions, while controlling for potential confounders. In this study, the primary outcome variable was COPD patient readmission rates. Length of pulmonary rehabilitation, age, and gender were the predictor variables. SPSS statistical software was used for all analyses.

Definitions

Operational definitions are provided below for the key terminology in the current study:

Chronic Obstructive Pulmonary Disease (COPD): This is a group of diseases that cause airflow blockage and breathing-related problems and includes emphysema and chronic bronchitis (Centers for Disease Control and Prevention [CDC], 2018).

Pulmonary rehabilitation: This refers to a personalized treatment program that teaches COPD management strategies to improve quality of life. Pulmonary rehabilitation is a comprehensive treatment that can include plans that teach people how to breathe better and conserve their energy, as well as provide advice on food nutrition and exercise (CDC, 2018).

Comorbid conditions: This term describes presenting with more than condition or disease; COPD patients tend to have other chronic diseases like arthritis, congestive heart failure, diabetes, coronary heart disease, stroke, or asthma (CDC, 2018).

Readmissions: In the context of the current study, only COPD-related hospital readmissions was considered under the readmission variable.

Assumptions

Assumptions are part of all research studies. In the current study, I assumed that COPD patients had an accurate diagnosis of COPD prior to participation in the current study; this was necessary because if the diagnoses were not accurate, the impacts of pulmonary rehabilitation on COPD specifically may not have been relevant or true. Additionally, I assumed that the pulmonary rehabilitation components were implemented effectively and that the practitioners tasked with carrying out the treatment did so with

fidelity; this assumption was necessary because pulmonary rehabilitation completion is not relevant if it was not implemented effectively. I also assumed that readmissions were due to the COPD diagnosis; this assumption was necessary because if the readmission is due to another condition, it is not possible to make claims about pulmonary rehabilitation's impact on COPD rehabilitation and the results from this study would be inconclusive. Last, I assumed that the data in the current study were normally distributed, because if the data violated assumptions of normality, parametric statistical methods are not appropriate. This assumption was necessary because if the assumptions of normality are not met, nonparametric designs for correlation and group differences would have been used, which would have changed the design slightly, but would not have impacted the variables or research questions.

Scope and Delimitations

The scope and delimitations involve factors that are of focus for the study and are in my control. The scope of the current study involved COPD patients from a single rehabilitation setting; this population was chosen because of the importance of reducing readmission rates for them in order to benefit the patients themselves and the hospitals that serve them. As described in the limitations for this study, however, the use of a single rehabilitation setting may have implications for the generalizability of the results to other settings. Additionally, this study only included patients diagnosed with COPD, not those who may have symptoms but lack diagnosis; this was necessary to identify the impacts of pulmonary rehabilitation on COPD readmissions.

Limitations

The current study was not without limitations. The first limitation involved the nonexperimental design, meaning that I was not able to make any causal claims. Instead, I discussed associations between variables and group differences in the data. Additionally, I did not evaluate COPD patients from a variety of settings; therefore, the results from this study may not be generalizable to other geographic locations or other rehabilitation settings. Specifically, the generalizability of the results obtained from only one rehabilitation setting in the current study may be limited to similar settings. Moreover, it is possible that the COPD patients from the single rehabilitation setting may not be representative of COPD patients from other rehabilitation settings, which posed another potential limitation for the current study. The implications for the generalizability of the study results are further described in the discussion of the findings.

Significance of the Study

COPD patients are faced with many challenges, including a high likelihood of readmission and the likelihood of comorbidities. Many previous scholars have examined readmission rates among COPD patients (Amin, 2015; Jiang et al., 2017; Tran et al., 2016; Zhang et al., 2017). The factors related to readmission for COPD patients include greater amounts of time spent at the hospital prior to readmission, older age, comorbidities, and COPD complexity (Candrilli et al., 2015). This is important because comorbid diseases have been shown to predict readmission of COPD patients (Baker et al., 2013). Furthermore, hospitals currently experience harsh financial penalties resulting from COPD patient readmissions, making it in the best interest of the patients and

hospitals to reduce COPD readmissions (Feemster & Au, 2014; Holt, 2013; Rinne et al., 2017). This study was significant because I examined whether the use of a postdischarge pulmonary rehabilitation program could significantly impact these fees and could promote more insurance coverage for these services. The findings of the study may assist researchers and practitioners in identifying protective and risk factors (including COPD patients that may be more vulnerable to readmission) for readmission among COPD patients, which can ultimately help hospitals identify COPD patients who may need outpatient treatment or rehabilitation, improve the health outcomes of COPD patients, and avoid monetary fines for readmission.

Summary

Through this study, I aimed to examine the benefits of pulmonary rehabilitation on hospital readmissions for COPD patients in one facility. The study was guided by Shearer's (2009) health empowerment theory, which describes how patients actively participate in behaviors to change their environment and promote self-change and well-being by making efficient use of the resources available to them. The results from this study may benefit COPD patients by identifying potential risk factors for readmission and identifying the benefits of pulmonary rehabilitation. Additionally, the results from the current study may help inform hospitals of the protective and risk factors related to COPD and COPD readmission. Hospitals may benefit from this because readmission for COPD patients is very costly for hospitals. The scope, delimitations, assumptions, and limitations of the study are further addressed in the discussion in Chapter 5. In Chapter 2,

I review the body of existing literature on this topic in order to better describe the background of this study and the research gap.

Chapter 2: Literature Review

Introduction

In the United States, 16 million Americans currently have COPD, and millions of others suffer from COPD but have not been formally diagnosed or treated (CDC, 2018). Hospital visits due to COPD-related problems are estimated to cost $60 billion per year (Feemster & Au, 2014). This is problematic because over 22% of patients with COPD are readmitted within 30 days of hospital discharge due to COPD-related issues and comorbid conditions (Crisafulli et al., 2008). Furthermore, comorbid conditions (Franssen & Rochester, 2014), along with age (CDC, 2018), are factors that could exacerbate the likelihood of readmission rates of patients with COPD. Previous researchers have indicated that hospitals are lacking information regarding ways to minimize COPD readmissions (Shah et al., 2016). In the current study, I evaluated whether pulmonary rehabilitation may be a beneficial option to decrease COPD readmission rates.

In this study, I evaluated the benefits of pulmonary rehabilitation on hospital readmissions for patients with COPD. First, I determined whether there is a difference between readmission rates of patients with COPD that participate in 30 days of pulmonary rehabilitation compared to those that do not complete any pulmonary rehabilitation, while adjusting for potential confounders. I then identified whether there is a relationship between age and 30-day readmission rates for patients admitted with COPD, while adjusting for potential confounders. In this chapter, I describe the literature search strategy and the theoretical framework that guided the study. I then provide a

description of the literature regarding COPD, pulmonary rehabilitation, readmission rates, and age.

Literature Search Strategy

I used Google Scholar, PubMed, and ERIC to identify previous studies regarding key variables and concepts in this study, as well as literature on Shearer's (2009) health empowerment theory, which is described in more detail in the next section. Key search terms included the following: *COPD, COPD readmission, Shearer's health empowerment theory, COPD AND age, COPD AND comorbid diagnoses, COPD readmission reasons, COPD readmission AND risk factors, predictors of COPD readmission, reducing COPD readmissions rates, pulmonary rehabilitation, pulmonary rehabilitation benefits, COPD AND pulmonary rehabilitation,* t-*test, correlation*, and *quantitative research methods*.

I focused on literature that occurred from 2013 to 2018 for the latest research and identify current research gaps. When unique and relevant to the study, articles published from other years were also included. The articles were mostly from peer-reviewed journals, but whitepapers, books, and CDC website resources were also used.

Theoretical Foundation

The current study was guided by Shearer's (2009) health empowerment theory. The health empowerment theory refers to the process of individuals purposefully participating in changing their environment and self-change, where individuals can engage the personal, social, and contextual resources available to them and recognize avenues for the best well-being (Shearer, 2009).

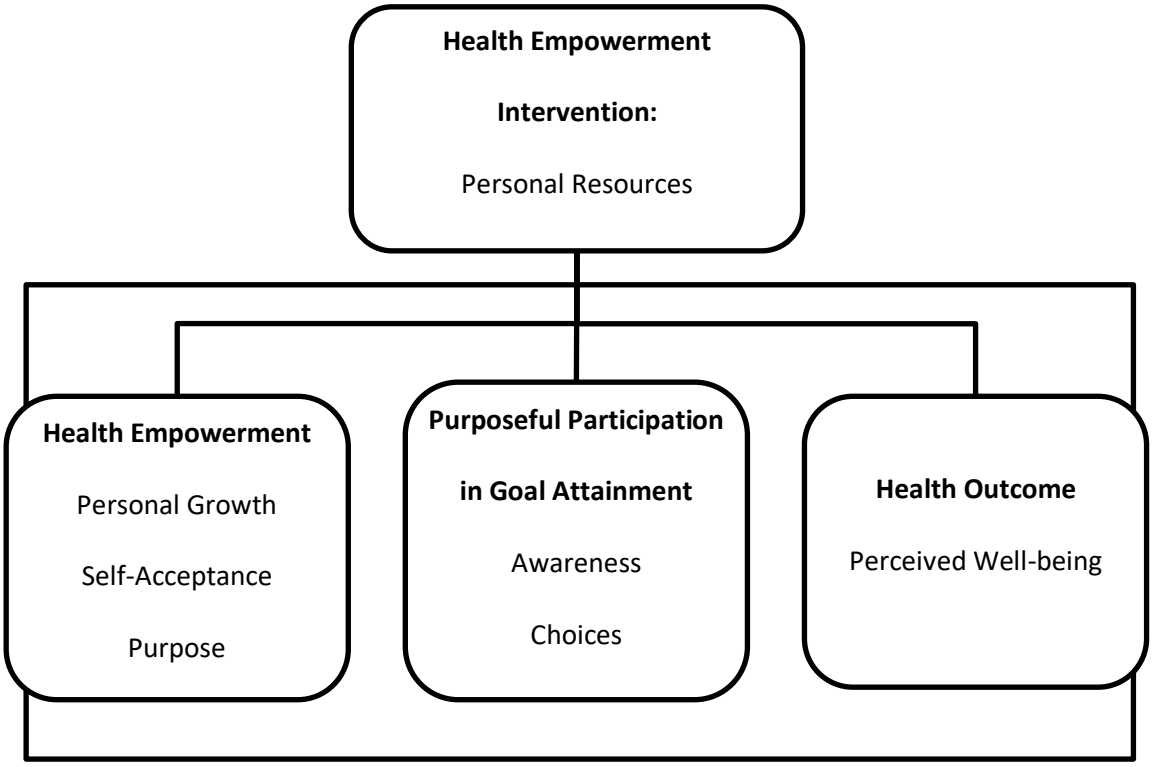
Origin of the Health Empowerment Theory

The health empowerment theory (Shearer, 2009) emerged as a theory-based health intervention to help individuals better use the personal, social, and contextual resources available to them. The original intervention was designed to help older adults enhance their well-being. This intervention aimed to guide older adults to participate in their health and treatment actively, to be engaged while attaining health-related goals, and to foster individual well-being (Shearer, 2009). Shearer (2009) suggested that adults' health becomes much more complicated as they age, and older adults are vulnerable to disease and at risk of losing their ability to live independently (Shearer, 2009). Additionally, older adults are more likely to have multiple health issues and may lack awareness of their health and their access to personal, social, and contextual resources (Shearer, 2009).

The health empowerment theory involves three steps: (a) assisting adults to recognize and increase their self-capacity; (b) increasing adults' awareness and use of social support networks; and (c) increasing awareness and use of social services. Although the health empowerment theory was initially designed for older home-bound adults with chronic conditions, its uses have expanded to other populations. Awareness, understanding, engagement, and participation are helpful for all patients; examples are provided later in this chapter. Figure 1 shows the conceptual model of the health empowerment theory (Shearer, 2009).

Figure 1

The Health Empowerment Theory Conceptual Model



Theoretical Propositions of Health Empowerment Theory

Awareness, understanding, engagement, and participation are critical components of the health empowerment theory; these involve four main assumptions: (a) empowerment is an inherent ability of all individuals; (b) empowerment is based on the relationships between individuals and their environment; (c) empowerment is a continuous process; and (d) empowerment is expressive of health patterns and well-being (Shearer, 2009).

Awareness and Understanding

A significant component of the health empowerment theory is understanding and awareness of one's health. This leads to improvements in personal well-being and allows for more effective healthcare decisions (Shearer, 2009; Watanabe et al., 2015). This understanding involves both personal resources (e.g., self-capacity) and social resources (e.g., social support). Importantly, even if an individual has access to sufficient resources, if they lack the ability to identify and understand these resources, their well-being is likely to be negatively impacted. In summary, one goal of health empowerment theory is to help individuals identify their available resources, identify their health goals, and identify methods to achieve those goals (Shearer, 2009). By increasing awareness and understanding of one's resources, health goals, and methods for attaining those goals, as well as by increasing engagement and ensuring individuals are actively participating in health-related activities, self-capacity can be increased (Shearer, 2009).

Engagement and Participation

Purposeful engagement and participation are other crucial components of health empowerment theory (Shearer, 2009). Furthermore, Shearer proposed health empowerment as a dynamic process that involves being engaged and actively participating in one's health by using internal and external resources. Part of fostering engagement and participation includes reminiscence; this involves asking a patient to reflect on a time they were able to impact their health and can also help with building self-capacity (Shearer, 2009). Health empowerment also includes encouraging patients to reflect on their strengths while acknowledging their weaknesses in a way that turns

negative characteristics or events into areas for improvement and learning. By actively participating in self-talk and thought restructuring, patients can think more positively and are less likely to allow negative thoughts to consume their health actions and decisions (Shearer, 2009). In summary, purposeful participation and engagement can be dependent on awareness and intention to change one's health and health goals (Shearer, 2009).

Previous Use of the Health Empowerment Theory

Many previous scholars have utilized the health empowerment theory (Shearer, 2009) to guide their research (Shearer Fleury et al., 2012; Shin & Park, 2017; Watanabe et al., 2015). In this section, I discuss previous research using the health empowerment theory, from well-being, quality of life, and exercise—all of which are critical components of pulmonary rehabilitation.

Health Empowerment, Well-Being, and Quality of Life

Researchers have emphasized the use of health empowerment theory for increasing prosperity and quality of life. For instance, this theory was used by Watanabe et al. (2015) to study the impact of empowerment on community health engagement. This study involved a qualitative methodology, and results indicated that health empowerment developed steadily over time as individuals in the community build knowledge and social resources; then, individuals are more prepared to take action to benefit their health and well-being. Shearer et al. (2012) conducted a literature review and utilized the health empowerment theory to examine how older adults make health decisions and outcomes of interventions in a literature review.

Grealish et al. (2017) used a cross-sectional research design and an internet based questionnaire to examine empowerment. A total of 423 individuals aged 16 to 29 years old participated in this study. Psychological factors, mental well-being, empowerment, and recovery from personal problems were assessed. Mediation analyses indicated that empowerment mediates the relationship between psychological factors (psychosocial, self-efficacy, thinking style, coping, and control) and mental health, well-being, and recovery from general life problems. Through empowerment, those psychological factors are related to mental health, well-being, and recovery (Grealish et al., 2017).

Shin and Park (2017) used the health empowerment theory to study how participation in self-help groups moderated the relationship between empowerment and quality of life among a sample of breast cancer survivors. The study involved over 250 participants, and overall, the results showed that empowering breast cancer survivors significantly increased their quality of life. Additionally, self-help group participation had a significant effect on the breast cancer survivors' feelings of empowerment; this, in turn, improved their quality of life. The study concluded that by empowering these patients, which included providing emotional support and information, is critical to the quality of life, offering support for the health empowerment theory.

Health Empowerment, COPD, and Pulmonary Rehabilitation

Limited research has been conducted on COPD through the health empowerment theory lens. Fotoukian et al. (2014) conducted a study with a qualitative approach using content analysis and purposeful sampling to recruit 24 participants. The researchers collected data by conducting in-depth semi-structured interviews and recording filed

notes. The researchers found the empowerment of elderly patients with COPD was affected by many social factors, health care systems, and personal resources, aligning with the health empowerment theory. Specifically, results indicated empowerment of elderly patients with COPD was mediated by aging, the nature of COPD, fear/hopelessness, culture, support systems, economic status, and experience.

Health Empowerment and Exercise

Some previous research has also been conducted on health empowerment and exercise; this is notable because exercise is a critical piece of COPD treatment and pulmonary rehabilitation. Park et al. (2015) used a randomized controlled trial design in a study with 43 Korean older adults with chronic illness, with just over half participating in the experimental group. The intervention was comprised of two phases: (a) an 8-week multi-disciplinary, team guided, group-based health education, exercise session, and individual empowerment counseling; and (b) 16 weeks of self-help group activities, including weekly exercise and group discussion about maintaining acquired self-management skills and problem-solving skills. The results showed that over time, health empowerment, physical activity, and physical function in the experimental group increased significantly compared to the control. The self-management program, which aligned with health empowerment theory, was shown to improve health, physical activity, and physical function among the older adults in the sample. The results indicated empowerment might be an effective method to increase self-control regarding health behaviors in adults with chronic illness.

Rationale for Health Empowerment Theory in the Current Study

Research is lacking regarding how the health empowerment theory can be applied to patients with COPD, specifically those who complete pulmonary rehabilitation. Through the current study, I aim to increase the understanding of the impacts of pulmonary rehabilitation and age on COPD readmission rates. Mainly, pulmonary rehabilitation may be a critical resource for patients with COPD, and awareness and participation in pulmonary rehabilitation may help to empower them. Furthermore, patients with COPD could benefit from being aware of pulmonary rehabilitation and how they can actively participate in their health-related activities and decisions. The results from this study can help practitioners in determining whether pulmonary rehabilitation might be more helpful for older patients with COPD.

A summary of the elements of the program theory involved in the health empowerment theory (Shearer, 2009) are listed below:

- Problem: a lack of awareness of and engagement in personal, social, and contextual resources (Shearer, 2009). In my study, the problem is there is a lack of awareness regarding factors related to the health of patients with COPD, leading to high readmission rates, which are costly to hospitals and negatively impact patients.
- Critical Inputs: these include personal, social, and contextual resources, including self-capacity, social networks, and service utilization, respectively (Shearer, 2009). In my study, these include age (personal resource) and engagement in pulmonary rehabilitation (social/contextual resource).

- Mediating Processes: these include health empowerment and purposeful participation and engagement in goal attainment (Shearer, 2009). In my study, awareness of the importance of pulmonary rehabilitation and active participation in one's health after hospital discharge.
- Expected Outcomes: thoughts and feelings about one's well-being (Shearer, 2009). For my study, improved well-being, related explicitly to decreased COPD-related readmissions rates
- Exogenous Factors: these include character traits of the patient, setting, and availability of resources (Shearer, 2009). In my study, comorbid conditions and possibly other demographics such as gender and race/ethnicity.
- Implementation Issues: these include materials/resources and environment/setting (Shearer, 2009). For my study, pulmonary rehabilitation materials and resources and clinic materials and resources.

Previous researchers have examined readmission rates among patients with COPD (Amin, 2015; Jiang et al., 2017; Tran et al., 2016; Zhang et al., 2017). Personal resources (part of health empowerment theory) related to readmission for patients with COPD include a longer length of stay, older age, comorbidities, and COPD complexity (Candrilli et al., 2015). Hospitals are also facing challenges regarding harsh financial penalties resulting from COPD patient readmission (Feemster & Au, 2014; Rinne et al., 2017). This study aims to help identify protective and risk factors for readmission among patients with COPD and to evaluate whether there are differences in readmission rates among patients with COPD who complete at least 30 days of pulmonary rehabilitation

compared to those who do not. The results from this study can ultimately help inform hospitals of patients with COPD who might need outpatient treatment or rehabilitation and avoid monetary fines for readmission.

Literature Review Related to Key Variables

Background of COPD

The CDC (2018) has described COPD as a group of diseases that hinder airflow and breathing. These include chronic bronchitis and emphysema. These diseases are treatable, but not curable. Estimates indicate that 16 million Americans currently have COPD, and millions of others suffer from COPD but have not been formally diagnosed or treated (CDC, 2018). Symptoms of COPD may include continuous coughing or wheezing, excessive phlegm or mucus production, shortness of breath, and/or difficulties taking deep breaths (CDC, 2018).

The CDC (2018) has found tobacco smoke, air pollutants, genetic factors, and respiratory infections to be some of the leading causes of COPD. There are many devastating impacts of COPD on one's life and well-being. For instance, individuals with COPD may experience difficulty walking, climbing stairs, or exercising; difficulty or inability to perform at work; a need to use special equipment to treat their disease; difficulties engaging in social activities; confusion and memory loss; other comorbid conditions; depression or other mental health problems; and poor health in general (CDC, 2018).

The Cost of COPD

The Centers for Medicare & Medicaid Services (CMS) implemented the Hospital Readmission Reduction Program (Lau et al., 2017), which included financial penalties for COPD readmissions that occur within 30 days of being discharged (Feemster & Au, 2014; Rinne et al., 2017). Currently, in the United States, two million emergency room (ER) visits are associated with COPD exacerbations with over 700,000 admissions annually, which totals a cost of $60 billion per year (Feemster & Au, 2014). These numbers are problematic because over 22% of patients with COPD are readmitted within 30 days of hospital discharge due to COPD-related issues and comorbid conditions (Crisafulli et al., 2008). Rinne et al. (2017) estimated that hospitals are expected to be penalized more than $500 million after 2017's readmission policies. Additional research is necessary to improve care and reduce readmission rates for patients with COPD after they are discharged from the hospital (Pruitt, 2018).

Age and COPD

COPD Risk Among the Elderly

Shearer (2009) suggested that adult health becomes much more complicated with age; therefore, efficient use of personal and social resources is critical. Researchers have shown that in comparison to younger individuals, older adults are more vulnerable to disease, at an increased risk of losing their ability to live independently, more likely to have multiple health issues, and less aware of their health and their access to resources (Shearer, 2009). Age is especially important regarding COPD, but further research is needed to better understand the relationship between age and COPD outcomes in the

United States because results from prior research have shown mixed results. For instance, the CDC (2018) suggested that adults over the age of 65 are at the highest risk for developing COPD compared to other ages. In contrast, Ni and Xu (2016) showed that COPD death rates have increased for women ages 45-64 and over 85 years of age, compared to other age groups. Other research has been conducted in the United Kingdom, the results of which indicated that COPD rates, specifically bronchitis, have declined among adults between 45 and 64 years of age (Pride & Soriano, 2002). More research is needed to determine whether there is a significant relationship between age and COPD readmission rates to assess which age groups—if any—may be more vulnerable.

Empowerment

Empowerment may be a critical component for treatment success for elderly individuals. Son and Kim (2017) conducted a study with 148 adults with at least one of the following diseases: hypertension, diabetes, hyperlipidemia, and atherosclerosis. Data were collected using a structured questionnaire and was analyzed using the independent *t*-test, Pearson correlation, ANOVA, and hierarchical multiple regression. The researchers found that health empowerment was significantly correlated with health literacy and social support. The researchers also found that perceptions of health status and social activity participation significantly predicted health empowerment. Overall, this study offers support for health empowerment interventions as a means to improve health behavior practices of elderly individuals.

Park and Oh (2017) conducted an experimental study with 76 individuals over the age of 65 who were registered with home visiting services. A health promotion empowerment program occurred in the experimental group, which lasted 8 weeks. Researchers assessed health factors (i.e., health promotion behavior, perceived health status and frailty) and empowerment factors (i.e., empowerment, social participation). The results showed the experimental group exhibited improvements in health status, social participation, and decreased frailty compared to the control group. In summary, the researchers found the empowerment program was effective for these elderly individuals.

Shin et al. (2016) also conducted an experimental study in Korea, with 41 participants in the experimental group and 36 in the control group. The experimental group received an empowerment program lasting 12 months. Self-efficacy, social support, self-care behaviors, blood pressure control, and renal function were assessed. The results indicated the experimental group had increased self-efficacy and self-care behavior over time. The experimental group exhibited significant improvement in blood pressure compared to the control group. The findings of this study also offer support for the use of empowerment for older individuals.

Sak et al. (2017) studied the roles of psychological empowerment and health literacy on older individuals' willingness to participate in treatment and engage in health decisions. The study was conducted with over 800 Swiss adults between the ages of 65 and 80 years old. This researcher used multivariate logistic regression to identify the contribution of health literacy, psychological empowerment, and trust in physicians on participants' preference to be active, collaborative, or passive in decision-making. Results

showed that psychological empowerment was significantly correlated with older adults' preferred and perceived involvement in medical decision-making. Notably, the study also showed that health literacy mediated the relationship between psychological empowerment and participant treatment involvement. This study offered support that providing information and empowering patients is essential, which aligns with the tenets of health empowerment theory.

Thakur (2017) used the health empowerment theory in a study with elderly individuals with heart failure who were living at senior centers. The intervention that was used focused on strategies to identify self-capacity and to increase self-capacity, informed decision making, goal setting, and social networks. This researcher found the empowerment program did help to enhance personal growth and purposeful participation in the attainment of personal health. In summary, this study supports the health empowerment theory in research with older individuals.

Fotokian et al. (2017) studied the empowerment of individuals with COPD. The researchers collected data through in-depth semi-structured interviews as well as field notes; a total of 24 participants were recruited with purposive sampling. The results indicated that elderly persons with COPD, their family caregivers, and professional team members engaged in managing life with COPD; striving to keep abreast of life; preparing for battle with disease; and helping to stabilize the elder's life.

Managing life with COPD was found to help the elderly patients with COPD feel in control and live optimally. Notably, the study showed it is critical to understanding the

experiences of elderly patients with COPD and how empowerment can impact their health. The study helped healthcare professionals provide more focused elderly care.

In summary, age is the key to understanding health and the impacts of empowerment. Shearer (2009) suggested that adults' health becomes much more complicated as they age; older adults are more vulnerable to disease and more likely to have multiple health issues compared to younger adults (Shearer, 2009). Further research is needed to better understand the relationship between age and COPD outcomes in the United States because results from prior research have shown mixed results (CDC, 2018; Ni & Xu, 2016; Pride & Soriano, 2002). Empowerment may be a critical component for treatment success for elderly individuals in the following ways:

- Son and Kim (2017) found empowerment can improve health behavior practices;
- Park and Oh (2017) found the health promotion empowerment program were effective, particularly for elderly individuals;
- Shin et al. (2016) found empowerment was effective for rural older adults with hypertension in South Korea;
- Sak et al. (2017) found psychological empowerment correlated with older adults' preferred and perceived involvement in making health decisions
- Thakur (2017) conducted an intervention and found empowerment significantly increased patient's levels of personal growth and purposeful health participation.

- Fotokian et al. (2017) found empowerment and managing life with COPD was found to help the elderly patients with COPD feel in control and live optimally.

COPD and Comorbid Conditions

Researchers have indicated individuals with COPD often have other diagnoses or health conditions, known as comorbidities (Franssen & Rochester, 2014; Schwab et al., 2017; Sievi et al., 2015). Patients with underlying health concerns can be problematic because comorbidities can exacerbate the risk of rehospitalization among patients with COPD (Schwab et al., 2017). Shah et al. (2016) discussed that 68% of patients with COPD have at least one comorbid condition, and 16% have two or more comorbid conditions. Comorbid conditions are important to study and statistically control for in the current study, as well as in any study involving COPD. The following are examples of comorbid conditions that individuals with COPD face:

- Congestive heart failure (Schwab et al., 2017);
- Coronary artery disease (Schwab et al., 2017);
- Sleep apnea (Schwab et al., 2017);
- Cerebrovascular disease (Franssen & Rochester, 2014; Schwab et al., 2017; Sievi et al., 2015);
- Depression (Franssen & Rochester, 2014; Schwab et al., 2017; Sievi et al., 2015), anxiety (Franssen & Rochester, 2014; Schwab et al., 2017; Sievi et al., 2015), and mental illness (van Eeden et al., 2018);
- Osteoporosis (Schwab et al., 2017; Sievi et al., 2015);

- Type 2 diabetes mellitus (Schwab et al., 2017; Sievi et al., 2015);
- Lung cancer (Sievi et al., 2015);
- Hypertension (Sievi et al., 2015);
- Metabolic syndrome (Franssen & Rochester, 2014; Sievi et al., 2015);
- Substance abuse disorder (van Eeden et al., 2018);
- Dysfunctional skeletal myopathies (Franssen & Rochester, 2014; Sievi et al., 2015); and
- Cardiovascular diseases (van Eeden et al., 2018).

COPD Readmission Rates

Hospital readmissions are an unfortunately common outcome among patients with COPD (CDC, 2018; Shah et al., 2015). In this section, the researcher discusses the results from previous studies pertaining to readmissions rates and reasons for readmission rates among patients with COPD.

COPD Readmission Rates and Statistics

Shah et al. (2015) performed a large study with over 27 million patients admitted into the hospital, in which 3.5% had COPD, and these patients were readmitted within 30 days postdischarge with unknown reasoning. Researchers have shown that one in five patients that are admitted to the hospital for COPD require rehospitalization within 30 days, which is troubling because it increases the economic burden of COPD (Shah et al., 2016). Although patients with COPD may have other disorders or conditions, researchers have found that half of the readmissions of patients with COPD are due to respiratory issues (Shah et al., 2015). Readmissions for patients with COPD are problematic because

they have been shown to contribute to increased morbidity and mortality (van Eeden et al., 2018). On the other hand, Shah et al. (2016) suggested that between 10% to 55% of COPD readmissions are preventable. Future research is needed to identify methods to prevent readmissions and identify patients who may be more vulnerable to rehospitalization.

Reasons for COPD Readmissions

Common factors related to readmission for patients with COPD include a longer length of stay, older age, comorbidity, and COPD complexity (Candrilli et al., 2015; Shah et al., 2016). Kim et al. (2016) found that there was a significant correlation between staffing and readmission. Shah et al. (2016) also suggested that due to the length of recovery time for COPD, it is likely that patients with COPD will need to be hospitalized within 30 days. Shah et al. conducted a literature review and found that the following variables are risk factors for early readmissions (readmissions occurring within 30 days of hospital discharge) for patients with COPD: Black race; comorbidities; congestive heart failure; frailty; diabetes; psychiatric disorders, such as depression, anxiety, psychosis, and alcohol or drug use; discharge to post-acute care; dual eligibility for Medicare and Medicaid; elevated serum arterial blood carbon dioxide level; low BMI; longer length of hospital stays; and male gender.

Reducing COPD Readmission Rates

Many hospitals lack the required information and methods to reduce COPD readmissions (Shah et al., 2016). Kim et al. (2016) suggested there is a need to provide patient education before being discharged from the hospital. Pulmonary rehabilitation

may offer beneficial treatment options for patients with COPD (Shah et al., 2016). Future research is needed to understand the impact it has on readmissions. After conducting a literature review, Shah et al. proposed various possible methods to decrease early (or 30-day) readmission rates for patients with COPD, including: patient self-management, inhaler device training, early outpatient follow-up within 30 days after discharge, telehealth care, receiving and filling all respiratory medications before being discharged, pharmacist-supervised medication reconciliation, medications, and pulmonary rehabilitation.

Summary of COPD Literature

COPD refers to a group of diseases that restrict and hinder airflow, including bronchitis and emphysema (CDC, 2018). It is hypothesized that tobacco smoke, air pollutants, genetic factors, and respiratory infections are some of the leading causes of COPD (CDC, 2018). Older adults are more vulnerable to disease and at risk of losing their ability to live independently compared to younger adults (Shearer, 2009); however, research regarding age and COPD readmissions has yielded mixed results. Previous studies have shown that individuals with COPD often have other diagnoses or health conditions (Franssen & Rochester, 2014; Schwab et al., 2017; Sievi et al., 2015), including coronary artery disease, mental health conditions, osteoporosis, hypertension, and Type 2 diabetes. These and other comorbid conditions may exacerbate readmissions rates.

Up to 20% of patients with COPD are hospitalized within 30 days of being discharged; many cases are preventable (Shah et al., 2016). Other reasons for

readmissions (other than comorbid conditions) include, but are not limited to, being African American, male, exhibiting dual eligibility for Medicare and Medicaid, and a low BMI (Shah et al., 2016). There has been research completed addressing ways to reduce the likelihood of COPD readmission; these include training on inhalers, early follow-up, telehealth care, and medications. Another promising intervention for treating COPD is pulmonary rehabilitation. In the following section, the researcher describes pulmonary rehabilitation and its potential to treat COPD and decrease COPD readmission rates.

The Background of Pulmonary Rehabilitation

Pulmonary rehabilitation, also known as respiratory rehabilitation, is a suggested treatment for COPD, along with other treatments such as smoking cessation, medications, and the use of supplemental oxygen (CDC, 2018). Pulmonary rehabilitation treatments are tailored to individual patients to help teach COPD management strategies that can ultimately help improve the quality of life. Part of this treatment includes teaching patients how to conserve their energy, engage in better breathing strategies, and increase/improve eating and exercise habits (CDC, 2018). Notably, the American Association of Respiratory Care (AARC, 2007) and CDC (2018) indicated a benefit of pulmonary rehabilitation is that it can be conducted in different treatment environments/settings and is designed uniquely for each patient.

Pulmonary rehabilitation treatment involves many components. Supervised exercise training is the major component; however, many other components can help manage and reduce COPD symptoms (Hill et al., 2013). Other elements of pulmonary rehabilitation include smoking cessation, pharmacotherapy, early identification and

treatment of acute exacerbations, management of acute dyspnea, physical activity, improvement of body composition, promotion of mental health awareness, advance care planning, and creation of social networks (Hill et al., 2013).

Benefits of Pulmonary Rehabilitation

Pulmonary rehabilitation has been shown to improve exercise performance, functional status, health status, and healthcare use among patients with COPD (Shah et al., 2016). In this section, the researcher outlines the significant benefits of pulmonary rehabilitation, including decreases in the likelihood of readmission, patient empowerment, and decreased fatigue and improvements on the BODE index. Notably, these benefits may help patients with COPD reduce their risk of future hospital readmissions.

Readmissions

There are many benefits of pulmonary rehabilitation. For instance, Alshabanat et al. (2017) developed a COPD management plan, which was implemented and shown to improve hospitalizations by 30% and decrease readmissions. Kargiannakis et al. (2017) utilized telehealth medicine to patients discharged from the hospital with a COPD exacerbation. This intervention was useful as it reduced readmissions from the standard of 20% down to 9% (Kargiannakis et al., 2017). Bhatt et al. (2018) studied a form of pulmonary rehabilitation referred to as telehealth pulmonary rehabilitation and found that compared to a control group, patients with COPD who received the exercise intervention had lower readmission rates. A gap in the literature remains regarding pulmonary

rehabilitation's impact on patients with COPD and other factors that may impact readmissions rates.

Ko et al. (2018) conducted a randomized controlled trial to examine the impact of pulmonary rehabilitation on patient readmissions. Patients in the invention group received four to eight sessions of 2-hour outpatient physiotherapy training, one to two times each week; each participant in the experimental group would have at least 4 to 8 weeks of supervised training by a trained physiotherapist. Patients in the intervention group were contacted by the case manager every 2 weeks, by phone, to provide support and reinforcement for continuous exercise at home for 1 year. The control group received care as they would usually, without a physiotherapist or case manager intervention. Over 130 individuals participated in the study, where activity was measured through activity monitors. The results indicated the readmission rate for individuals in the control group was significantly higher at 12 months compared to the individuals in the experimental group. Notably, after 12 months, there was no change in the steps per day (measured by the activity tracker) in the experimental versus the control group. The results were that individuals in the control group had a shorter period between discharge and readmission, meaning they were being readmitted sooner than individuals in the experimental group. Overall, this study offers support for the use of short-course pulmonary rehabilitation to decrease the number of readmissions and lengthen the time between readmissions.

Maddocks et al. (2015) conducted a literature review to examine the impact of pulmonary rehabilitation programs on readmissions rates for patients with COPD. These researchers found that most randomized controlled trials showed exercise-based

interventions, such as pulmonary rehabilitation, can improve exercise capacity, improve health-related quality of life, reduce healthcare utilization, and reduce readmissions. The researchers cautioned that the results from these particular and controlled trials might not generalize to all healthcare settings. This study still offers support for the use of pulmonary rehabilitation as a potentially useful method for increasing health and reducing readmission rates.

Rajput and Banerjee (2017) conducted a study to examine the impact of pulmonary rehabilitation. A total of 60 patients with COPD were randomly selected for inclusion in the study; 30 had completed pulmonary rehabilitation, and 30 had not. The primary outcome variable assessed in the study were hospital readmissions rate at 12 months, and the baseline data were similar for both groups. Overall, results showed pulmonary rehabilitation could reduce readmissions and mortality in patients with COPD. The researchers found that the patients that completed pulmonary rehabilitation showed a more significant improvement in the walking test compared to the patients that did not complete pulmonary rehabilitation. In addition, the patients that completed pulmonary rehabilitation showed a more significant improvement in their stress scores compared to patients that did not complete pulmonary rehabilitation. The patients that completed pulmonary rehabilitation showed a more significant improvement in their depression scores compared to those that did not complete pulmonary rehabilitation. Lastly, at 12 months, the readmission rate was significantly lower for patients that complete pulmonary rehabilitation compared to those that did not (1.5 to 5.2, respectively); of the

patients that completed pulmonary rehabilitation, zero died, whereas 15 of the patients that did not complete pulmonary rehabilitation died (Rajput & Banerjee, 2017).

Patient Empowerment

Importantly, pulmonary rehabilitation may help to empower patients. For instance, pulmonary rehabilitation helps to increase self-management and behavior change (Bourbeau et al., 2018). Fotokian et al. (2017) conducted a qualitative study and found the ability of older patients to manage their life with COPD enables them to feel in control and live optimally. This study also showed that understanding the experiences of the empowerment process of elderly patients with COPD can help health professionals provide more focused elderly care (Fotokian et al., 2017).

Meis et al. (2014) linked pulmonary rehabilitation to autonomy, which is also linked to patient empowerment. Focus groups and semi-structured interviews were conducted; data were collected from seven patients with COPD before completing a pulmonary rehabilitation program, but data from only six patients were collected after pulmonary rehabilitation. The researchers also conducted focus groups and semi-structured interviews with 14 healthcare workers. Qualitative data analysis involved a phenomenological approach. The following themes were apparent:

- Before pulmonary rehabilitation, patients expressed challenges in accepting their COPD diagnosis;
- Before pulmonary rehabilitation, patients had insufficient knowledge of COPD;

- Before pulmonary rehabilitation, patients had difficulty with setting realistic goals;
- Support from others and healthcare workers helped patients with COPD overcome challenges;
- After beginning pulmonary rehabilitation, the patients with COPD showed increases in confidence to exercise and manage their daily activities;
- Patients with COPD expressed a desire to have control over their lives;
- Healthcare professionals played a vital role in guiding patients with COPD through pulmonary rehabilitation; and
- Overall, pulmonary rehabilitation provided a personalized approach to treatment for patients with COPD by offering tailored advice, autonomy-supportive counseling, self-management skills, and referrals to local exercise facilities (Meis et al., 2014).

Decreased Fatigue

Pulmonary rehabilitation has also been linked to reduced fatigue. For instance, Farias et al. (2014) conducted an experimental study where participants completed an experimental study where 40 patients with COPD were assigned to participate in an 8-week pulmonary rehabilitation (n=20) or a control group (n=20). The researchers found those patients that received pulmonary rehabilitation experienced less fatigue and feelings of dyspnea (Farias et al., 2014).

McCarthy et al. (2015) also studied pulmonary rehabilitation's impact on fatigue. Results offered support for pulmonary rehabilitation as a critical component in managing

COPD, improving health-related quality of life, and increased exercise. These researchers found that pulmonary rehabilitation significantly reduced dyspnea and fatigue. The researchers noted future research on pulmonary rehabilitation is needed to understand its effectiveness.

Other research by Lewko et al. (2014) examined the impacts of pulmonary rehabilitation on fatigue. A total of 37 patients participated in this study; 23 of these patients completed pulmonary rehabilitation, and the remainder did not. Researchers collected data using the Multidimensional Fatigue Inventory, Quality of Life Questionnaire, Anxiety and Depression (HADS) measure, the London Chest Activity of Daily Living Scale (LCADL), muscle strength test, and incremental (ISWT) and endurance (ESWT) shuttle walk tests. Data analysis involved the Wilcoxon test and Spearman correlation. The results indicated that after pulmonary rehabilitation, there were statistically significant improvements in reduced activity, general fatigue, physical fatigue, ISWT/ESWT, and muscle strength (Lewko et al., 2014). Lewko et al. identified no statistically significant difference in motivation or mental fatigue scores between patients who completed pulmonary rehabilitation compared to those who did not. Impacts on fatigue may only apply to physical fatigue; furthermore, the effects of pulmonary rehabilitation may not always be apparent, and further research is necessary in additional settings to determine its effectiveness.

Improvements in the BODE Index

The BODE index is a mortality index that includes measures of body-mass index, airflow obstruction, dyspnea, and exercise capacity. (Farias et al., 2014). Farias et al.

found that patients with COPD who completed an 8-week pulmonary rehabilitation program showed improvements in the BODE index compared to COPD patients in the control group. A total of 34 COPD patients participated in the study and were assigned to a control group and an intervention group (that received pulmonary rehabilitation). The researchers assessed the following variables: pulmonary function, distance covered during the 6-minute walk test (6MWT), respiratory strength, peripheral muscle strength, health-related quality of life (HRQOL), body composition, and level of activities of daily living (Farias et al., 2014). The results indicated the intervention group exhibited improvements in the 6MWT, decreases in sensation of dyspnea and fatigue, increases in work performed, improvements on the BODE index, improvements on the HRQOL, increases in ADL level, and increases in lower limb strength ($p<0.05$). The researchers also found it was more cost-effective for patients who received pulmonary rehabilitation. This study showed that, among patients with COPD, physical activity in pulmonary rehabilitation leads to clinical benefits in a cost-effective manner (Farias et al., 2014).

Benavides and Wilches (2017) conducted a study evaluating 8 weeks of pulmonary rehabilitation. These researchers used a descriptive, retrospective-longitudinal study. A total of 24 patients were selected for inclusion in the study. The researchers gathered data from a hospital from 2009-2010 for these patients. Information records filled out in the years 2009-2010 were selected. Data were analyzed using descriptive analysis, which included frequencies, measures of central tendency, and plots of the distributions. The results indicated that the estimated 4-year survival significantly increased from 55.17% to 71.83% after pulmonary rehabilitation. In addition, the total

score on the BODE index, the exercise tolerance score, the walk test score, and the dyspnea score all significantly improved after pulmonary rehabilitation (Benavides & Wilches, 2017).

Güell et al. (2017) examined whether pulmonary rehabilitation benefits decrease over time, gradually, for patients with COPD. The researchers tested whether a long-term (3-year) maintenance program given to patients with COPD after pulmonary rehabilitation preserves the short-term benefits for patients with COPD. The randomized trial involved over 140 patients with moderate to severe COPD. Patients in the intervention group received 3 years of maintenance after completing an 8-week pulmonary rehabilitation program. Patients in the control group were assigned to receive a standard monitoring program or control group. The researchers assessed the programs' effects on the BODE index, the 6-minute-walk test distance (6MWD), and the health-related quality of life score (Güell et al., 2017).

Patients' scores were assessed at 12, 24, and 36 months (Güell et al., 2017). A total of 138 (96.5%) completed the 8-week program. For all participants, after the 8-week pulmonary rehabilitation program alone, health-related quality of life was significantly improved. During the follow-up maintenance period, the intervention group exhibited a more significant increase in the 6MWD compared to the control group, and the gradual decline in the 6MWD occurred more slowly in the intervention group compared to the control group. The adherence rate for the control group was significantly higher than the control group, with rates of 66% and 17%, respectively. Overall, the study showed pulmonary rehabilitation is effective for short-term impacts and the follow-up program

helped to maintain those benefits pertaining to the scores on the BODE index and 6MWD (Güell et al., 2017).

Perhar et al. (2015) also examined pulmonary rehabilitation's impact on the BODE index. The researchers used an experimental design, and a total of 60 patients participated in the study; all participants had moderate to severe COPD diagnoses. The 30 patients in the control group received treatment for COPD, and the 30 patients in the experimental group received treatment for COPD and pulmonary rehabilitation. The researchers collected data through the BODE index. Overall, the results showed that pulmonary rehabilitation participation by COPD patients improved BODE index scores. More specifically, the results indicated that the experimental group exhibited significant improvement on the BODE index from the time of diagnosis until the first week of pulmonary rehabilitation. In addition, the experimental group exhibited significant improvement on the BODE index from the first week through the sixth week of pulmonary rehabilitation. Finally, the experimental group exhibited significant improvement on the BODE index from the time of diagnosis till the sixth week of pulmonary rehabilitation.

Summary of Pulmonary Rehabilitation Literature

In summary, pulmonary rehabilitation is a respiratory treatment for COPD tailored to each patient (CDC, 2018). Hill et al. (2013) noted there are various essential components of pulmonary rehabilitation, including exercise training, smoking cessation, and pharmacotherapy. Early identification and treatment of acute exacerbations help manage the following; acute dyspnea; physical activity; improvement of body

composition; promotion of mental health awareness; advance care planning; and creation of social networks (Hill et al., 2013). Pulmonary rehabilitation can lead to many benefits for patients with COPD; these benefits include decreases in the likelihood of readmission, patient empowerment, decreased fatigue, and improvements on the BODE index. Importantly, these benefits of pulmonary rehabilitation may help patients with COPD reduce their risk of future hospital readmissions. In the following sections of Chapter 2, the researcher describes and evaluates the research methods of previous studies; afterward, the research gap and aim of the current study are discussed.

Critique of Previous Research Methods

Research is lacking concerning quantitative studies comparing pulmonary rehabilitation participants' readmissions rates to readmissions rates of patients who do not complete pulmonary rehabilitation in the United States. It is also critical research is conducted to control for potential confounding variables and examine the relationship between age and readmission rates for patients with COPD. In this section, the researcher critiques the research methods used in studies that are similar to the two research questions of the current study.

Studies Regarding Pulmonary Rehabilitation and COPD Readmission Rate

Many studies pertaining to pulmonary rehabilitation's impact on COPD readmissions rates have involved experimental designs (e.g., Garvey, 2015), and literature reviews (e.g., Maddocks et al., 2015; Shah et al., 2016). Some studies support the idea that pulmonary rehabilitation can positively influence readmission rates (Alshabanat et al., 2017; Garvey, 2015; Kargiannakis et al., 2017; Ko et al., 2018;

Maddocks et al., 2015). Other researchers have offered contradictory findings; for instance, pulmonary rehabilitation may only be effective when started soon after hospital discharge, and possibly may not be significantly effective at all (Lee, 2005). Some have indicated that standard pulmonary rehabilitation without RMT does not impact the readmission rates of patients with COPD (PN Medical, 2016). Further research is needed using a quantitative methodology and controlling for potential confounds such as the presence of comorbid conditions and time between discharge and the start of pulmonary rehabilitation.

Studies Regarding Age and COPD Readmission Rates

Previous research pertaining to age and COPD readmission rates have shown mixed results. For instance, the CDC (2018) suggested that adults over the age of 65 are at the highest risk for developing COPD compared to other ages. Ni and Xu (2016) showed that COPD death rates have increased for women aged 45-64 years, as well as for those over 85 years of age. Other research has been conducted in the United Kingdom, the results of which indicated that COPD rates, specifically bronchitis, has declined among adults between 45 and 64 years of age (Pride & Soriano, 2002). Future research is needed in the United States to determine whether there is a significant relationship between age and COPD readmission rates to determine ages that may be more vulnerable. Empowerment may be a critical component for treatment success for elderly individuals (Son & Kim, 2017); therefore, it is crucial that future researchers examine COPD through the lens of health empowerment theory.

The Research Gap and Significance of the Current Study

Researchers have stated that hospitals have little guidance when it comes to implementing practices and strategies to reduce COPD readmissions, and it is pertinent that future research examines the correlation of COPD readmissions with the benefits of pulmonary rehabilitation (Shah et al., 2016). The lack of understanding around factors impacting COPD readmissions, among pulmonary rehabilitation patients, is significant because COPD is a leading cause of both hospitalizations and readmissions in the United States (Baker et al., 2013). Furthermore, pulmonary rehabilitation is a widely used method of treatment for patients with COPD (e.g., Apps et al., 2016; Rochester et al., 2015).

This research study regarding readmission rates of patients with COPD is necessary because readmissions of patients with COPD can be costly to the hospitals and indicate poor health of the patient. Pruitt (2018) discusses the loss of CMS reimbursement as a result of COPD readmissions, which can then negatively impact hospitals, particularly those with narrow profit margins. There is a need to improve care and reduce readmission (Pruitt, 2018); studying readmission for patients with COPD is particularly important because patients with COPD tend to have comorbid conditions (Crisafulli et al., 2008). For instance, in one study, the researchers found that over half (51%) of patients with COPD who were going through pulmonary rehabilitation had at least one other chronic disease; metabolic diseases and heart diseases were the two most common comorbidities (Crisafulli et al., 2008). Some previous researchers have supported the notion that pulmonary rehabilitation helps decrease readmission rates

(Alshabanat et al., 2017; Garvey, 2015; Kargiannakis et al., 2017; Ko et al., 2018; Maddocks et al., 2015), whereas other studies do not (Lee, 2005; PN Medical, 2016). Quantitative research that controls for potential confounds such as the presence of comorbid conditions, gender, etc., is needed.

Furthermore, the lack of understanding regarding factors impacting COPD readmissions among pulmonary rehabilitation patients is significant because COPD is a leading cause of both hospitalizations and hospital readmissions in the United States (Baker et al., 2013). Importantly, researchers have indicated there is a lack of research pertaining to the impact of empowerment on healthcare and health issues (Jacquinet et al., 2018); through this study, the researcher aimed to fill part of this gap by examining the health of patients with COPD from the United States, from the health empowerment theory perspective. Researchers have also found that increasing knowledge of and access to pulmonary rehabilitation is important for patients, physicians, and insurance companies (Rochester et al., 2015).

This study was guided by the health empowerment theory (Shearer, 2009). Additional research regarding the health empowerment of patients with COPD is critical, as pulmonary rehabilitation may be a crucial resource for patients with COPD, and awareness and participation in pulmonary rehabilitation may help to empower them. Furthermore, patients with COPD could benefit from being made aware of pulmonary rehabilitation and how they can actively participate in their own health-related activities and decisions. The results from this study assist practitioners in determining whether

pulmonary rehabilitation might be more helpful for older patients with COPD if age and COPD readmission rates are significantly correlated.

Summary and Conclusions

I used Google Scholar, PubMed, and ERIC to identify previous studies regarding key variables and concepts in this study for the literature review; search terms were both broad and narrow to capture enough information for the literature review. The current study was guided by Shearer's (2009) health empowerment theory, which initially emerged as a theory-based health intervention to help individuals better use the personal, social, and contextual resources available to them (Shearer, 2009). The health empowerment theory involves assisting adults in recognizing and increasing their self-capacity, increasing adults' awareness use of social support networks, and increasing awareness and use of social services. This theory assumes that empowerment is an inherent ability; based on the relationships between individuals and their environment, a continuous process, and expressive of health patterns (Shearer, 2009).

A significant component of the health empowerment theory is understanding and awareness of one's own health could lead to improvements in well-being and allow for more effective health care decisions (Shearer, 2009; Watanabe et al., 2015). Purposeful engagement and participation are additional crucial components of health empowerment theory (Shearer, 2009). Many other studies have utilized the health empowerment theory (Shearer, 2009) to guide their research (Shearer Fleury et al., 2012; Shin & Park, 2017; Watanabe et al., 2015); these topics include research pertaining to health empowerment, well-being, and quality of life (e.g., Grealish et al., 2017; Watanabe et al., 2015); health

empowerment, COPD, and pulmonary rehabilitation (e.g., Fotoukian et al., 2014); and health empowerment and exercise (e.g., Park et al., 2015).

The CDC (2018) describes COPD as a group of diseases that hinder airflow and breathing, which affects approximately 16 million individuals in the United States. Individuals with COPD face many obstacles, including, but not limited to, difficulty walking, work performance issues, confusion and memory loss, other comorbid conditions, and poor health (CDC, 2018). Notably, COPD is very costly to hospitals and society in general. Age is key to understanding health and the impacts of empowerment. Shearer (2009) suggested that adults' health becomes much more complicated as they age; older adults are more vulnerable to disease and more likely to have multiple health issues compared to younger adults (Shearer, 2009). Empowerment may be a critical component for treatment success for elderly individuals.

Unfortunately, individuals with COPD often have other diagnoses or health conditions (Franssen & Rochester, 2014; Schwab et al., 2017; Sievi et al., 2015), including—but not limited to—coronary heart disease, mental health disorders, hypertension, and cardiovascular disease. Furthermore, patients with COPD have a high likelihood of readmissions (CDC, 2018; Shah et al., 2015). Some of the key reasons for readmission include a long length of initial hospital stay, being male and African American, and having comorbid conditions such as diabetes. Pulmonary rehabilitation may offer beneficial treatment options for patients with COPD (Shah et al., 2016). Future research is needed to understand its impact.

Pulmonary rehabilitation treatment involves many components. Supervised exercise training is one major component; however, other components can help patients with COPD manage and reduce symptoms (Hill et al., 2013). These additional components include smoking cessation, advance care planning, creation of social networks, and more (Hill et al., 2013). Pulmonary rehabilitation has been shown to improve exercise performance, functional status, health status, and health-care use among patients with COPD (Shah et al., 2016). Research suggests pulmonary rehabilitation may help reduce readmissions rates (e.g., Ko et al., 2018), increase patient empowerment (e.g., Bourbeau et al., 2018), decrease fatigue (e.g., McCarthy et al., 2015), and improve performance on the BODE index (e.g., Farias et al., 2014).

Researchers have stated that hospitals have little guidance when it comes to implementing practices and strategies to reduce COPD readmissions and it is pertinent that future research examines the correlation of COPD readmissions, and the benefits of pulmonary rehabilitation (Shah et al., 2016). Currently, the literature is lacking quantitative studies involving patients with COPD from the United States in pulmonary rehabilitation that controls for potential confounds. In the current study, the researcher assessed the benefits of pulmonary rehabilitation on hospital readmissions for patients with COPD in one facility. Specifically, the researcher identified whether there is a statistically significant difference between readmission rates of patients with COPD who participate in 30 days of pulmonary rehabilitation compared to those who do not complete any pulmonary rehabilitation, after adjusting for potential confounders. The researcher also examined whether there is a relationship between age and 30-day

readmission rates for patients admitted with COPD, after adjusting for potential confounders. In the next chapter, I discuss the study's design and rationale, methodology (including information on the population and sampling), and procedures for recruitment, participation, and data collection. Statistical analyses and ethical procedures are also described.

Chapter 3: Research Methods

Introduction

Through this quantitative study, I evaluated the benefits of pulmonary rehabilitation on hospital readmissions for patients with COPD. Specifically, the dependent variable of readmissions was investigated in relation to the predictor variables of participation in a 6-week pulmonary rehabilitation program and the age of COPD patients. The purpose of this study was to determine whether the completion of a 6-week pulmonary rehabilitation program impacts the outcomes of care for patients with COPD, measured by hospital readmission. This study included the exploration of demographic factors that may impact the hospital readmission of patients with COPD to determine whether hospital readmission for COPD patients differs based on demographics and how results associated with a 6-week pulmonary rehabilitation program may differ based on demographics. This chapter includes of a description of the study's research design, methodology, and data analysis plan, potential threats to validity, and ethical considerations.

Research Design and Rationale

In this section, I discuss the selected research design and the rationale for this selection. This section is organized into the following subsections: research design, study variables, and potential constraints.

Research Design

I employed a quantitative cross-sectional design. The cross-sectional design was selected for use in the current study because the participants in cross-sectional study

designs are selected based on the criteria set for the research, rather than based on the outcome or exposure status (Setia, 2016). In the current study, the selection criteria included patients from McLaren Lapeer, a clinic in Michigan, that were diagnosed with COPD. Cross-sectional studies are also used to investigate diseases in clinic-based samples (Setia, 2016). In the current study, a clinic sample was used.

I employed multiple linear regression because this type of analysis provides a model to determine the relations between two or more predictor variables (i.e., independent variables) and a response variable (i.e., dependent variable; Alexopoulos, 2010; StatSoft, 2013). The purpose of this study was to determine the relationship between hospital readmissions for patients with COPD as a response variable in relation to the predictor variables of the completion of a 6-week pulmonary rehabilitation program and demographic variables. In the subsections to follow, the dependent and independent variables are described, followed by a presentation of the constraints of this study.

Variables

In the current study, the dependent variable was readmissions for patients with COPD, which the researcher measured in rates. The predictor variables in this study included a categorical variable, which was participation in a 6-week pulmonary rehabilitation program, and a continuous variable, which was age of patients with COPD. I used statistics to examine group differences and relationships, and the variables were continuous and numeric, both of which are hallmarks of the quantitative methodology. For this to occur, I compared 30-day readmissions for patients with COPD who complete

at least 6 weeks of pulmonary rehabilitation program to the readmissions of those who do not complete a pulmonary rehabilitation program; 6 weeks was chosen because it takes at least 6 weeks to exhibit changes in well-being (Shearer, 2009). Age and other relevant demographics, such as gender, weight, and BMI, were included in the analysis to determine whether they had any impact on the likelihood of readmission. A description of these variables is included in Table 1 below.

Table 1

Variable Descriptions

Variable	Variable Type and Range
Dependent Variable	
30-day hospital readmission	Discrete [0…30]
Independent Variables	
Participation in a 6-week pulmonary rehabilitation program	Categorical [Yes/No]
Age	Continuous [x …. x]
Sex	Categorical [Male/Female]
Weight	Continuous [x….x]
BMI	Categorical [up to 18.5/18.5 – 24.9/25.0 – 29.9/30.0 and above]

Potential Constraints

There were no anticipated time constraints, other than completing this study within the timeframe for graduation. Resource constraints included a lack of access to COPD client data from a variety of clinics for comparison; this limitation is further discussed in Chapter 5. For this reason, only one clinic in Northern Michigan was selected as the population of study. There were, therefore, limitations associated with the generalizability of the results generated from this study. The constraint of access to

COPD client data was reduced by using only one in Northern Michigan as the target population.

Methodology

Population

The target population included all patients with COPD that went to McLaren Lapeer Regional Medical Center, a clinic in Michigan, between the years 2017 and 2019. The target population included both male and female patients between 48 and 90 years old. The total number of patients with COPD in the clinic of study was 218, as this study was conducted in a single facility. After obtaining permission from McLaren Lapeer Medical Center and Walden University's Institutional Review Board (IRB), I collected deidentified, secondary data of all patients with COPD from McLaren Lapeer Medical Center. The sample population and procedures are further described in the following section.

Sampling and Sampling Procedures

This target population included 154 patients with COPD, 77 of which participated in pulmonary rehabilitation and 77 of which did not. Convenience and purposive sampling were used in the current study because the data available to the researcher were from one nearby clinic; only patients with a diagnosis of COPD were considered in this study. The sample size selected for this study was determined and supported with a power analysis conducted to calculate the required sample size based on the parameters for this study. The sampling and sampling procedures are further described below. The researcher first obtained approval from McLaren Lapeer to conduct the study; afterward,

the researcher gained approval from Walden University's IRB (approval number: 05-22-20-0602321). I did not work directly with any of the patients, and the data were anonymous. McLaren Lapeer provided the data without me ever meeting with participants. The inclusion criteria involved patients with a clinical diagnosis of COPD; half had participated in pulmonary rehabilitation, and half did not participate in pulmonary rehabilitation. Exclusion criteria included not expressing consent for me to use patient data, not having completed at least 30 days of pulmonary rehabilitation criteria, and not having been in posthospital treatment at the clinic for at least 30 days.

I conducted an a priori power analysis in G*Power to determine the required minimum sample size for the study. Four factors were considered in the power analysis: significance level, effect size, the power of the test, and statistical technique. The significance level, also known as Type I error, refers to the chance of rejecting a null hypothesis given that it is true (Creswell & Poth, 2017). Most quantitative studies make use of a 95% confidence level because it adequately provides enough statistical evidence of a test (Creswell & Poth, 2017). The effect size refers to the estimated measurement of the relationship between the variables being considered (Cohen, 1988). Cohen categorized effect size into small, medium, and large; a medium effect size strikes a balance between being too strict (small) and too lenient (large). The power of test refers to the probability of correctly rejecting a null hypothesis (Sullivan & Feinn, 2012). In most quantitative studies, 80% power is usually used (Sullivan & Feinn, 2012). I used G*Power to calculate the minimum sample size (Appendix A). When using hierarchical regression, in order to detect a medium effect size of $f^2 = 0.15$ at a 5% level of

significance, with 80% power, a minimum sample size of at least 55 participants is required. A sample of 128, therefore, would cover both minimum size requirements. To compensate for any cases that may be removed due to data cleaning, missing information, or outliers, a 20% increase was applied to the minimum sample size of 128. Thus, 26 additional individuals were sampled, bringing the minimum sample size to 154.

Procedures for Recruitment, Participation, and Data Collection

Participants for this study were not recruited; rather, I collected deidentified, secondary data from the McLaren Lapeer clinic in Michigan. Data included patient demographics, such as gender, age, race/ethnicity, in addition to patient participation in a pulmonary rehabilitation program, patient participation in a pulmonary rehabilitation program for at least 6 weeks, 30-day patient readmission rates, and cause for patient readmission. McLaren Lapeer did not share patient names or identifying information with me. The clinic in Michigan provided data on demographics and pulmonary rehabilitation completion to me through a password-protected Excel file. The data were then stored on a password-protected computer only available to me. I will delete the data file 7 years after the research is completed, and there will not be a follow-up to this study. For the duration of the 7-year period in which the data are retained, the data will be stored on a password-protected computer only available to me.

Instrumentation and Operationalization of Constructs

No instruments were used in this study. The predictor and criterion variables of this study, as well as demographics, were collected from the treatment clinic, as they

routinely collect this data for all of their patients. This study did not include any research instruments; therefore, there are no estimates of reliability and validity.

Data Analysis Plan

The data analysis first involved the cleaning of the data that has been collected, including the identification of any outliers or inconsistent data. All of the data were provided from McLaren Lapeer through a password-protected Excel file. I stored this file on a password-protected computer. I cleaned the data, which involved looking for data that seems erroneous (with values that do not apply) or missing data. I communicated with the clinic regarding any errors or missing data using Excel. The data from the Excel file were imported into SPSS to clean and troubleshoot the data and for statistical analyses. Following the cleaning of the data and import of the data into SPSS, basic descriptive statistics were generated, including the means, frequencies, and trends in the data. Descriptive analyses were also conducted to define the average, standard deviation, and ranges of the independent and dependent variables in this study. The data were examined to determine whether they met the assumptions of normality by conducting tests of normality and plotting the distributions of the variables in SPSS. I conducted statistical analyses to answer the following research questions:

Research Question 1: Is there a difference between readmission rates of patients with COPD who participate in 6 weeks of pulmonary rehabilitation compared to those who do not?

$H1_0$: There is no difference in the readmission rates of patients with COPD who participate in at least 6 weeks of pulmonary rehabilitation compared to those who do not.

$H1_a$: There is a difference in the readmission rates of patients with COPD who participate in at least 6 weeks of pulmonary rehabilitation compared to those who do not.

Research Question 2: Is there a relationship between age and 30-day readmission rates for patients admitted with COPD?

$H2_0$: There is no relationship between age and 30-day readmission rates for patients admitted with COPD.

$H2_a$: There is a relationship between age and 30-day readmission rates for patients admitted with COPD.

I conducted a simple linear regression analysis to determine the differences in readmission rates for patients with COPD that participate in at least 6 weeks of pulmonary rehabilitation versus patients with COPD that do not. A simple linear regression was on the outcome and each independent variable. Simple linear regression was used to test Research Question 1 regarding whether there are differences in COPD readmissions rates for patients that completed 6 weeks of pulmonary rehabilitation compared to those who did not. Simple linear regression was also used to test Research Question 2 regarding whether there is a significant predictive relationship between patient age and COPD readmissions rates. Lastly, I conducted a multiple linear regression to consider potential confounding variables and to determine the relationship between the

dependent variable and all independent variables. Multiple linear regression was used to enter demographic variables such as gender and comorbid disorders into the model to determine whether they impact COPD readmissions rates. Multiple linear regression was also used to explore adjusted odds ratios (ORs) and to answer the research questions more thoroughly. In the review of all statistical analyses, particularly in the simple linear regression and multiple linear regression, a p-value of <0.05 was used to determine statistical significance. Linear regression and multiple linear regression were appropriate based on the research questions, the continuous nature of the criterion variable, and the continuous and categorical predictor variables.

Threats to Validity

I did not anticipate any threats to external validity, internal validity, or construct validity because no instruments were utilized in this study. The variables involved in this study were strictly monitored by the clinic for all patients; therefore, the likelihood of error was low.

Ethical Procedures

I did not anticipate any ethical concerns for participants. Before collecting any data, I obtained written permission from McLaren Lapeer and the Walden University IRB. Informed consent was not needed in this study because I collected secondary data from the clinic, and no names or identifying information were used. There were no anticipated ethical concerns regarding recruitment or data collection procedures.

Summary

Through this quantitative study, I assessed the benefits of pulmonary rehabilitation on hospital readmissions for patients with COPD. Specifically, I determined whether there is a difference in readmission rates for patients with COPD who complete at least 6 weeks of pulmonary rehabilitation compared to those who do not complete any pulmonary rehabilitation. Additionally, I determined whether there is a significant relationship between age and readmission rates. The predictor variables in this study included participation—or lack thereof—in a 6-week pulmonary rehabilitation program and the age of COPD patients; 6 weeks was chosen because changes in well-being are estimated to emerge after 6 weeks (Shearer, 2009). The criterion variable included readmission rates for COPD patients. I obtained approval from McLaren Lapeer and the Walden University IRB before conducting this study and did not anticipate any ethical concerns because the data were anonymous and only accessible to me.

Chapter 4: Results

Introduction

The purpose of this quantitative study was to examine the benefits of pulmonary rehabilitation on hospital readmissions for COPD patients. To do this, I compared 30-day readmissions for COPD patients who completed a pulmonary rehabilitation program to the readmissions of those who did not complete a pulmonary rehabilitation program. Furthermore, because age may impact treatment and care received (Candrilli et al., 2015), I also examined whether age was significantly related to hospital readmission for COPD patients in one COPD facility. I statistically controlled for the demographic variables of sex and BMI..

Research Questions and Hypotheses

In this study, I focused on key variables related to readmissions for COPD patients. The research questions and hypotheses that guided this study were:

RQ1: Is there a difference between readmission rates of patients with COPD who participate in 6 weeks of pulmonary rehabilitation compared to those who do not?

$H1_0$: There is no difference in the readmission rates of patients with COPD who participate in at least 6 weeks of pulmonary rehabilitation compared to those who do not.

$H1_a$: There is a difference in the readmission rates of patients with COPD who participate in at least 6 weeks of pulmonary rehabilitation compared to those who do not.

RQ2: Is there a relationship between age and 30-day readmission rates for patients admitted with COPD?

$H2_0$: There is no relationship between age and 30-day readmission rates for patients admitted with COPD.

$H2_a$: There is a relationship between age and 30-day readmission rates for patients admitted with COPD.

To answer the questions and test the hypotheses, I employed a quantitative research design and conducted linear regression analysis to test whether the independent variables were related to the dependent variables, while controlling for demographic variables. In this chapter, I present the descriptive statistics of the variables of interest and examines the data and test of assumptions for all variables. Next, I present the results from the linear regressions. A summary of the results concludes the chapter.

Data Collection

I collected the data used for this study from McLaren Lapeer clinic between 2017 and 2019. Due to the collection of secondary hospital data, no recruitment methods were used during this study. The targeted population included any patients with COPD who went to McLaren Lapeer Medical Center, a clinic in Michigan, between the years 2017 and 2019. Data were collected from 253 patients with COPD. This met the criteria for the minimum sample requirements to detect an effect, because the sample was greater than 128. Specifically, the final sample for this study included 51 COPD patients who participated in pulmonary rehabilitation and 202 COPD patients who did not participate in pulmonary rehabilitation.

Results

Descriptive Statistics

The participants included 253 patients with COPD who went to McLaren Lapeer Medical Center, a clinic in Michigan, between years 2017 and 2019. Of this sample, 44 had readmission rates greater than the targeted 30 days, leaving a final sample of 209 (21.5% completed 6 weeks of pulmonary rehabilitation). In the sample, 53.1% were female and 46.9% were male. For BMI, 12 (5.7%) patients had a BMI less than 18.50, while 82 (39.2%) patients had a BMI of 30 or above. In addition, about 12% of the sample were readmitted within 30 days. Table 2 below presents the characteristics of the sample. The average days to readmission for the total sample was 1.86 (*SD* = 5.72). Assessing only those who were readmitted, the average days to readmission was 15.52 (*SD* = 7.92).

Table 2

Descriptive Statistics for the Continuous Dependent and Independent Variables

Variable	*N*	Mean	Std. Deviation	Minimum	Maximum
Readmission (Total Sample)	209	1.86	5.72	0.000	30.00
30-day Readmitted Patients	25	15.52	7.92	3.00	30.00
Age (Years)	209	69.70	9.45	47.00	96.00
BMI (kg/m^2)	209	29.28	8.24	15.40	58.70

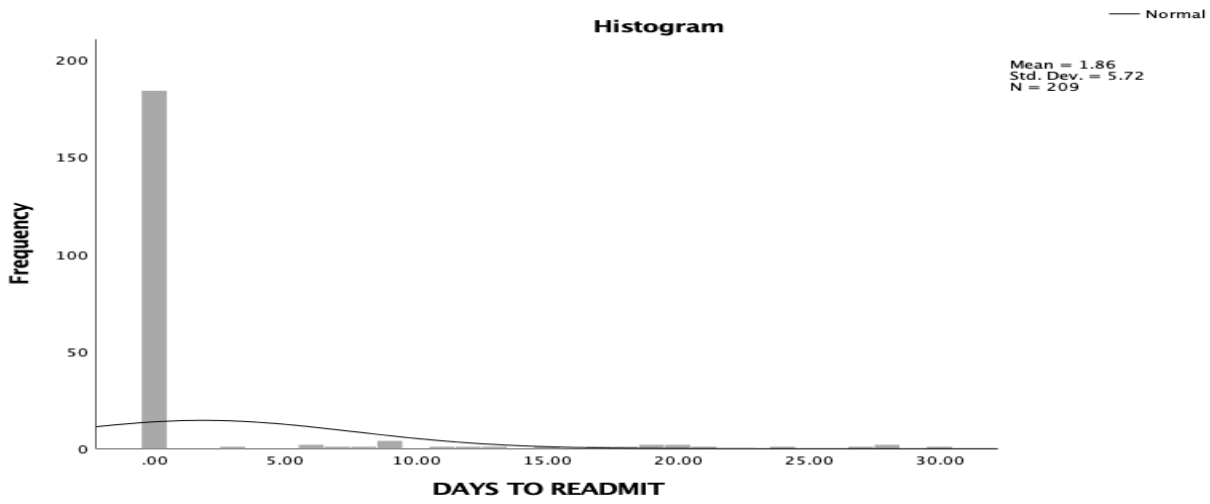
Testing Assumptions

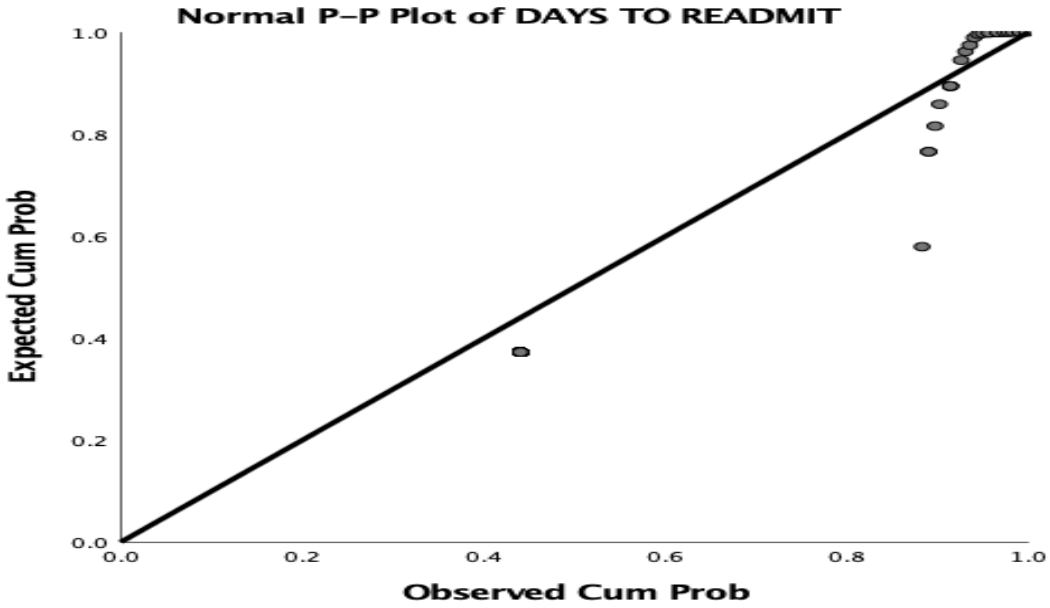
I answered the research questions using linear regression analysis. There are four assumptions of linear regression: normality, homoscedasticity, independence, and linearity (Cohen et al., 2003). There was only one predictor variable in the simple linear regression models; therefore, the assumptions of multicollinearity and independence were

met. Multicollinearity and independence for the multiple regression model are discussed below. To examine normality of the dependent variables, I examined the histogram and P-P plot for readmission rate (see Figure 2). Figure 2 illustrates that the readmission rate was positively skewed, and the Shapiro-Wilks was also significant (W = .37, $p < .001$), suggesting nonnormality. A logarithm transformation (log10) of the data did not reveal a normally distributed dependent variable. Thus, I concluded that logarithmic transformation was inappropriate for the present analysis.

Figure 2

Histogram and P-P Plot for Readmission Rate





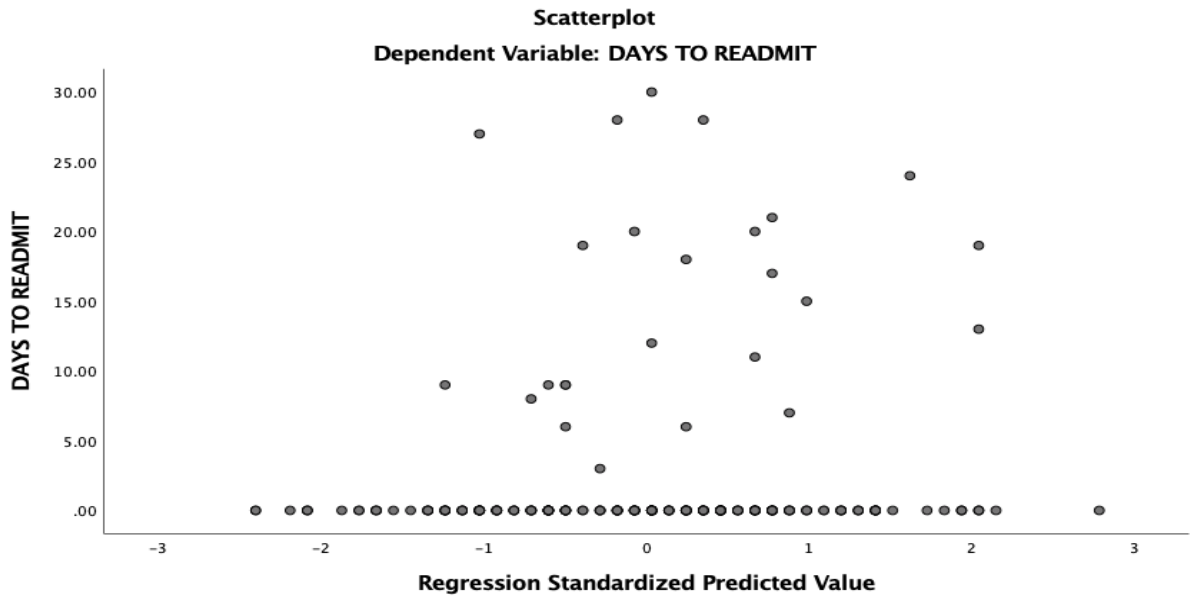
To test the assumption of multicollinearity, I tested the variance inflation factor (VIF) amongst the independent variables in the multiple regression model. A VIF value greater than 10 suggests a violation of multicollinearity (Cohen et al., 2003). The VIF values ranged from 1.003 to 1.034. Thus, I concluded that the assumption of multicollinearity was met.

To test the assumption of independence, I evaluated the Durbin-Watson value for the residuals for the independent variables. The Durbin-Watson value was 1.41, which is within the range for acceptability (values should be close to 2; see Cohen et al., 2003). Based on these results, I determined that the assumption of independence was met.

To test the assumption of linearity, I examined scatterplots of the continuous independent variable (Age) against Readmission Rate (Log Transformed). The scatterplot did not follow a linear pattern (see Figure 3); therefore, the assumption of linearity was not met.

Figure 3

Scatterplots for Linearity Test of Assumption for Age



Given the lack of normality and linearity for the independent and dependent variables, I selected robust linear regression to analyze the data, as this method is designed to overcome violations of assumptions and are not sensitive to outliers (Andersen, 2008).

Simple Linear Regression

First, each independent variable was evaluated separately on readmission rates. To investigate whether sex predicts the readmission rates of COPD patients, I conducted a simple linear regression with readmission rates as the dependent variable and sex as the independent variable. The results of the linear regression were not significant, at $F(1, 207) = 1.141$ and $p = .287$, with an R^2 of 0.005. This indicates that sex ($B = -.847$, $p = .287$) did not contribute significantly to the model.

To investigate whether age predicts the readmission rates of COPD patients, I conducted a simple linear regression with readmission rates as the dependent variable and age as the independent variable. The results of the linear regression were not significant, at $F(1, 207) = 1.966$ and $p = .162$, with an R^2 of 0.009. This indicates that age ($B = .059$, $p = .162$) did not contribute significantly to the model.

To investigate whether BMI predicts the readmission rates of COPD patients, I conducted a simple linear regression with readmission rates as the dependent variable and BMI as the independent variable. The results of the linear regression were not significant, at $F(1, 207) = .028$ and $p = .867$, with an R^2 of 0.000. This indicates that BMI ($B = -.008$, $p = .867$) did not contribute significantly to the model.

To investigate whether 6 weeks of pulmonary rehabilitation predicts the readmission rates of COPD patients, I conducted a simple linear regression with readmission rates as the dependent variable and pulmonary rehabilitation as the independent variable. The results of the linear regression were not significant, at $F(1, 207) = 0.002$ and $p = .964$, with an R^2 of 0.000. This indicates that pulmonary rehabilitation ($B = -.044$, $p = .964$) did not contribute significantly to the model. Table 3 summarizes the results of the simple linear regressions.

Table 3

Summary of Simple Linear Regressions with Independent Variables Predicting Readmission Rates of COPD Patients

Variable	B	SE	β	*t*	*p*
(Constant)	2.306	.578		3.992	.000
Sex	-.847	.793	-.074	-1.068	.287
(Constant)	-2.234	2.944		-.759	.449
Age	.059	.042	.097	1.402	.162

(Constant)	2.094	1.468		1.427	.155
BMI	-.008	.048	-.012	-.168	.867
(Constant)	1.866	.448		4.167	.000
Pulmonary Rehabilitation	-.044	.965	-.003	-.045	.964

Multiple Linear Regression

Next, I conducted a two-step hierarchical multiple regression to evaluate whether age and 6 weeks of pulmonary rehabilitation predicted readmission rates of COPD patients, while controlling for sex and BMI. In Step 1 of the model, I conducted the multiple regression with sex and BMI as covariates and readmission rates of COPD patients as the dependent variable. The results of the regression for Step 1 indicated that the model was not significant for sex and BMI on readmission rates of COPD patients, at $F(2, 206) = .574$ and $p = .564$, with an R^2 of 0.006.

In Step 2, I determined that adding age and pulmonary rehabilitation to the regression model explained an additional 0.3% of variance in readmission rates of COPD patients; however, the change in R^2 was not significant, at $Fchange(2, 204) = 0.983$ and $p = .376$. The overall omnibus test for the Model in Step 2 was also not significant, at $F(4, 204) = .778$ and $p = .540$, with an R^2 of .015, suggesting that the final model was not significantly different than 0. This suggests that the data analysis did not support age or pulmonary rehabilitation to predict readmission rates of COPD patients after controlling for demographic and personal factors (sex and BMI). Table 4 summarizes the results of the hierarchical multiple regression model.

Table 4

Summary of Hierarchal Multiple Regression for Variables Predicting Readmission Rates of COPD Patients

	Model 1			Model 2		
Variable	B	SE	β	B	SE	β
(Constant)	2.461	1.508		-1.938	3.515	
Sex	-.842	.796	-.074	-.837	.796	-.073
BMI	-.005	.048	-.008	.004	.049	.005
Age				.060	.043	.099
Pulmonary Rehabilitation				-.223	.978	-.016
R^2		.006			.015	
F for Change in R^2					.983	

*$p < .05$. **$p < .01$

Summary

In this chapter, I presented the results after testing the central hypothesis of this study, which was that age and pulmonary rehabilitation would influence the readmission rates of COPD patients. The results of the data analysis did not support age or pulmonary rehabilitation to predict readmission rates of COPD patients. In addition, I concluded that demographic and personal factors (i.e., sex and BMI) did not influence the rate of readmission of COPD patients. In Chapter 5, I provide a detailed summary of the analysis results, discusses the potential contributions of this study, and presents theoretical and practical implications, limitations, and future directions based on the findings.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this quantitative study was to examine the benefits of pulmonary rehabilitation on hospital readmissions for COPD patients. To achieve this, I compared 30-day readmissions for COPD patients who completed a pulmonary rehabilitation program to the readmissions of those who did not complete a pulmonary rehabilitation program. I included age and other relevant demographics—such as gender, weight, and BMI—in the analysis to determine the likelihood of readmission. Pulmonary rehabilitation is designed to improve the physical and psychological conditions of people with chronic respiratory disease and can involve exercise training, education, and behavior changes (Man et al., 2015). Pulmonary rehabilitation is only offered to a small amount of COPD patients and may or may not be a key component of readmissions (Casaburi, 2018). The lack of rehabilitation options proves to be problematic as pulmonary rehabilitation may be influential in decreasing readmissions (Alshabanat et al., 2017). COPD readmissions can be expensive for the hospital and can decrease patient health (Crisafulli et al., 2008; Pruitt, 2018). In this chapter, I interpret the findings by comparing them to the conclusions outlined in the previous body of literature.

Interpretation of the Findings

Before analysis of Research Question 1, I performed a simple linear regression analysis of BMI readmission rates of COPD patients to understand whether individual factors influenced the rate of readmission for COPD patients. From this analysis, I found that BMI was not significantly associated with COPD readmissions.

The first research question asked whether there was a difference between readmission rates of patients with COPD who participated in 6 weeks of pulmonary rehabilitation compared to those who did not. The results of the analysis were that there was no statistically significant relationship between the two groups. The existing literature highlighted the importance of COPD treatment in reducing readmissions, thereby the results of this study differ from previous findings. Previously, Rajput and Banerjee (2017) and Lewko et al. (2014) supported the importance of pulmonary rehabilitation. Rehabilitation treatments such as pharmacotherapy, physical activity, improvement of body compensation, and advanced care planning should all be beneficial to reducing readmissions for a COPD patient (Farias et al., 2014; Hill et al., 2013; McCarthy et al., 2015). The results of Research Question 1 in this study indicated no significant association between pulmonary rehabilitation and COPD readmissions. It is unknown whether a specific type of pulmonary rehabilitation may have changed the results, but as a whole, rehabilitation did not influence COPD readmission.

Research Question 2 asked whether there was a relationship between age and 30-day readmission rates for patients admitted with COPD. I determined that there was not a statistically significant relationship between age and 30-day readmission rates for patients with COPD. These data allow for acceptance of the null hypothesis in this study. In the literature reviewed in Chapter 2, I identified that some researchers had found a significant relationship between age and COPD. When focusing on age and COPD, Shearer (2009) indicated that adult health becomes more complicated as one gets older because the elderly are more prone to vulnerable diseases, have a decreased ability to live

independently, have coexisting health issues, and are less aware of their medical resources. The CDC (2018) stated that those over the age of 65 years have the highest risk for COPD and readmissions, in comparison to other age groups. However, this investigation did not find a relationship between age and readmission rates. Because the literature is undecided on the importance of pulmonary rehabilitation to COPD readmissions, the importance of addressing the role of pulmonary rehabilitation as it relates to hospital readmission remains.

The mixed findings from the literature, when compared to the findings of this study, indicate that pulmonary rehabilitation may have no influence on COPD and that age is also a questionable variable when it comes to readmission rate. The results of the current study, therefore, indicate that age nor BMI should be a priority for COPD treatment to reduce readmissions. Additionally, less emphasis should be placed on pulmonary rehabilitation as a whole assessing reduction in COPD readmissions. Instead, other variables that have not been examined within this study may have a greater influence on COPD readmissions.

Limitations

There were numerous limitations for the study. The first limitation was my selection of a nonexperimental design, limiting his ability to make casual claims (Blundell & Costa Dias, 2000). Additionally, this study was quantitative instead of qualitative. A qualitative design could have offered insight into patients' or doctors' views into health empowerment and COPD treatment along with readmission rates. Another limitation was the geographic range; the data were gathered and collected from

one site, meaning that transferability to other hospitals may be limited. This offers the opportunity for future researchers to compare results between locations. Lastly, the variables selected from the study may have limited the results of the study. By including other variables such as other medical conditions, pre-existing conditions, and treatment options, the findings of the research may have changed.

Recommendations

The first recommendation for future research would be to change the methodology from quantitative to mixed-methods. A mixed-methods approach to the study opens up new research avenues, such as the use of health empowerment theory to understand the thoughts and feelings of the participants regarding COPD recovery and readmissions. When dealing with the participants own opinion/perspective, there is a potential for bias. An additional option for future research would be a take the study to multiple hospitals in various geographic areas. Urban areas may have different results than rural; therefore, it is important to understand these differences. Furthermore, by expanding the scope of the research, scholars could evaluate the transferability of the study findings between areas.

The discrepancies between previous scholarly findings and this study's results, and the lack of certain variables in the body of literature, also present opportunities for further investigation. The first pathway for future research would be to study the variables not necessarily covered in the literature. Variables such as BMI and gender had minimal references in the literature review. Extending the literature research for age and

BMI might shed light on the phenomenon. It would also be beneficial to compare the results of this study and other existing ones.

One variable not included within the study was underlying health conditions. COPD is affected by other diseases (Shearer, 2009). Another variable to be studied is whether patients practice the doctors' instructions upon discharge. Studying self-efficacy, family support, and following the doctor's orders could all offer an opportunity to shine further light on the health problem.

Implications

Positive Social Change

While there were no statistically significant relationships between the selected variables, there are implications for positive social change at the individual, organizational, and theoretical level. At the individual level, the first suggestion is to limit the use of 6 weeks of pulmonary rehabilitation for COPD and focus on other treatments. As mentioned in the literature review, it is imperative to practice a high degree of self-efficiency when dealing with this disease. The literature contained information expanding patient knowledge to help limit readmission rates. Additionally, following exercises and doctor's orders could also reduce COPD readmission. Age should also not be considered when prioritizing patients with COPD. Instead, doctors should look at other co-variates to determine the proper course of action.

Due to the lack of statistical significance for both questions, there are some implications at the organizational level. Health organizations such as hospitals should invest less money into pulmonary rehabilitation programs and should instead focus on

imparting health knowledge to the patient upon discharge. By reducing investments into COPD rehabilitation, this money could support the implementation of other, more proven methods, thereby lowering health costs. Previous researchers have indicated that an increase of knowledge and self-efficiency help decrease readmission rates; therefore, it is the doctor's prerogative to impart the necessary knowledge and information to the patient to help reduce the chances of readmission. Health organizations should also focus on the severity of the disease itself and not prioritize those of greater age.

Theoretical Implications

Health empowerment theory was strongly supported by the literature; however, it was a difficult fit to link them to the results of this study. It was uncovered that through health empowerment theory, patients should maintain knowledge of COPD, follow the doctor's orders, practice self-efficiency, and have caregiver support to reduce 30-day admissions. Health empowerment theory largely came into play to determine whether there is a difference between readmission rates of patients who participated in 6 weeks of pulmonary rehabilitation and those who did not. While there was no significant relationship, the theory aligned with the literature about treatment options which could improve health conditions and reduce readmissions. Health empowerment theory, therefore, should not be limited within the confined treatment of this study and instead be used with other treatments.

Conclusion

Through this study, I aimed to investigate the benefits of pulmonary rehabilitation on hospital readmissions for COPD patients in one facility. Currently, the existing

literature is lacking quantitative studies involving patients with COPD from the United States in pulmonary rehabilitation that controls for multiple variables. Future researchers could benefit by a change to a mixed methods approach to utilize health empowerment theory to understand the perceptions of the patients' time in COPD recovery. By focusing on the participants' perceptions along with hard data, positive and negative behaviors may be determined. While I did not identify any statistically significant relationships, I suggest several opportunities for positive social change, such as an investment into other more proven methods of COPD treatment. Despite the lack of statistical significance, the results provide actionable insights to improve the treatment of COPD patients.

References

Alexopoulos, E. C. (2010). Introduction to multivariate regression analysis. *Hippokratia, 14*(Suppl 1), 23–28. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3049417

Alshabanat, A., Otterstatter, M. C., Sin, D. D., Road, J., Rempel, C., Burns, J., & FitzGerald, J. (2017). Impact of a COPD comprehensive case management program on hospital length of stay and readmission rates. *International Journal of Chronic Obstructive Pulmonary Disease*, *12*, 961–971. https://doi.org/10.2147/COPD.S124385

American Academy of Respiratory Care. (2007). *Clinical practice guidelines.* https://www.aarc.org/resources/clinical-resources/clinical-practice-guidelines/

Amin, A. (2015). *Best practices between formulary managers and pharmacists to address challenges in COPD readmissions.* http://formularyjournal.modernmedicine.com/formulary-journal/news/blog-best-practices-between-formulary-managers-and-pharmacists-address-challenges-copd-readmissions?page=full.

Andersen, R. (2008). *Modern methods for robust regression.* Sage.

Ansari, S., Hosseinzadeh, H., Dennis, S. M., & Zwar, N. A. (2017). Empowerment of primary care patients with chronic obstructive pulmonary disease (COPD) in the context of multi-morbidity by tailored self-management education in Sydney, Australia. In *The revolving door: COPD hospitalization and readmission* (pp. A7004-A7004). American Thoracic Society.

Apps, M., Mukherjee, D., Abbas, S., Minter, J., & Whitfield, J. (2016). Integration of hospital and community COPD services including pulmonary rehabilitation can improve patient care and reduce hospital stays. *1.2 Rehabilitation and Chronic Care*. https://doi.org/10.1183/13993003.congress-2016.pa3737

Baker, C. L., Zou, K. H., & Su, J. (2013). Risk assessment of readmissions following an initial COPD-related hospitalization. *International Journal of Chronic Obstructive Pulmonary Disease, 8*, 551-559. https://doi.org/10.2147/COPD.S5150

Benavides, V., & Wilches, E. (2017). BODE index score changes before and after pulmonary rehabilitation. *European Respiratory Journal, 50*, PA3726. https://doi.org/10.1183/1393003.congress-2017.PA3726

Bhatt, S. P., Patel, S. B., Anderson, E. M., Baugh, D., Givens, T., Schumann, C., … Dransfield, M. T. (2018). Video Telehealth Pulmonary Rehabilitation Intervention in COPD Reduces 30-Day Readmissions. B93. COPD: MORTALITY AND RISK PREDICTION. https://doi.org/10.1164/ajrccm-conference.2019.199.1_meetingabstracts.a7376

Blundell, R., & Costa Dias, M. (2005). Evaluation Methods for Non-Experimental Data. Fiscal Studies, 21(4), 427–468. https://doi.org/10.1111/j.1475-5890.2000.tb00031.x

Bourbeau, J., Alsowayan, W., & Wald, J. (2018). Self-management in pulmonary rehabilitation. In (*Textbook of pulmonary rehabilitation* pp. 217-232). Springer.

Candrilli, S. D., Dhamane, A. D., Meyers, J. L., & Kaila, S. (2015). Factors associated with inpatient readmission among managed care enrollees with COPD. *Hospital Practice, 43*(4), 199-207. https://doi.org/10.1080/21548331.2015.1085797

Casaburi, R. (2018). Pulmonary rehabilitation: Where we've succeeded and where we've failed. *COPD: Journal of Chronic Obstructive Pulmonary Disease, 15*(3), 219-222. https://doi.org/10.1080/15412555.2018.1503245

Centers for Disease Control and Prevention. (2018). *Chronic obstructive pulmonary disease.* https://www.cdc.gov/copd/basics-about.html

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Erlbaum.

Creswell, J. W., & Poth, C. N. (2017). *Qualitative inquiry and research design: Choosing among five approaches*. SAGE.

Crisafulli, E., Costi, S., Luppi, F., Cirelli, G., Cilione, C., Coletti, O., Fabbri, L., & Clini, E. M. (2008). Role of comorbidities in a cohort of patients with COPD undergoing pulmonary rehabilitation. *Thorax, 63*(6), 487-492. https://doi.org/10.1136/thx.2007.086371

Farias, C. C., Resqueti, V., Dias, F. A., Borghi-Silva, A., Arena, R., & Fregonezi, G. A. (2014). Costs and benefits of pulmonary rehabilitation in chronic obstructive pulmonary disease: A randomized controlled trial. *Brazilian Journal of Physical Therapy, 18*(2), 165-173. https://doi.org/10.1590/s1413-35552012005000151

Feemster, L. C., & Au, D. H. (2014). Penalizing hospitals for chronic obstructive pulmonary disease readmissions. *American Journal of Respiratory & Critical Care Medicine*, *189*(6), 634-639. https://doi.org/10.1164/rccm.201308-1541PP.

Fotoukian, Z., Shahboulaghi, F. M., Fallahi-Khoshknab, M., & Pourhabib, A. (2017). The empowerment of elderly patients with chronic obstructive pulmonary disease: Managing life with the disease. *PloS One, 12*(4), e0174028.

Fotoukian, Z., Shahboulaghi, F. M., Khoshknab, M. F., & Mohammadi, E. (2014). Concept analysis of empowerment in old people with chronic diseases using a hybrid model. *Asian Nursing Research, 8*(2), 118-127. https://doi.org/10.1016/j.anr.2014.04.002

Franssen, F. M., & Rochester, C. L. (2014). Comorbidities in patients with COPD and pulmonary rehabilitation: Do they matter? *European Respiratory Review, 23*(131), 131-41. http://err.ersjournals.com/content/errev/23/131/131.full.pdf

Garvey, C. (2015). Impact of pulmonary rehabilitation on readmission and cost in a community hospital setting. In *Recent developments in pulmonary rehabilitation: Broadening the scope* (pp. A2011-A2011). American Thoracic Society.

Gonya, J., Martin, E., McClead, R., Nelin, L., & Shepherd, E. (2014). Empowerment programmed for parents of extremely premature infants significantly reduced length of stay and readmission rates. *Acta Paediatrica, 103*(7), 727-731.

Grealish, A., Tai, S., Hunter, A., Emsley, R., Murrells, T., & Morrison, A. P. (2017). Does empowerment mediate the effects of psychological factors on mental health, well-being, and recovery in young people? *Psychology and Psychotherapy: Theory, Research and Practice, 90*(3), 314-335. https://doi.org/10.1111/papt.12111

Güell, M. R., Cejudo, P., Ortega, F., Puy, M. C., Rodríguez-Trigo, G., Pijoan, J. I., Martinez-Indart, L., Gorostiza, A., Bdeir, K., Celli, B., & Galdiz, J. B. (2017). Benefits of long-term pulmonary rehabilitation maintenance program in patients with severe chronic obstructive pulmonary disease: Three-year follow-up. *American Journal of Respiratory and Critical Care Medicine, 195*(5), 622-629. https://doi.org/10.1164/rccm.201603-0602OC

Hill, K., Vogiatzis, I., & Burtin, C. (2013). The importance of components of pulmonary rehabilitation, other than exercise training, in COPD. *European Respiratory Review, 22*(129), 405-13. https://doi.org/10.1183/09059180.00002913

Holt, T. (2013). COPD management: Avoiding readmissions due to acute exacerbation. *RT: The Journal for Respiratory Care Practitioners*, 26(11), 12-15.

Jacquinet, M., Curado, H., Nobre, Â. L., Sousa, M. J., Arraya, M., Pimenta, R., & Martins, A. E. (2018). Management of tacit knowledge and the issue of empowerment of patients and stakeholders in the health care sector. In *Health care delivery and clinical science: Concepts, methodologies, tools, and applications* (pp. 1122-1146). IGI Global.

Jiang, X., Park, H., Xiao, H., & Segal, R. (2017). Trends in readmission rates and hospital charges for patients with chronic obstructive pulmonary disease (COPD) in Florida from 2009 to 2014. *International Society for Pharmoeconomics and Outcomes.* https://www.ispor.org/research_pdfs/55/pdffiles/CS1.pdf

Kargiannakis, M., Fitzsimmons, D. A., Bentley, C. L., & Mountain, G. A. (2017). Does telehealth monitoring identify exacerbations of chronic obstructive pulmonary disease and reduce hospitalizations? An analysis of system data. *JMIR Medical Informatics*, *5*(1), e8.

Kashani, M. D., Eliasson, A. H., Walizer, E. M., Fuller, C. E., Engler, R. J., Villines, T. C., & Vernalis, M. N. (2015). Early empowerment strategies boost self-efficacy to improve health outcomes. *Circulation: Cardiovascular Quality and Outcomes, 8*, A331.

Kim, S. J., Park, E. C., Han, K. T., Kim, S. J., & Kim, T. H. (2016). Nurse staffing and 30-day readmission of chronic obstructive pulmonary disease patients: A 10-year retrospective study of patient hospitalization. *Asian Nursing Research*, *10*(4), 283–288.

Ko, F. W., Chan, K. P., Tam, W., Wong, I., Chan, T. O., Ip, A., & Hui, D. S. C. (2018). Short-course pulmonary rehabilitation and exacerbations and activity of COPD patients over 1 year. *European Respiratory Journal*. https://doi.org/10.1183/13993003.congress-2018.PA3353

Lau, C. S. M., Siracuse, B. L., & Chamberlain, R. S. (2017). Readmission after COPD exacerbation scale: Determining 30-day readmission risk for COPD patients. *International Journal of COPD, 12*. https://doi.org/10.2147/COPD.S136768

Lee, D. K. (2005). Pulmonary rehabilitation and readmissions in COPD: Hospital readmissions did not fall. *British Medical Journal, 330*(7489), 480. https://doi.org/10.1136/bmj.330.7489.480-a

Lewko, A., Bidgood, P. L., Jewell, A., & Garrod, R. (2014). Evaluation of multidimensional COPD-related subjective fatigue following a pulmonary rehabilitation program. *Respiratory Medicine, 108*(1), 95-102. https://doi.org/10.1016/j.rmed.2013.09.003

Maddocks, M., Kon, S. S., Canavan, J. L., Jones, S. E., Nolan, C. M., Labey, A., Polkey, M. I., & Man, W. D. (2016). Physical frailty and pulmonary rehabilitation in COPD: A prospective cohort study. *Thorax, 71*(11), 988-95. http://thorax.bmj.com/content/thoraxjnl/early/2016/06/06/thoraxjnl-2016-208460.full.pdf

Maddocks, M., Kon, S. S., Singh, S. J., & Man, W. D. C. (2015). Rehabilitation following hospitalization in patients with COPD: Can it reduce readmissions? *Respirology, 20*(3), 395-404.

Man, W. D.-C., Puhan, M. A., Harrison, S. L., Jordan, R. E., Quint, J. K., & Singh, S. J. (2015). Pulmonary rehabilitation and severe exacerbations of COPD: Solution or white elephant? *ERJ Open Research*, *1*(2), 1-10.

McCarthy, B., Casey, D., Devane, D., Murphy, K., Murphy, E., & Lacasse, Y. (2015). Pulmonary rehabilitation for chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews, 2.*

Meis, J. J., Bosma, C. B., Spruit, M. A., Franssen, F. M., Janssen, D. J., Teixeira, P. J., Augustin, I. M. L., Wouters, E. F. M., de Vries, N. K., Schols, A. M. W. J., & Kremers, S. P. (2014). A qualitative assessment of COPD patients' experiences of pulmonary rehabilitation and guidance by healthcare professionals. *Respiratory Medicine, 108*(3), 500-510. http://www.resmedjournal.com/article/S0954-6111(13)00442-3/fulltext

Melnyk, B. M., Alpert-Gillis, L., Feinstein, N. F., Crean, H. F., Johnson, J., Fairbanks, E., Small, L., Rubenstein, J., Slota, M., & Corbo-Richert, B. (2004). Creating opportunities for parent empowerment: Program effects on the mental health/coping outcomes of critically ill young children and their mothers. *Pediatrics, 113*(6), e597-e607.

Ni, H., & Xu, J. (2016). COPD-related mortality by sex and race among adults aged 25 and over: United States, 2000–2014. *Age, 65*(84), 45-64. https://pdfs.semanticscholar.org/3e98/5bb813ad1a3e6013447dfb95aa146ebc8fe9.pdf

Park, C., Song, M., Cho, B., Lim, J., Song, W., Chang, H., & Park, Y. H. (2015). Effects of a multi-disciplinary approached, empowerment theory based self-management intervention in older adults with chronic illness. *Journal of Korean Academy of Nursing, 45*(2), 192-201. https://doi.org/10.4040/jkan.2015.45.2.192

Perhar, P. S., Singhal, P., Singhal, S., Perhar, H., Sharma, A., & Sharma, H. (2015). A comparative study of Bode Index in patients with moderate to severe COPD, with and without pulmonary rehabilitation programme. *International Journal of Contemporary Medical Research, 4*, 591-594. https://www.ijcmr.com/

PN Medical. (2016). *How RMT could reduce hospital readmission rates in COPD patients.* https://www.pnmedical.com/2016/11/17/how-rmt-could-reduce-hospital-readmission-rates-in-copd-patients/

Postolache, P., Pop, C. S., Nemes, R. M., & Nitu, F. M. (2015). Pulmonary rehabilitation in COPD. *Archives of the Balkan Medical Union, 50*(2), 262-267. http://umbalk.org/reviews/2015/UMB

Pride, N. B., & Soriano, J. B. (2002). Chronic obstructive pulmonary disease in the United Kingdom: Trends in mortality, morbidity, and smoking. *Current Opinions in Pulmonary Medicine, 8*(1), 95–101.

Pruitt, B. (2018). Preventing COPD readmissions: Factors that influence success: Many factors have been shown to affect 30-day COPD readmissions and some hospitals have shown success in reducing their rates. *RT for Decision Makers in Respiratory Care, 31*(1), 18-22.

Rajput, S., & Banerjee, S. (2017). Effectiveness of a community based pulmonary rehabilitation (PR) programme for patients with chronic obstructive pulmonary disease (COPD): A retrospective review. *European Respiratory Journal, 40*, PA763. https://doi.org/10.1183/1393003.congress-2017.PA763

Rinne, S. T., Castaneda, J., Lindenauer, P. K., Cleary, P. D., Paz, H. L., & Gomez, J. L. (2017). Chronic obstructive pulmonary disease readmissions and other measures of hospital quality. *American Journal of Respiratory and Critical Care Medicine, 196*(1). https://doi.org/10.1164/rccm.201609-1944OC

Rochester, C. L., Vogiatzis, I., Holland, A. E., Lareau, S. C., Marciniuk, D. D., Puhan, M. A., Spruit, M. A., Masefield, S., Casaburi, R., Clini, E. M., Crouch, R., Garcia-Aymerich, J., Garvey, C., Goldstein, R. S., Hill, K., Morgan, M., Nici, L., Pitta, F., Ries, A. L., …ZuWalack, R. L. (2015). An official American Thoracic Society/European Respiratory Society policy statement: Enhancing implementation, use, and delivery of pulmonary rehabilitation. *American Journal of Respiratory and Critical Care Medicine, 192*(11), 1373-1386. https://www.atsjournals.org/doi/pdf/10.1164/rccm.201510-1966ST

Sak, G., Rothenfluh, F., & Schulz, P. J. (2017). Assessing the predictive power of psychological empowerment and health literacy for older patients' participation in health care: A cross-sectional population-based study. *BMC Geriatrics, 17*(1), 59. https://doi.org/10.1186/s12877-017-0448-x

Schwab, P., Dhamane, A. D., Hopson, S. D., Moretz, C., Annavarapu, S., Burslem, K., Renda, A., & Kaila, S. (2017). Impact of comorbid conditions in COPD patients on health care resource utilization and costs in a predominantly Medicare population. *International Journal of Chronic Obstructive Pulmonary Disease, 12*, 735. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5327909/

Setia, M. S. (2016). Methodology series module 3: Cross-sectional studies. *Indian Journal of Dermatology, 61*(3), 261-64. https://doi.org/10.4103/0019-5154.182410

Shah, T., Churpek, M. M., Coca Perraillon, M., & Konetzka, R. T. (2015). Understanding why patients with COPD get readmitted: A large national study to delineate the Medicare population for the readmission penalty expansion. *Chest*, *147*(5), 1219–1226.

Shah, T., Press, V. G., Huisingh-Scheetz, M., & White, S. R. (2016). COPD readmissions: addressing COPD in the era of value-based health care. *Chest, 150*(4), 916-926. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5812767/

Shearer, N. B. C. (2009). Health empowerment theory as a guide for practice. *Geriatric Nursing, 30*(2), 4-10. https://doi.org/10.1016/j.gerinurse.2009.02.003

Shearer, N. B. C., Fleury, J., Ward, K. A., & O'Brien, A. M. (2012). Empowerment interventions for older adults. *Western Journal of Nursing Research, 34*(1), 24-51. https://journals.sagepub.com/home/wjn

Shin, D. S., Kim, C. J., & Choi, Y. J. (2016). Effects of an empowerment program for self-management among rural older adults with hypertension in South Korea. *Australian Journal of Rural Health, 24*(3), 213-219. https://doi.org/10.1111/ajr.12253

Shin, S., & Park, H. (2017). Effect of empowerment on the quality of life of the survivors of breast cancer: The moderating effect of self-help group participation. *Japan Journal of Nursing Science, 14*(4), 311-319. https://doi.org/10.1111/jjns.12161

Sievi, N. A., Senn, O., Brack, T., Brutsche, M. H., Frey, M., Irani, S., Leuppi, J. D., Thurnheer, R., Franzen, D., Kohler, M., & Clarenbach, C. F. (2015). Impact of comorbidities on physical activity in COPD. *Respirology, 20*(3), 413-418. https://doi.org/10.1111/resp.12456

Son, H., & Kim, G. S. (2017). Health empowerment of older adults with high-risk of cardio-cerebrovascular diseases. *Journal of Korean Academy of Community Health Nursing, 28*(4), 410-420. https://doi.org/10.12799/jkachn.2017.28.4.410

StatSoft, Inc. (2013). *Electronic statistics textbook*. StatSoft.

Sullivan, G. M., & Feinn, R. (2012). Using effect size—or why the *p* value is not enough. *Journal of Graduate Medical Education, 4*(3), 279-82. https://doi.org/10.4300/JGME-D-12-00156.1

Thakur, R. D. (2017). Feasibility study of the health empowerment intervention to evaluate the effect on self-management, functional health, and well-being in older adults with heart failure [Doctoral dissertation, Arizona State University]. https://repository.asu.edu/attachments/181233/content/Thakur_asu_0010E_16673.pdf

Tran, M., Xiang, P., Rascati, K. L., Stock, E. M., Godley, P. J., Coleman, A., Bogart, M. R., & Stanford, R. H. (2016). Predictors of appropriate pharmacotherapy management of COPD exacerbations and impact on 6-month readmission. *Journal of Managed Care & Specialty Pharmacy, 22*(10), 1186-1193.

Van Eeden, S. F., Bartels, W., Adamson, S. L., Leung, L., & Sin, D. D. (2018). Emergency department management of acute exacerbations of chronic obstructive pulmonary disease (AECOPD): Factors predicting readmission. In *Determinants of outcomes and high-value care in COPD* (pp. A2505-A2505). American Thoracic Society.

Watanabe, N., Kaneko, A., Yamar, S., Taleo, G., Tanihata, T., Lum, J. K., Larson, P. S., & Shearer, N. B. (2015). A prescription for sustaining community engagement in malaria elimination on Aneityum Island, Vanuatu: An application of Health Empowerment Theory. *Malaria Journal, 14*(1), 291. https://malariajournal.biomedcentral.com

Zhang, W., Higgins, M., Wongtrakool, C., & Sadikot, R. (2017). Predicting risk factors for COPD hospital readmission: A big data analysis. *Chest, 152*(4).

Appendix A: Power Calculations for Minimum Sample Size

ANCOVA

F tests – ANCOVA: Fixed effects, main effects and interactions

Analysis:	A priori: Compute required sample size		
Input:	Effect size f	=	0.25
	α err prob	=	0.05
	Power (1−β err prob)	=	.80
	Numerator df	=	1
	Number of groups	=	2
	Number of covariates	=	4
Output:	Noncentrality parameter λ	=	8.0000000
	Critical F	=	3.9188157
	Denominator df	=	122
	Total sample size	=	128
	Actual power	=	0.8012613

Hierarchical Regression

F tests – Linear multiple regression: Fixed model, R^2 increase

Analysis:	A priori: Compute required sample size		
Input:	Effect size f^2	=	0.15
	α err prob	=	0.05
	Power (1−β err prob)	=	.80
	Number of tested predictors	=	1
	Total number of predictors	=	5
Output:	Noncentrality parameter λ	=	8.2500000
	Critical F	=	4.0383926
	Numerator df	=	1
	Denominator df	=	49
	Total sample size	=	55
	Actual power	=	0.8038932