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Self-Efficacy in Pulmonary Rehabilitation

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SELF-EFFICACY IN PULMONARY REHABILITATION

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ABSTRACT

As the fourth leading cause of death in the United States, Chronic Obstructive Pulmonary Disease (COPD) is a major contributor of morbidity and mortality. The disease is characterized by chronic irritation and inflammation of the airways. The most common symptoms include chronic cough and shortness-of-breath. Pulmonary rehabilitation is a comprehensive exercise and education program for people with lung disease. It is well-established as an intervention to improve symptoms and other quality-of-life outcomes in people with COPD. Self-efficacy is the belief in one's own abilities. It is recognized by the American Thoracic Society and European Respiratory Society as an integral part of motivation and necessary to develop the self-management skills fostered in pulmonary rehabilitation. The aim of this study was to explore self-efficacy as measured by the PRAISE instrument as it relates to pulmonary rehabilitation completion rates and self-efficacy changes. This study also tested associations between self-efficacy levels and psychosocial risk factors. No significant association was found between self-efficacy levels and pulmonary rehabilitation completion. No change in self-efficacy was found post-pulmonary rehabilitation. However, a significant association was revealed between low levels of self-efficacy and high levels of depression when testing associations of psychosocial risk factors.

Keywords: Chronic Obstructive Pulmonary Disease (COPD), pulmonary rehabilitation, self-efficacy

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LIST OF ABBREVIATIONS

AACVPR	American Association of Cardiovascular and Pulmonary Rehabilitation
ATS	American Thoracic Society
CDC	Centers of Disease Control and Prevention
COPD	Chronic Obstructive Pulmonary Disease
CSES	COPD Self-Efficacy Scale
ERS	European Respiratory Society
GSE	General Self-Efficacy Scale
HRQOL	Health-Related-Quality-of-Life
PR	Pulmonary Rehabilitation
PRAISE	Pulmonary Rehabilitation Adapted Index of Self-Efficacy
PRFS	Psychosocial Risk Factor Survey
SCT	Social Cognitive Theory

CHAPTER 1

INTRODUCTION

Background of the Problem

Chronic Obstructive Pulmonary Disease (COPD) is a major contributor of worldwide morbidity and mortality. In the United States, it is behind cancer, heart disease, and accidents as the fourth leading cause of death (Kochanek et al., 2016). According to the Centers for Disease Control and Prevention (CDC), nearly 16 million Americans have COPD. Experts agree that the prevalence is likely much higher, with possibly millions living with the disease without proper diagnosis and subsequent treatment (CDC, 2020). The prevalence of COPD in Alabama is among the highest in the United States. Nearly 10 percent of adults in Alabama have COPD diagnosis (CDC, 2020).

COPD is a chronic inflammatory disease of the lungs characterized by partially reversible airflow obstruction. COPD is an umbrella term which includes chronic bronchitis and emphysema (Singh et al., 2019). Chronic bronchitis is the chronic irritation and inflammation of the airways. It is characterized by chronic cough and the production of excess mucus. Emphysema refers to damaged alveoli, or air sacs. Damage to the alveoli causes air trapping, leading to shortness-of-breath. Primary indicators of COPD include chronic cough, excess mucus production, shortness-of-breath, and chronic fatigue (Singh et al., 2019). These symptoms generally worsen with activity and progress

over time. These symptoms often become debilitating as COPD is a chronic, progressive disease.

In addition to respiratory-related issues, COPD is often associated with cachexia, cardiovascular disease, anxiety, and depression (Bernard et al., 1998; Gosselink et al., 1996; Mador et al., 2003). COPD symptoms interfere with many activities of daily living. Persons with COPD often avoid physical activity as a means to avoid symptoms. As with other chronic diseases, frailty is quite common among individuals with COPD. The data suggest that older adults living with COPD have twice the odds of frailty (Marengoni et al., 2018). As previously mentioned, individuals with COPD have a tendency to avoid physical activities due to frailty and as a means to avoid shortness-of-breath and other symptoms. Blodgett and colleagues (2015) found sedentary behavior to be independently associated with frailty. Physical inactivity leads to deficits in muscle strength, which impacts both physical and emotional quality-of-life for individuals living with COPD.

Pulmonary rehabilitation is a supervised program of health education, exercise training, nutrition, and breathing techniques. It involves a series of sessions supervised by qualified pulmonary rehabilitation staff. Participation in a pulmonary rehabilitation program is well-established to improve a variety of outcomes in patients with COPD (Ries et al., 2007; Spruit et al., 2103) and an important intervention for individuals living with COPD. In addition to disease-related physical improvements, such as dyspnea and fatigue, pulmonary rehabilitation is associated with improvements in emotional function (McCarthy et al., 2015). Further, it is associated with potential survival benefit in individuals with COPD (Lindenauer et al., 2020). Effective pulmonary rehabilitation

programs maintain a goal-oriented approach, with careful planning between patients and healthcare professionals.

For patients with COPD, pulmonary rehabilitation is one of the most effective management strategies. However, once the program is complete, the benefits begin to decline (Guell et al., 2017; Ries et al., 2003). Novel maintenance exercise strategies are well-represented in the literature. Maintenance exercise diaries have been used to improve motivation (Spencer et al., 2010; Wooton et al., 2018). Follow-up phone calls have been used to support adherence to maintenance exercise (Berry et al., 2003; du Moulin et al., 2010). While many strategies are being investigated, it is still unclear how to best maintain pulmonary rehabilitation benefits. It is likely that there is no one-size-fits all maintenance approach; however, effective pulmonary rehabilitation programs and maintenance strategies should promote self-management and raise self-efficacy.

Self-efficacy is the "belief in one's capabilities to organize and execute the course of action required to produce given attainments" (Bandura, 1997, p. 3). It is an important predictor of increased physical activity in exercise programs (McAuley & Blissmer, 2000). Previous research has found self-efficacy to be an important factor in behavior change in the COPD population (Richardson et al., 2014), with suggestions of self-efficacy as a mediator for improvements in both quality-of-life and physiological outcomes (Arnold et al., 2006, Kohler, 2002). Further, the importance of self-efficacy as it relates to pulmonary rehabilitation is recognized by important advisory bodies in pulmonary medicine (Rochester et al., 2015).

The importance of self-efficacy within the context of pulmonary rehabilitation is well-described in an official statement of the American Thoracic Society (ATS) and

European Respiratory Society (ERS). The authors acknowledged the importance of self-efficacy in self -regulation and motivation and described the valuable role of self-efficacy in the development of self-management skills. The authors stated, "[t]he scope of outcomes assessment has broadened, allowing for the evaluation of COPD-related knowledge and self-efficacy" (Spruit et al., 2013, p. 14). While the authors emphasized the importance of self-efficacy assessment in the context of pulmonary rehabilitation, it is unclear if self-efficacy is routinely assessed in this setting.

In the context of pulmonary rehabilitation, previous studies have used well-validated instruments to assess self-efficacy. The COPD Self-Efficacy Scale (CSES) measures self-efficacy in a COPD patient's ability to manage their daily activities and shortness-of-breath (Wigal et al., 1991). The Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) is an adaptation of the General Self-Efficacy Scale (GSE) (Schwarzer et al., 1995) and includes five task-specific items related to pulmonary rehabilitation. The PRAISE has demonstrated sensitivity to change (Harrison et al., 2014; Mitchell et al., 2014), providing the ability to asses a change in self-efficacy after completion of pulmonary rehabilitation.

As previously stated, the PRAISE is the only pulmonary rehabilitation-specific measure of self-efficacy. The instrument includes 10 general self-efficacy items as well as five pulmonary rehabilitation-specific items. Previous research has demonstrated good internal validity and reliability (Vincent et al., 2011). Further, ATS/ERS recognizes the PRAISE tool as a sensitive and reliable measure of self-efficacy in pulmonary rehabilitation (Spruit et al., 2013).

The ATS/ERS Official Statement also recognizes the important role of depression and anxiety in pulmonary rehabilitation outcomes. It is estimated that around 40% of patients with COPD experience depression (Coventry, 2009), and the prevalence of depressive symptoms increases with severity of disease (Lacasse et al., 2001). Previous research has found an association between depression and lower rate of adherence to and completion of pulmonary rehabilitation (Brown et al., 2016).

The identification of psychological stress is an important aspect of cardiopulmonary rehabilitation. The Psychosocial Risk Factor Survey (PRFS) is a validated instrument used to identify psychological risk factors for cardiopulmonary rehabilitation participants. The 70-item questionnaire includes domains in depression, anxiety, anger/hostility, social isolation, and emotional guardedness (Eichenauer et al., 2010). Previous research suggests an association between higher levels of self-efficacy and lower levels of anxiety and depression among patients with COPD (Simspon & Jones, 2013).

Statement of the Problem

Self-efficacy is an important component of behavior change and health promotion in tertiary prevention. Previous studies suggest that a focus on self-efficacy enhancement can improve health status in individuals with COPD (Bentsen et al., 2010; Selzer et al., 2016). The concept of self-efficacy as it relates to pulmonary rehabilitation has been acknowledged by important advisory bodies (Rochester et al., 2015). Self-efficacy assessments are not widely utilized in pulmonary care. While the American Thoracic Society acknowledges the importance of self-efficacy assessments as a patient-reported-

outcome (Rochester et al., 2015), the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) does not require self-efficacy assessments as performance measures for accreditation (AACVPR, 2019).

Self-efficacy is essential to goal attainment, as such, these assessments are a very important aspect of patient reported outcomes in pulmonary rehabilitation. While self-efficacy assessments are not widely assessed in the clinical setting, self-efficacy assessment is well-represented in the pulmonary rehabilitation research literature. A review of the literature finds self-efficacy to be a primary outcome in a multitude of research pulmonary rehabilitation interventions (Garrod et al., 2008; Lox & Freehill, 1999; Scherer & Schmeider, 1997). Well-supported in the literature, self-efficacy assessments have the potential to help facilitate and support long-term behavior change in patients with COPD.

This study evaluated the effect of a large tertiary care pulmonary rehabilitation program on participants' self-efficacy at baseline and end of treatment. The knowledge gained from this study may be used to inform future pulmonary rehabilitation program planning. Data collected included the PRAISE to assess self-efficacy pre and post intervention. Relationships between PRAISE scores and pulmonary rehabilitation completion were explored as well as relationships between the PRAISE and PRFS assessments. Based on the literature review for this research, this will be the first study to explore relationships between the PRAISE self-efficacy score and the PRFSs.

Research Questions

1. Is self-efficacy as measured by the Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) predictive of pulmonary rehabilitation completion?
2. What is the relationship between self-efficacy as measured by PRAISE and psychosocial risk factors of depression, anxiety, anger/hostility, and social isolation as measured by the Psychosocial Risk Factor Survey (PRFS) pre PR?
3. Is there a change in self-efficacy as measured by the PRAISE after completion of pulmonary rehabilitation?

Significance of the Study

Changes in self-efficacy are not widely assessed in pulmonary rehabilitation programs. However, the importance of self-efficacy has been acknowledged by the American Thoracic Society/European Respiratory Society Statement on Pulmonary Rehabilitation (Rochester et al., 2015). Data from this study may contribute to a better understanding of how self-efficacy impacts pulmonary rehabilitation completion. This study is the first to explore the relationship between the Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) and Psychosocial Risk Factor Survey (PRFS). In addition, this study can contribute to the body of knowledge concerning the impact of pulmonary rehabilitation on self-efficacy scores.

Procedures

Thirty-seven participants were recruited during pulmonary rehabilitation enrollment at the University of Alabama at Birmingham's (UAB) Cardiopulmonary Rehabilitation. All participants had a clinical diagnosis of COPD, were between 40 and

90 years of age, had a provider referral for pulmonary rehabilitation, and were able to provide informed consent. After informed consent was obtained via phone contact, participants completed the pre-pulmonary rehabilitation PRAISE assessment. Upon program completion, participants were contacted to complete post-program PRAISE assessments. PRFS scores were obtained from participants' medical records.

Limitations and Delimitations

In the original study design, a sample size of 66 was determined best to meet the research objectives. However, during the recruitment period for this study, our community experienced several COVID-19 surges and those with underlying health conditions were urged to be very cautious in any public setting. While this study did not require in-person visits for consenting and questionnaire administration, it did require enrollment in UAB's on-site pulmonary rehabilitation program. The uncertainty surrounding the COVID-19 Pandemic and related guidelines likely served as a barrier to recruitment.

Key Terms

Chronic Obstructive Pulmonary Disease (COPD): refers to a group of diseases that cause airflow blockage and breathing-related problems (CDC, 2022).

Pulmonary Rehabilitation: a comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies that include, but are not limited to, exercise training, education, and behavior change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors (Spruit et al., 2013).

Self-Efficacy: belief in one's capabilities to organize and execute the course of action required to produce given attainments (Bandura, 1997).

Social Cognitive Theory: posits that behavior is a product of personal cognitive factors interacting with socio-environmental factors (Bandura, 1989, 1998).

CHAPTER 2

LITERATURE REVIEW

Introduction

The following chapter provides an overview of Social Cognitive Theory and how its constructs serve to inform interventions related to chronic disease management. It includes a review of the literature of the current knowledge of the epidemiology, etiology, and pathogenesis of COPD. It contains a review of evidence-based interventions commonly used in COPD management as well as a detailed review of pulmonary rehabilitation in terms of COPD management. Finally, it explores Social Cognitive Theory and self-efficacy as it relates to COPD Pulmonary Rehabilitation program planning and treatment adherence.

COPD Epidemiology

Chronic Obstructive Pulmonary Disease (COPD) is a leading cause of death and disability in the United States. Approximately, 15 million Americans have COPD (CDC, 2020). Behind cardiovascular disease, cancer, and accidents, it is the fourth leading cause of death in the United States (CDC, 2020). Most authorities believe the prevalence of COPD is likely higher as many cases are in early stages and yet to be diagnosed. Awareness is considered poor in the general public and among those with the greatest

risk, and it is estimated that an additional 12 million Americans may have undiagnosed COPD (American Lung Association, 2019).

COPD serves as an umbrella term for a set of chronic lung diseases which include emphysema and chronic bronchitis. It is characterized by chronic inflammation of the lungs and airflow limitation. Symptoms include shortness-of-breath, wheezing, cough, excessive sputum production, and fatigue (Global Initiative for Chronic Obstructive Lung Disease, 2018). COPD is a major contributor of morbidity. As symptoms progress, they interfere with normal daily activities. Of adults diagnosed with COPD, 24.3% report being unable to work, 49.6% report activity limitations because of their health problems, 38.4% report difficulty walking or climbing stairs, and 22.1% report needing special equipment for health problems (Wheaton et al., 2015). While COPD is an irreversible, progressive disease, proper diagnosis and treatment can slow down disease progression, reduce symptoms, and improve health related quality of life.

Psychosocial Risk Factors

Psychosocial risk factors bear a significant effect on health outcomes in individuals with COPD. There is abundant literature to support associations between COPD and depression and anxiety. In addition, anger/hostility and social isolation are associated with poor COPD-related outcomes (Kubansky et al., 2006; Jordan et al., 2008).

The literature supporting an increased risk for developing depression in individuals with COPD is robust (Lewis et al., 2007; Wong et al., 2006). In addition,

greater disease severity is associated with the development of depression (Schneider et al., 2010).

Anxiety is also strongly associated with a diagnosis of COPD (Gudmundsonn et al., 2005; Lewis et al., 2007; Vögele & von Leupoldt, 2008). This association is likely bidirectional as dyspnea and poor health can result in depression and anxiety. While less abundant than the literature supporting COPD-related depression and anxiety, research suggests associations between poor COPD-related outcomes and anger/hostility and social isolation. Kubzansky and colleagues (2006) found anger and hostility to be associated with lower lung function among males. Social isolation was found to be associated with increased hospitalizations among individuals with COPD (Jordan et al., 2008).

The identification of psychosocial risk factors is crucial in determining appropriate treatments and strategies to improve quality-of-life in individuals living with COPD. The Psychosocial Risk Factor Survey (PRFS) is an assessment tool used to recognize primary psychosocial risk factors in participants of cardiopulmonary rehabilitation programs. The PRFS screens for anxiety, depression, anger/hostility, social isolation, and guardedness. The PRFS is comprised of 70 easy-to-read items. Participants respond to each item on a five-point scale. Results are presented as a detailed risk assessment for each factor (Eichenauer & Feltz, 2006). This detailed risk assessment helps identify patients who warrant a referral to a behavioral health specialist or other targeted intervention.

Comparing pre- and post-intervention PRFS scores can provide information regarding the impact of the intervention on an individual's psychosocial health.

Risk Factors and Disparities

While there are several risk factors associated with COPD, tobacco use is the most common. Killing more than 480,000 Americans per year, tobacco use is the number one cause of preventable death in the United States. The economic impact is staggering, with smoking-related illness costing the United States billions of dollars each year. In 2018, it was reported that an estimated 34.2 million adults in the United States smoked cigarettes. A current smoker is defined as an individual who reports smoking cigarettes every day and smoking at least 100 cigarettes during their lifetime. Men are more likely to report cigarette smoking than women, with about 15.6% of adult males and 12% of adult females reporting smoking cigarettes (CDC, 2020). Alabama exceeds the national average at 21.5% of the adult population. Alabama ranks eighth highest among states in prevalence of smoking. (Alabama Department of Public Health, 2020).

The primary causative factors associated with COPD relate to air quality, and while tobacco use is the leading cause, there are other risk factors which contribute to the development and progression of COPD. Atmospheric gas exposures are substantial contributors. Outdoor environmental air pollution includes greenhouse gases and various forms of particle pollution. Common sources of indoor air pollution include biomass fuels used for heating and cooking as well as molds and various household products. Occupational exposures in the workplace, such as fumes or other chemical agents contribute to the development of COPD (National Heart Lung and Blood Institute, 2020). In addition, alpha1 antitrypsin deficiency is a genetic disorder that often results in early onset of emphysema. While considered rare, approximately 80,000 to 100,000

individuals in the United States have alpha1 antitrypsin deficiency (National Organization of Rare Disorders, 2020).

As an established Healthy People 2020 goal, reducing health disparities is an important initiative. Disparities exist when health outcomes are seen to a greater or lesser extent between different populations. The U.S. Office of Disease Prevention and Health Promotion's Healthy People 2020 describes disadvantaged populations as "[g]roups of people who have experienced greater obstacles to health based on their racial or ethnic group; religion, socioeconomic status (SES), gender, age, occupation, mental health, cognitive, sensory or physical disability" (U.S. Department of Health and Human Services, 2020). Socioeconomic factors, including education, income, and social and physical environment, play a major role in the etiology and outcomes related to COPD.

Historically, COPD has been considered predominantly a disease among men as men exhibited higher rates of tobacco use and were much more likely to encounter occupational exposures. However, since 2000, COPD death rates have trended down for men and increased among women (American Lung Association, 2017). During the first part of the 20th century, it was socially unacceptable for women to smoke (Cockerham, 2017). The social roles of women generally related to domesticity. However, as labor force participation among women increased, women adopted normative behaviors of the workplace, such as drinking alcohol and smoking. COPD is a progressive disease with a long latency period, so the problem of COPD among women took many years to realize.

In addition to the gender/sex disparity, there is a strong association between lower socioeconomic status and poor COPD outcomes. Poverty and education are important social indicators in the development and progression of COPD. In the United States,

those living in poverty and with low levels of educational attainment report much higher rates of cigarette smoking (CDC, 2020). Social connections as well as the chronic stress of living in poverty are major contributors to the high smoking rates in poor communities. Moreover, many in the lower socioeconomic strata live without access to healthcare and smoking cessation programs.

` The chronic stress associated with living in poverty contributes to the tobacco abuse disparity. Stressors related to relationships, economic hardship, work-family conflict, and perceived inequality all contribute to smoking persistence (Slopen et al., 2013). These psychological stressors make quit attempts extremely difficult and likely contribute to high pack-years, a measure of the amount of an individual's smoking over time. High pack-years are associated with increased health risk.

Economic Burden

In the United States, the burden of COPD places a substantial strain on healthcare resources. The CDC reported COPD costing the country $32.1 billion in 2010, with projections of $49 billion in 2020. Fifty-one percent of these healthcare costs were covered by Medicare, followed by 25% covered by Medicaid, and 18% covered by private insurance (CDC, 2020).The financial burden of COPD consists of both direct and indirect costs. Direct costs include prescription drugs, provider services, and inpatient services. Indirect costs primarily include workplace absenteeism for both patients and caregivers. The 2010 CDC statistics indicated $3.9 billion lost due to COPD-related absenteeism, with an estimated 16.4 million lost days of work (CDC, 2020). Other indirect costs may result from hired caregiver and transportation expenses. While direct

COPD costs are relatively easy to quantify, limited data sources make it difficult to measure indirect costs.

Recognized as the most complete source of data on the use and cost of healthcare and health insurance coverage, the Medical Expenditure Panel Survey (MEPS) assesses individuals, health plans, and providers (U.S. Department of Health and Human Services, 2020). Blanchette and colleagues (2012) analyzed the 2007 MEPS survey to review the changes in COPD costs over a 21-year period. The study concluded that there was indeed a trend towards increased costs associated with COPD; these increases were seen on both a societal level and individual patient level. However, inpatient hospitalizations and emergency department served as the dominant resource burden in the COPD population, accounting for two-thirds of healthcare costs associated with COPD (Blanchette et al., 2012). Comprehensive strategies aimed to reduce inpatient hospitalizations and other acute care services not only improved HRQOL for COPD patients but also served as a means to control the increasing costs related to COPD care.

Pulmonary Rehabilitation

Healthy People 2020 recognized "Reducing activity limitations among adults with chronic obstructive lung disease (COPD)" as an important objective for this patient population (Office of Disease Prevention and Health Promotion, 2020). One of the most effective interventions to restore levels of activity and improve quality-of-life in individuals with COPD is pulmonary rehabilitation. The American Thoracic Society defined pulmonary rehabilitation as:

> (A) comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies that include, but are not limited to, exercise training, education, and behavior change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors. (Rochester et al., 2015, p. 1374)

Effective pulmonary rehabilitation can improve functional capacity, quality-of-life, emotional function, and disease knowledge in individuals with COPD. It is also associated with substantial reduction in the frequency of acute exacerbations.

Pulmonary rehabilitation typically requires 20 to 36 visits to a medical center. The initial session involves an extensive assessment of functional capacity, including a comprehensive psychosocial assessment. Based on information obtained in the initial session, a tailored pulmonary rehabilitation intervention is established for the patient. This intervention includes the exercise prescription, educational objectives, and psychosocial support, if indicated.

The American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) is an organization dedicated to reducing the morbidity, mortality and disabilities for cardiovascular and pulmonary disease. Comprised of multidisciplinary health professionals, the AACVPR promotes education, prevention, rehabilitation, and research in cardiovascular and pulmonary medicine. The organization provides standards and guidelines to pulmonary rehabilitation programs. In addition, the AACVPR's peer-reviewed accreditation process determines individual program certification (American Association of Cardiovascular Pulmonary Rehabilitation, 2020).

Theoretical Framework

Social Cognitive Theory and Pulmonary Rehabilitation

A variety of effective interventions for individuals with COPD have been predicated on Social Cognitive Theory (SCT). Aliakbari and colleagues (2020) developed a questionnaire to evaluate several SCT constructs applied in an educational intervention for individuals with COPD. Their study revealed a significant improvement in all SCT construct domains.

Developed by Bandura, Social Cognitive Theory (SCT) posits that behavior is a product of personal cognitive factors interacting with socio-environmental factors. SCT assumes human agency, but also recognizes the causal contribution of environmental influences. Major cognitive influences include outcome expectations, knowledge, and self-efficacy. Socio-environmental constructs include observational learning, normative beliefs, social support, and physical environment (Bandura, 1989, 1998).

Complex interactions between the individual, behavior, and environment are described as reciprocal determinism. In other words, behavior is determined by the individual as a result of cognitive processes interacting with its environment. The concept of reciprocal determinism recognizes the context of cognitive processes and behavior. This context includes physical and social environment. Individuals receive reinforcement from physical and social environments; however, reinforcement may also come from one's motivation and mental state (Bandura, 1978).

Reciprocal determinism places emphasis on the role of environmental and social interactions. Tobacco use is the number one risk factor for COPD. Smoking cessation is an important aspect of pulmonary rehabilitation, and the interactions between the

individual, the behavior, and environment inform effective smoking cessation interventions. While smoking cessation is a crucial component of pulmonary rehabilitation, the interactions described as reciprocal determinism can inform all elements of behavior modification within the pulmonary rehabilitation umbrella.

Knowledge is an essential component of behavior change. For example, people who smoke tobacco products who become aware of the health consequences have a foundation for smoking cessation. While knowledge is a necessary component, serving as a foundation, it is not sufficient on its own. Bandura characterized two types of knowledge. Content knowledge describes an understanding of the pros and cons of a specific behavior. Procedural knowledge involves the comprehension of how to employ a certain behavior (Bandura, 1986). Knowledge and skill acquisition are the foundations of pulmonary rehabilitation. This component is essential to meaningful behavior change and disease-effective self-management.

Bandura described self-efficacy as an individual's confidence in their ability to perform a specific task or behavior. The formation of self-efficacy is a result of four different experiences. Vicarious experience is obtained by watching the successes and failures of others performing a specific task. Mastery experience is an individual's success performing a certain behavior. Social persuasion is generally approval or disproval by a loved one or peer concerning a specific behavior. Finally, emotional arousal involves emotions associated with specific behaviors. The experiences contribute to the cognitive processes that develop one's self-efficacy, or perceived ability to perform a specific task or behavior (Bandura, 1997).

While individuals do in fact have the ability to make and act on decisions, SCT recognizes that there are a multitude of environmental influences which affect these decisions and actions. A comprehensive pulmonary rehabilitation involves individual, behavioral, and environmental factors. Self-efficacy is very important to an individual's ability to manage their disease. The fundamental concepts of pulmonary rehabilitation are well-suited to enhance one's self-efficacy.

As previously discussed, self-efficacy is a key factor in chronic disease management. An individual's confidence in their ability to perform or not perform specific behaviors is both promoted and demonstrated in pulmonary rehabilitation. According to Bandura (1997), there are four factors that affect self-efficacy. These include mastery experience, verbal persuasion, vicarious experience, and somatic states. These cognitive processes are exemplified in the typical pulmonary rehabilitation experience.

Mastery experience is well-demonstrated in pulmonary rehabilitation. Mastery experience results from the practice involved in goal attainment and behavior change (Bandura, 1997). The structured experience that pulmonary rehabilitation provides offers each participant the opportunity to improve self-efficacy. Trained pulmonary rehabilitation staff offer feedback and guide participants as they progress through the program. This experience facilitates the mastery experience required for meaningful behavior change.

Vicarious experience describes the way individuals gain knowledge as they observe others, in other words, social comparisons (Bandura, 1997). Like mastery experience, this concept is well-demonstrated in pulmonary rehabilitation. Participants

attain vicarious experience as they observe their peers' participation in the program. Observing successful behavior change among peers with similar disease states and challenges provides the opportunity to grow a more robust sense of self-efficacy.

Verbal persuasion describes evaluative feedback, or the impact that words can have on an individual's self-efficacy. These words may be offered in the form of encouragement, or coaching, and they can raise efficacy beliefs (Bandura, 1997). Verbal persuasion is a common technique used in personal health training. In the pulmonary rehabilitation setting, healthcare providers offer encouragement, evaluative feedback, and may even provide examples of other participants in similar situations who have been successful in attaining personal health goals.

Somatic and emotional states, such as anxiety or stress related to performing specific actions, affect self-efficacy (Bandura, 1997). The anticipation of performing a certain behavior provokes emotion. If this emotion manifests as worry or anxiety, a person's perceived self-efficacy is affected. Worry, stress, and anxiety can affect emotional states and lead to avoidance behavior. For example, the anticipation of shortness-of-breath with physical activity may provoke worry or anxiety in a patient with COPD. These emotional states disrupt usual physical activities and the patient gradually suffers an overall loss of functional capacity. An effective pulmonary rehabilitation program provides coaching and feedback in a psychologically safe environment. This safe, supported space allows the participant to work through the anxieties associated with physical activity.

In terms of a socially-oriented concept of health, self-efficacy can be generalized to collective efficacy. According to Bandura (1997), collective efficacy is defined as "[a]

group's shared belief in its conjoint capability to organize and execute the courses of action required to produce given levels of attainment" (p. 477). This concept relates to an individual's perceptions about their social environment. Collective efficacy is an appropriate construct to inform community outreach and engagement programs.

SCT proposes that behavior is rooted in both individual-level and socio-environmental influences. SCT provides a comprehensive, well-supported framework for a better understanding of the complex interactions through which learning occurs, influencing behavior. The various constructs of SCT provides specific opportunities to tease out a multitude of behavioral influences.

Social Cognitive Theory, Behavior Change, and COPD Management

Effective health promotion involves much more than individual-level education; it requires changes to social systems and practices that lead to detrimental health effects. Application of Social Cognitive Theory can offer insight into a wide variety of health issues, including a model for tertiary prevention or chronic disease management.

As our population ages, the prevalence of chronic conditions remains on a steady rise. According to the National Council on Aging (2020), around 80% of older adults have a chronic condition, and around 77% have at least two chronic conditions. Tertiary prevention is key in reducing the impact of chronic disease. Effective tertiary prevention can slow disease progression and improve quality-of-life.

Behavior change is key for chronic disease management. Most chronic health conditions are rooted in health behaviors, environment, and other lifestyle factors. SCT is well-established as an appropriate conceptual framework for effective COPD disease

management interventions. Richardson and colleagues (2014) found SCT and self-efficacy theory to be the most frequently cited theoretical frameworks for chronic disease self-management involving physical activity. Effective self-management models have been predicated on many SCT constructs. Self-regulatory mechanisms have effectively served as the theoretical basis of cardiovascular disease risk reduction programs (DeBusk et al., 1994). Patients' efficacy has effectively been raised in adhering to low sodium diets (West et al., 1999). Observational learning, or modeled guidance, has been effective in arthritis self-management (Holman & Lorig, 1992). Moreover, collective agency has been credited for reducing public smoking rates (Bandura, 2000).

As discussed, SCT has informed a variety of effective tertiary prevention interventions. Each construct offers a unique opportunity to better understand and target health-related behaviors. This knowledge is key in developing effective tertiary prevention plans for the management of chronic disease.

Self-Efficacy and the Opportunity for Intervention

Bandura (1997) identified self-efficacy as a direct predictor of intention and behavior. Efficacy beliefs affect personal goals. The impact of self-efficacy on behavior change is well-documented in the literature (Strecher et al., 1986). Effective chronic disease management relies on meaningful behavior change; thus, the role of self-efficacy is an important aspect of chronic disease management.

Improving disease knowledge and self-efficacy is essential to the facilitation of skills needed for disease self-management. In terms of COPD, previous research suggests that COPD patients with lower self-efficacy scores have more disease-related perceived

symptoms (Lopes et al., 2019). A variety of self-management education programs have been developed as self-efficacy enhancing interventions. Mitchell and colleagues (2014) evaluated such an intervention in the primary care setting. While no significant changes were found in self-efficacy scores between the intervention and usual care groups, significant improvements in dyspnea, fatigue, anxiety, and disease knowledge were reported. Similarly, Bringsvor et al. (2018) found no significant changes in self-efficacy assessments, but significant improvements in all other self-management domains. A better understanding of the associations between validated self-efficacy instruments and domains of self-management are needed to help inform COPD self-management program development.

A variety of self-efficacy enhancing strategies for COPD patients exists in the literature. However, the largest body of evidence involves pulmonary rehabilitation attendance. Bentsen and colleagues (2010) posited increases in self-efficacy should be an important aim in pulmonary rehabilitation for COPD patients. They reported findings of improved functional capacity and quality-of-life measures after pulmonary rehabilitation. Further, they found that higher baseline self-efficacy scores predicted improvements in health status and quality-of-life (Bentsen et al., 2010). Previous research suggests that pulmonary rehabilitation attendance improves general self-efficacy (Lox & Freehill, 1999). In addition, previous research has shown higher self-efficacy to be associated with lower perceptions of dyspnea (Simpson & Jones, 2013). The literature suggests that valid and reliable measures of self-efficacy can widely assess self-efficacy in both research and clinical practice.

Self-Efficacy and Pulmonary Rehabilitation

Previous studies have explored COPD, self-efficacy, and physical activity. Larson and colleagues (2014) conducted an interventional study to determine whether a self-efficacy enhancing strength and walking program would increase physical activity in individuals with COPD. The self-efficacy enhancing intervention utilized four constructs of Bandura's self-efficacy theory: mastery experience, vicarious experience, verbal persuasion, and emotional states. For example, vicarious experience was encouraged by watching video clips of people performing upper body exercises. Posters with older people exercising and having fun were displayed in the laboratory. Mastery experience was attained with graphing progress, and staff feedback and a buddy system was established to encourage verbal persuasion (Larson et al., 2014).

Patients were randomized into self-efficacy enhancing upper body resistance training, health education with upper body training, or health education with gentle chair exercises. After four months of training, the self-efficacy enhancing upper body resistance group saw gains of 20 to 30 minutes of light physical activity per day. The other groups saw a decrease in light physical activity after four months of training. However, these changes were not sustained at 12 months (Larson et al., 2014). While this intervention was successful in increasing self-efficacy and light physical activity in the short-term, results were not sustained. COPD interventions should be constructed with measures in place designed to transition participants into other programs or situations which will continue self-efficacy enhancing measures. Otherwise, avoidance behavior will likely resume followed by a decrease in functional capacity.

Participation in an effective pulmonary rehabilitation program will provide patients with COPD the confidence to increase physical activity and to manage their disease. An effective self-efficacy enhancing intervention should identify situations in which participants experience low self-efficacy. Once these situations are identified, specific measures may be taken to increase self-efficacy in participants.

Validated Measures of Self-Efficacy

Previous research suggests that an increase in self-efficacy is associated with improved exercise tolerance and other quality-of-life measures (Lox & Freehill, 1999). The ability to identify situations in which individuals with COPD experience low self-efficacy is very important. This knowledge can help behavioral scientists, physicians, and other healthcare providers develop effective interventions which target increases in self-efficacy.

The General Self-Efficacy Score (GSES) is a 10-item, self-reported instrument developed to measure general self-efficacy. Total scores range from 10 to 40, with higher scores indicating higher levels of self-efficacy (Schwarzer & Jerusalem, 1995).

The COPD Self-Efficacy Scale (CSES) was developed to assess self-efficacy in individuals with COPD. The 34-item scale allows healthcare providers to assess a patient's self-efficacy in situations specific to the population. The five-factor structure explores negative affect, emotional arousal, physical exertion, environmental, and behavioral risk factors (Wigal et al., 1999). Previous research demonstrates significant post-pulmonary rehabilitation improvements in CSES (Garrod et al., 2008). However, the CSES does not include items specific to pulmonary rehabilitation.

The Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) was adapted from the General Self-Efficacy Score (GSES) to measure self-efficacy in the Pulmonary Rehabilitation setting. Previous studies have found the PRAISE instrument to be both reproducible and sensitive in the COPD population (Vincent et al., 2015). The PRAISE instrument has 15 items, with both general and PR specific domains.

A Korean version of the PRAISE assessment was tested on 118 patients with COPD. Analyses revealed a relationship between the PRAISE instrument and 6MWT and SGRQ. These findings suggest that the tool was reliable in detecting behavior change among this population (Song & Nam, 2017).

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this chapter is to introduce the research methodology. It outlines the research rationale, research approach, sample selection, data collection instruments and methods, and data analyses. In addition, this chapter describes the research process, ethical considerations, and research limitations.

Study Rationale

Healthy People 2020 identified "Reducing activity limitations among adults with chronic obstructive lung disease (COPD)" as an objective (Healthy People 2020, 2020). Pulmonary rehabilitation is well-established as the most successful intervention for restoring individuals with COPD to their highest functional capacity. The burden of COPD in Alabama is among the highest in the country (MMWR Morbidity and Mortality Weekly Report, 2012), underscoring the importance of providing effective pulmonary rehabilitation within the state. Improved levels of self-efficacy is associated with pulmonary rehabilitation completion and improved quality-of-life (Bentsen et al., 2010; Larson et al., 2014, Lox & Freehill, 1999).

The research hypotheses for this study included: relationships exist between self-efficacy levels as measured by PRAISE scores and pulmonary rehabilitation completion,

relationships exist between self-efficacy levels as measured by PRAISE scores and psychosocial risk factors as measured by PRFS scores, and self-efficacy as measured by PRAISE scores will increase post pulmonary rehabilitation.

UAB's Spain Rehabilitation Center is an integral part of the institutional health system. The center provides a multitude of clinics and programs, including the cardiopulmonary rehabilitation program. The cardiopulmonary program consists of separate cardiac and pulmonary rehabilitations programs. Pulmonary rehabilitation is an important component of evidence-based care for patients with a variety of chronic lung diseases.

The study population included pulmonary rehabilitation participants from UAB's Spain Cardiopulmonary Rehabilitation Center. The study included both men and women with a clinical diagnosis of COPD and pulmonary rehabilitation referral.

Research Methods

In order to satisfy the first objective of this research study, an analysis was conducted of data collected from pulmonary rehabilitation participants' pre-PRAISE scores and their pulmonary rehabilitation completion status. Binary logistic regression was used to determine if pre-PRAISE scores were predictive of pulmonary rehabilitation completion.

For the second objective, multivariable logistic regression was used to test relationships between baseline PRAISE and PRFS scores and pulmonary rehabilitation completion. Total PRFS as well as each specific domain were tested in separate models. Pulmonary rehabilitation completion was defined as completing between 20 and 36

sessions. Multivariable linear regression was used to test relationships between baseline PRAISE and PRFS scores. Multiple regression is well-supported in the literature in testing two or more predictors with one outcome (Aiken et al., 1991). Both models were adjusted for age, sex, and baseline lung function as the sample size was small.

To satisfy the third objective, an analysis was conducted of data collected from pulmonary rehabilitation participants using a pre-post intervention design. Quantitative methods used to test continuous variables. PRAISE and PRFS assessments were collected prior to the first pulmonary rehabilitation session and at the last session. Paired t-tests were used to compare the means of the PRAISE scores pre- and post-intervention. This statistical analysis is well-supported in the literature as most appropriate when comparing the means of paired assessments (Daya, 2003; Kirkwood & Sterne, 2003; Peck et al., 2012).

Despite the many benefits of pulmonary rehabilitation, uptake and completion rates remain low (Hayton et al., 2013; Spitzer et al., 2018). As such, this study used an intent-to-treat approach, meaning that data were analyzed regardless of noncompliance or withdrawal (Gupta, 2011).

Research Instruments and Variables

Non-COVID-19 research best practices were reviewed to ensure the safety and wellbeing of study participants (Fleming et al., 2020). Prior to any data collection, approval was obtained from UAB's Office of Institutional Review Board. Telephone informed consent was obtained in order to not place study participants at an increased risk of COVID-19 from study procedures.

Inclusion Criteria

1. Clinical diagnosis of COPD;
2. Age 40 to 90 years;
3. Provider referral to UAB's Pulmonary Rehabilitation Program;
4. Willingness to provide informed consent.

Exclusion Criteria

1. Unwillingness to comply with pulmonary rehabilitation enrollment;
2. Participants with physical infirmities that precluded participation in an exercise program.

As discussed in the literature review, both the COPD Self-Efficacy Scale (CSES) and the Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) are validated instruments used to assess self-efficacy in individuals with COPD. However, the PRAISE is the only measure of self-efficacy specific to pulmonary rehabilitation. The instrument consists of 15 items, with both general and pulmonary rehabilitation-specific domains. Pulmonary rehabilitation participants completed a variety of assessments at program enrollment and completion. These assessments helped tailor programming as well as assess outcomes. Due to the fact that the PRAISE includes pulmonary rehabilitation-specific domains, it was determined to be the best option for this research. Further, it has fewer items, reducing cognitive burden at pulmonary rehabilitation enrollment.

Building on the 10-item General Self-Efficacy Scale (GSES), the PRAISE has five additional items which address challenges specific to pulmonary rehabilitation. It takes approximately four minutes to complete, with scores ranging from 15 to 60. Higher scores indicate higher levels of self-efficacy (Vincent et al., 2011). Permission to use the

PRAISE was obtained from the corresponding author of the original publication describing the instrument.

The Psychosocial Risk Factor Survey (PRFS) assessment is administered as a component of usual care in UAB's pulmonary rehabilitation program. Based on a thorough review of the literature, this study will be the first research project exploring relationships between self-efficacy and psychosocial stress using the PRAISE and PRFS instruments.

With 70 items, the PRFS assessment takes approximately 15 to 20 minutes to complete. The standardized measurements include T-scores and percentiles. Ranges of severity include minimal (below 66 percentile), mild (66-83 percentile), moderate (84-94 percentile), and severe (95-99 percentile) categories. Assessment domains include depression, anxiety, anger/hostility, social isolation, and emotional guardedness (Eichenauer & Feltz, 2006).

As previously mentioned, drop-out rates remain high among pulmonary rehabilitation participants. In addition to exacerbations and transportation issues, drop-out rates may be related to perceived disabilities and confidence in their own capabilities (Fischer et al., 2007).

CHAPTER 4

FINDINGS

This chapter reports the study findings. The first section describes study recruitment and baseline characteristics with demographics. The next section describes independent and dependent variables analyzed for the study. The third section describes the results of the binary logistic regression used to test the association between self-efficacy levels and pulmonary rehabilitation completion. The following section reports findings from simple linear regressions to test associations between baseline self-efficacy and psychosocial risk factors. The last section reports the findings of a paired samples t-test used to test self-efficacy levels before and after pulmonary rehabilitation. Data from this study were analyzed using SPSS (version 26).

Recruitment and Baseline Characteristics

Thirty-six participants were recruited during pulmonary rehabilitation enrollment at UAB's Cardiopulmonary Rehabilitation. All participants had a clinical diagnosis of COPD, were between 40 and 90 years of age, had a provider referral for pulmonary rehabilitation, and were able to provide informed consent. After informed consent was obtained via phone contact, participants completed the pre-pulmonary rehabilitation PRAISE assessment. Upon program completion, participants were

contacted to complete post-program PRAISE assessments. PRFS scores were obtained from participants' medical records.

Table 1

Participant Demographics

	N	Percentage	Minimum	Maximum	Mean	Std. Deviation
Male	19	53%				
Female	17	47%				
Age	36		46	81	65	9
FEV1 %Predicted	28		19	96	51	19

Figure 1

Composition of Participants by Gender

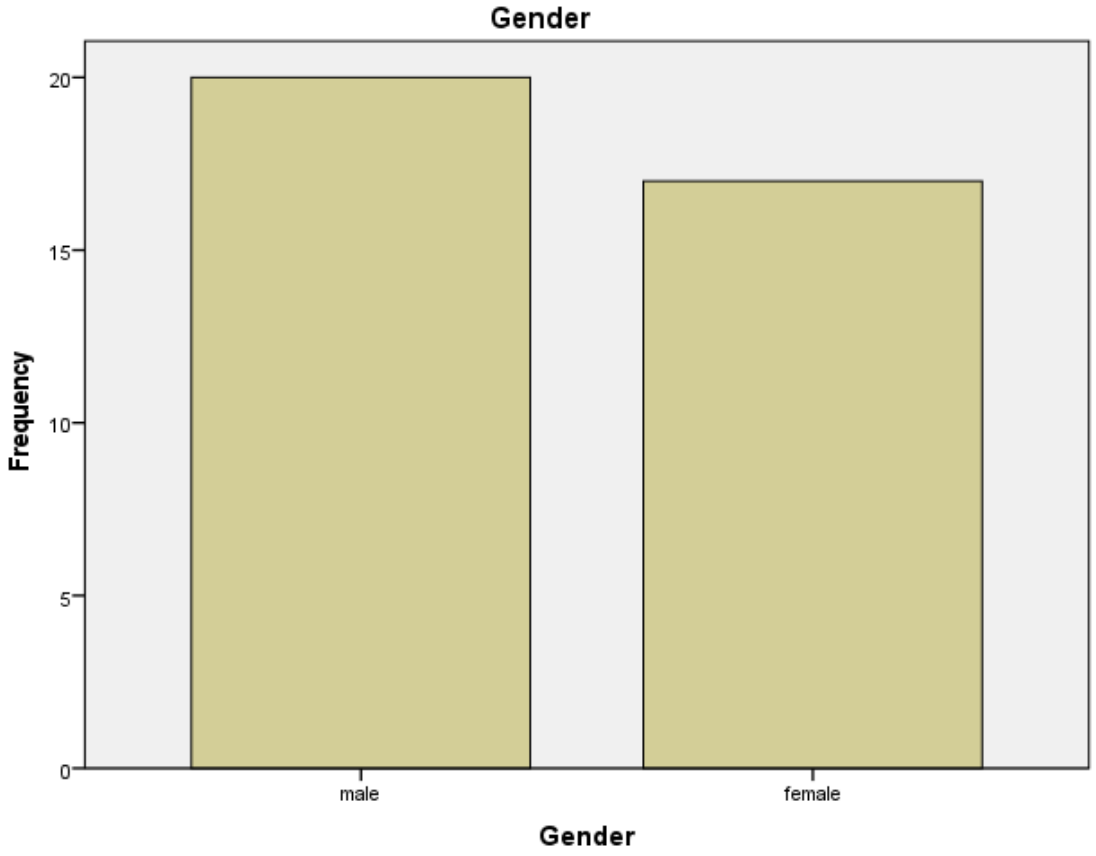


Figure 2

Composition of Participants by Age

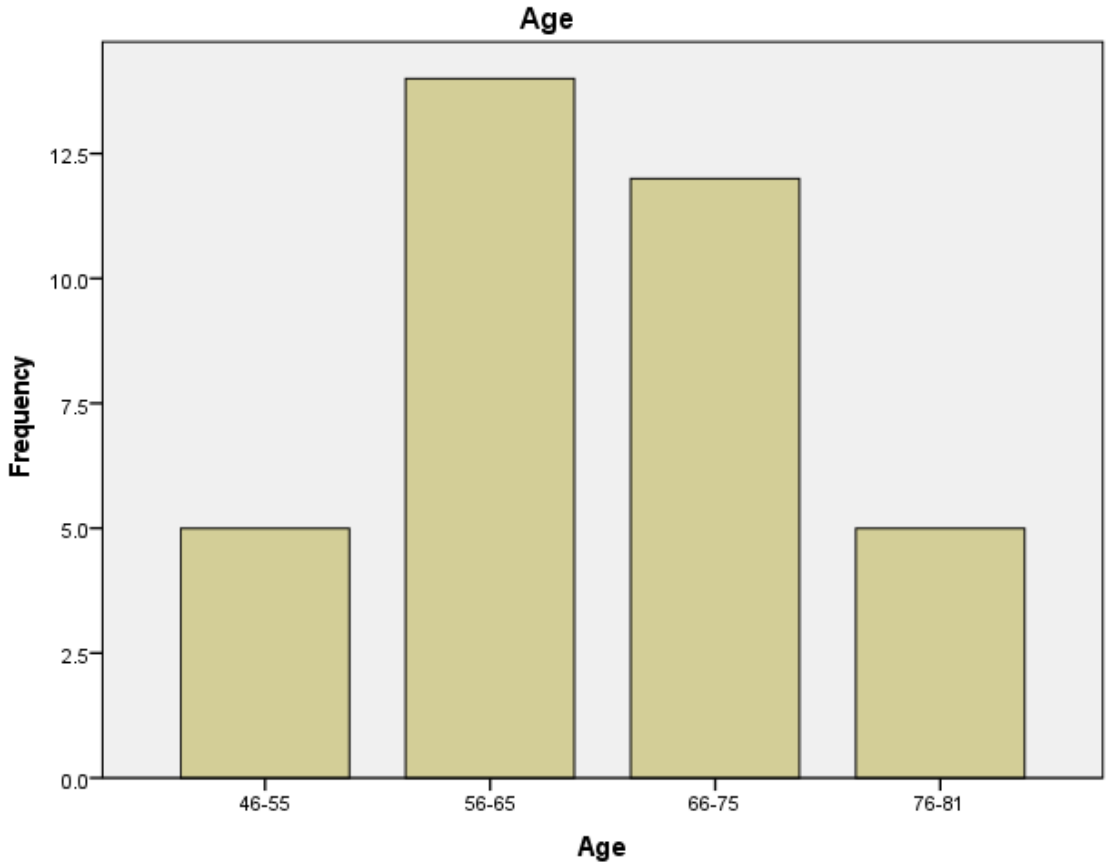
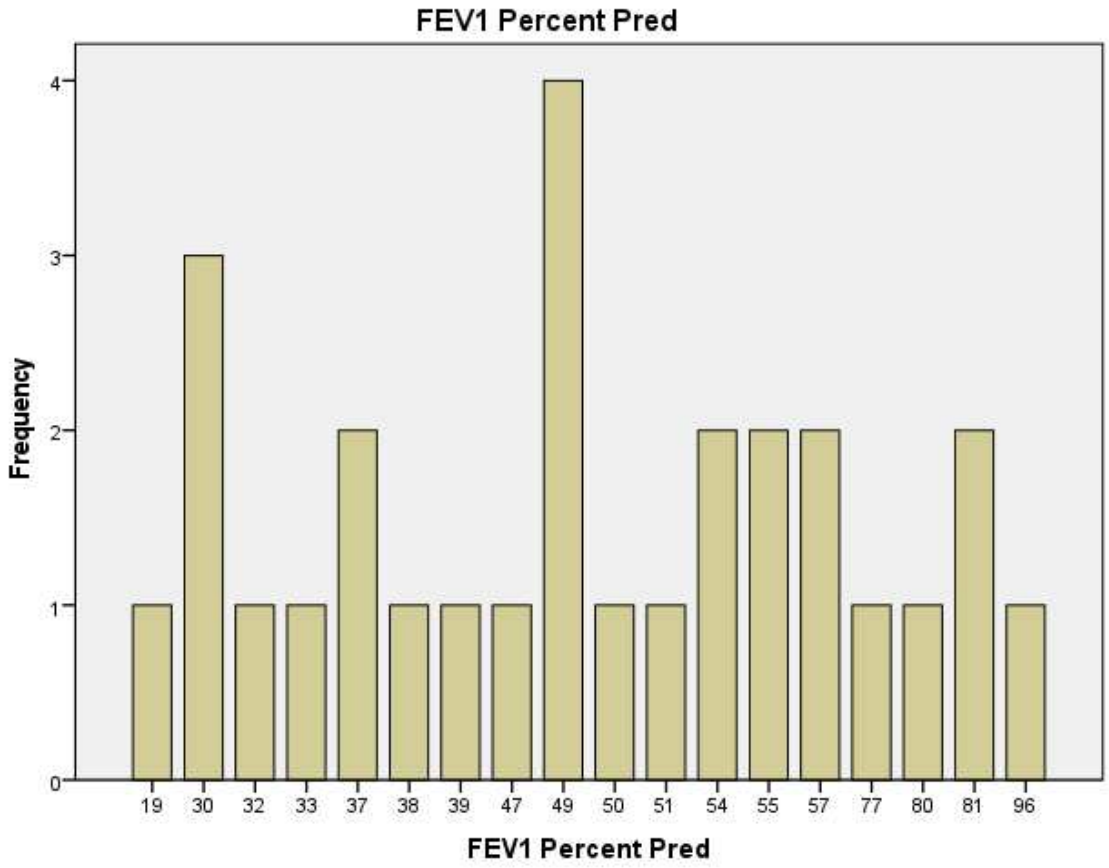


Figure 3

Disease Severity



Independent Variables

As discussed in the previous chapter, the Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) is a measure of self-efficacy specific to participants of pulmonary rehabilitation programs.

Dependent Variables

The Psychosocial Risk Factor Survey (PRFS) is a validated instrument used to measure psychosocial risk factors. It is a 70-item survey which includes domains in anxiety, depression, social isolation, emotional guardedness, and anger/hostility. Total

PRFS score as well specific domain scores tested associations with Pre-PRAISE scores. As mentioned in a previous chapter, pulmonary rehabilitation completion rates remain low (Hayton et al., 2013; Spitzer et al., 2018). Completion rates were measured and determined by the attendance of at least 20 pulmonary rehabilitation sessions.

Research Question 1

Is self-efficacy as measured by the Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) predictive of pulmonary rehabilitation completion?

Assumptions

Logistic regression is designed to predict an outcome with a dichotomous dependent variable. The pre-PRAISE scores and completion status were mutually exclusive. The total case count for this analysis was 36. A binary logistic regression model was used to test the hypothesis that higher levels of self-efficacy, as measured by the PRAISE instrument, would be associated with higher levels of pulmonary rehabilitation completion. No significant association was found between higher levels of self-efficacy and pulmonary rehabilitation completion.

Table 2

Pre PR PRAISE Scores and Completion Status

Variable	B	SE	Exp (B)	P
Pre- PR PRAISE	0.50	0.50	1.052	.316
Completion	-1.712	2.332	.539	.463

Model	P	Cox and Snell R Squared	Negelkerke R Squared	Model Prediction
Constant	.075			
Pre-PRAISE Score Completion		.028	.038	64.9%

Research Question 2

What is the relationship between self-efficacy as measured by PRAISE and psychosocial risk factors of depression, anxiety, anger/hostility, and social isolation as measured by the Psychosocial Risk Factor Survey (PRFS) administered pre PR?

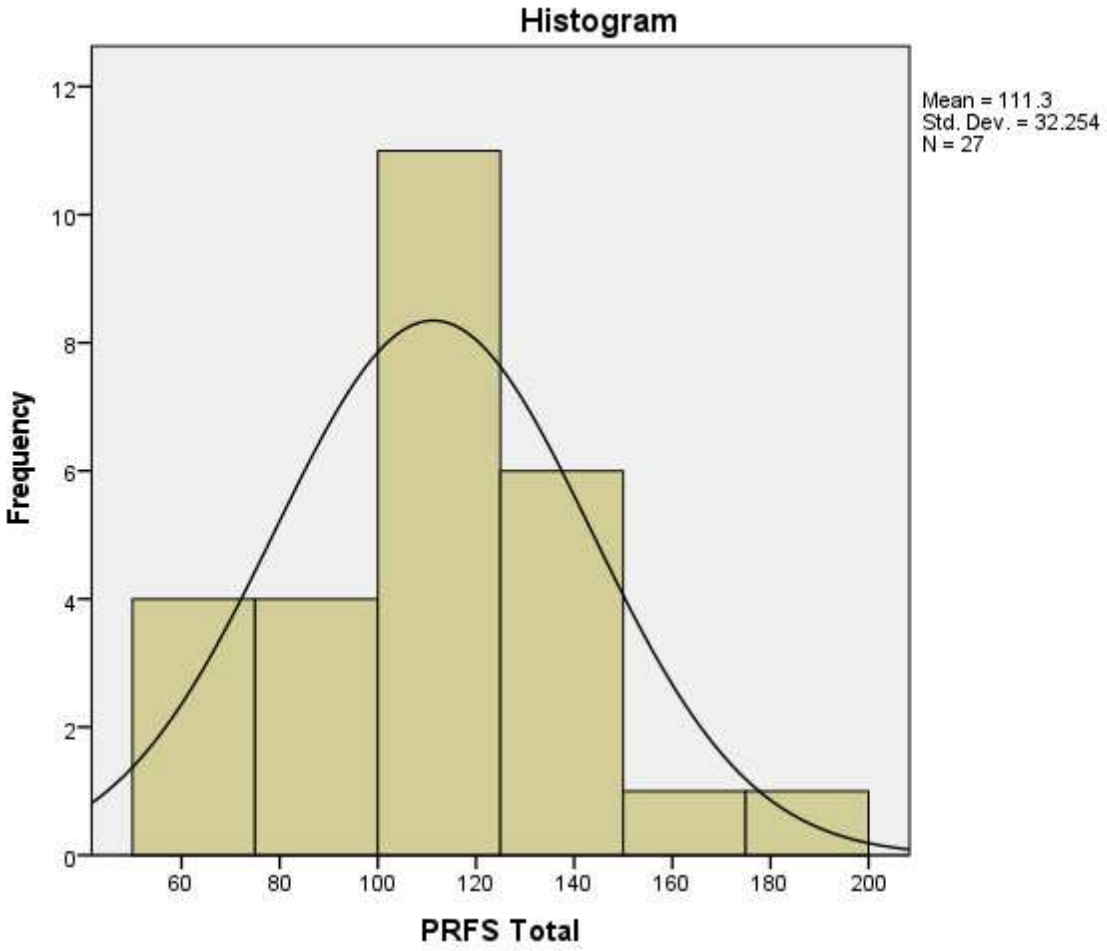
A linear regression model with self-efficacy as the predictor and total PRFS, depression, anxiety, social isolation and anger/hostility as outcome variables tested associations between self-efficacy and psychosocial risk factors.

Assumptions Pre-PRAISE PRFS Total

The assumption of normality and outliers was met.

Figure 4

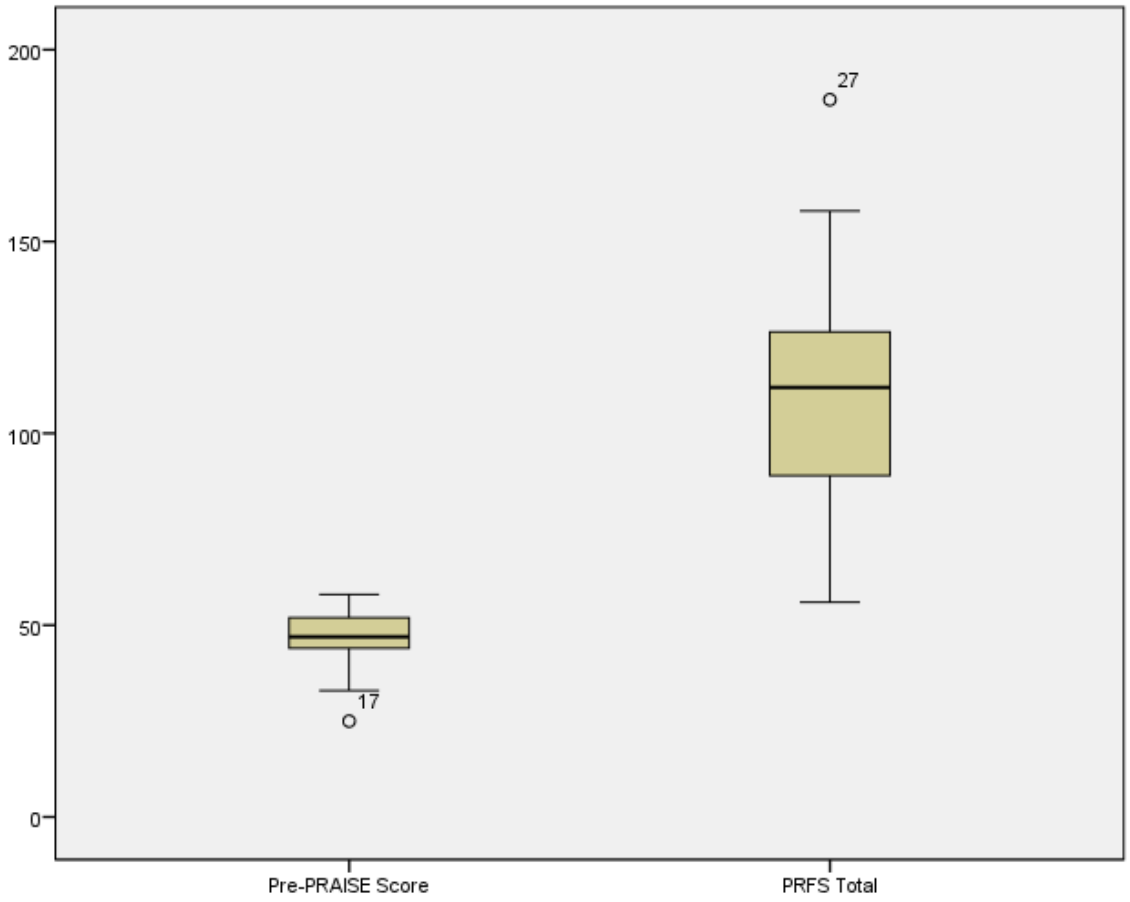
Pre PR PRAISE PRFS Total



Note. Skewness for PRFS Total= .141 (assumption was met).

Figure 5

Pre PR PRAISE PRFS Total



Notes. Pre-PRAISE= 1 outlier
Range- 33
Min- 25
Max- 58

PRFS Total= 1 outlier
Range- 131
Min- 56
Max- 187

Table 3

Pre PR PRAISE PRFS Total

Predictor Variable	P	R	R Square	a	b
PRFS Total	.223	NA	NA	NA	NA

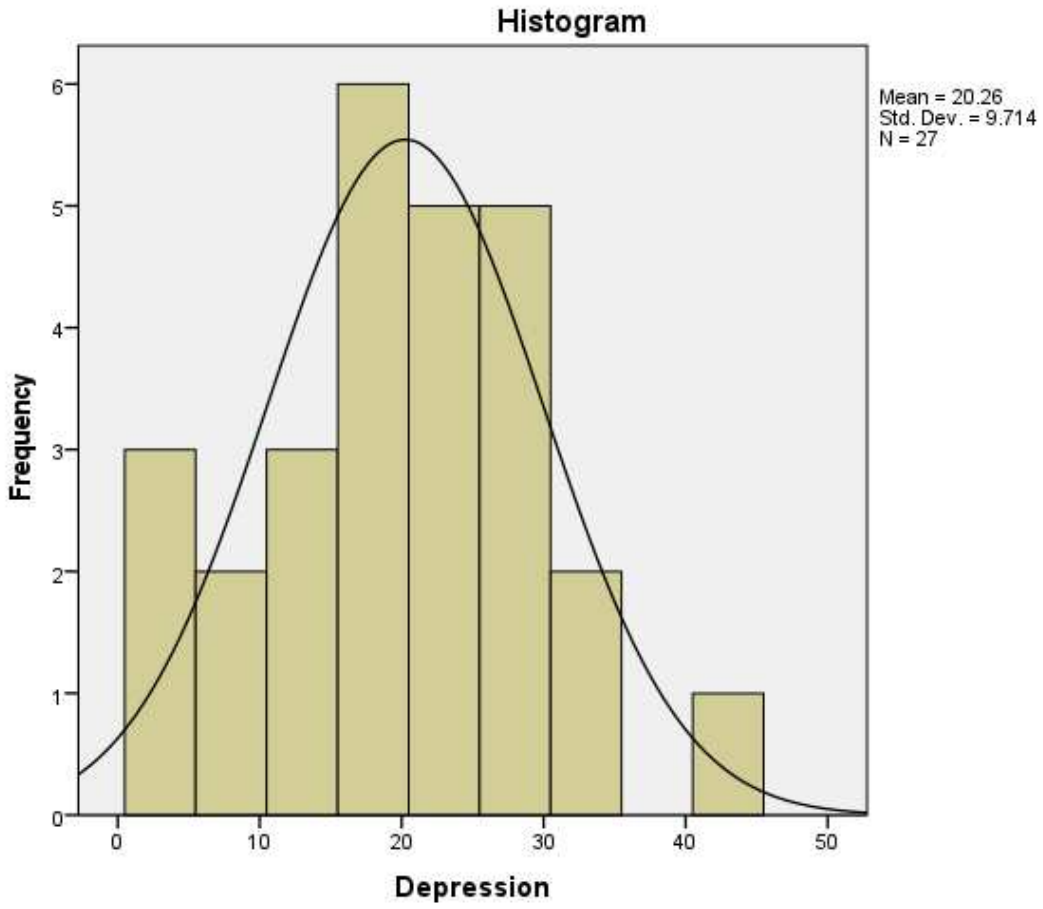
Single linear regression was conducted to predict associations between PRFS Total and Pre-PRAISE scores. The results were statistically insignificant, F (1, 25), = 1.561, p= .223. Pre-PRAISE scores were not found to be a significant predictor of PRFS total scores.

Assumptions Pre-PRAISE Depression

The assumption of normality and outliers was met.

Figure 6

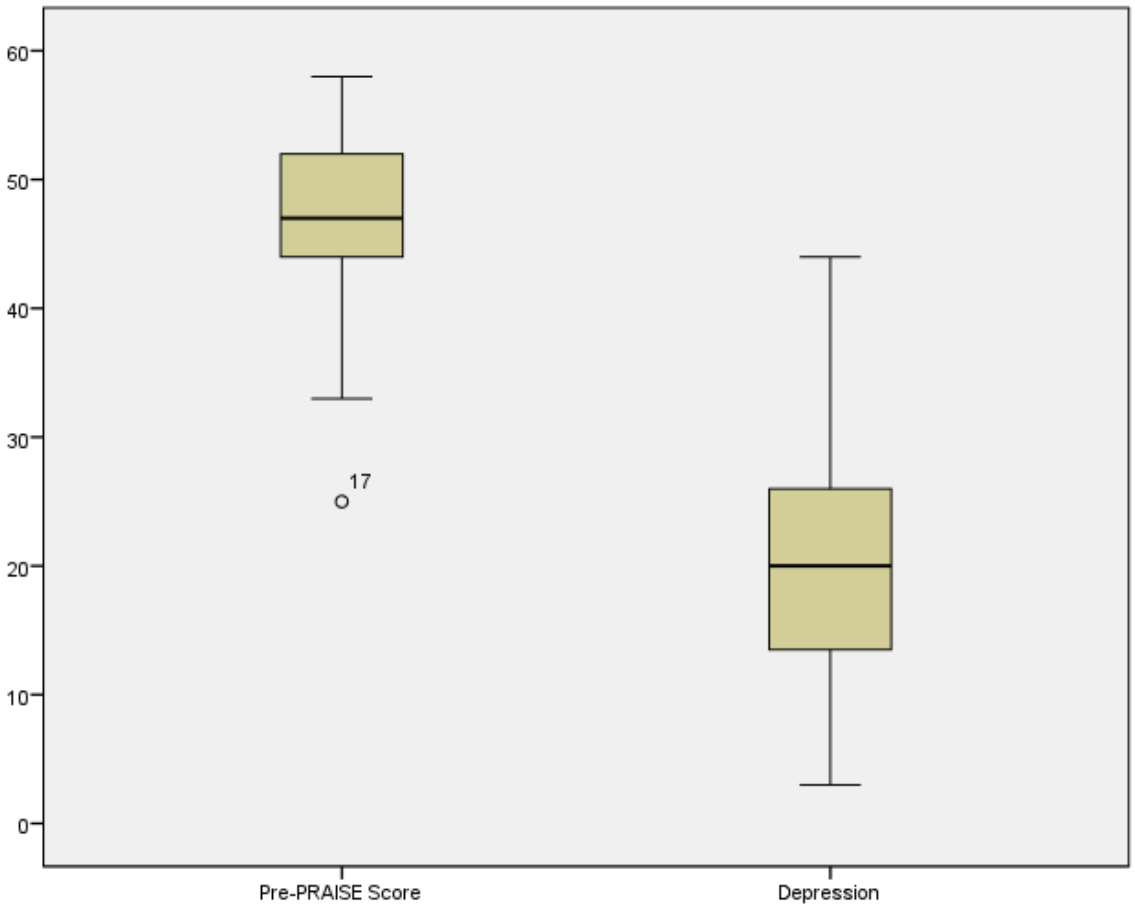
Pre PR PRAISE Depression



Note. Skewness for Depression = .082.

Figure 7

Pre PR PRAISE Depression



Notes. Pre-PRAISE Outliers = 1
Range- 33
Min- 25
Max- 58

Depression Outliers = 0
Range- 41
Min- 3
Max- 44

Table 4

Pre PR PRAISE Depression

Predictor Variable	P	R	R Square	a	b
Depression	.037	.402	.162	48.758	-.607

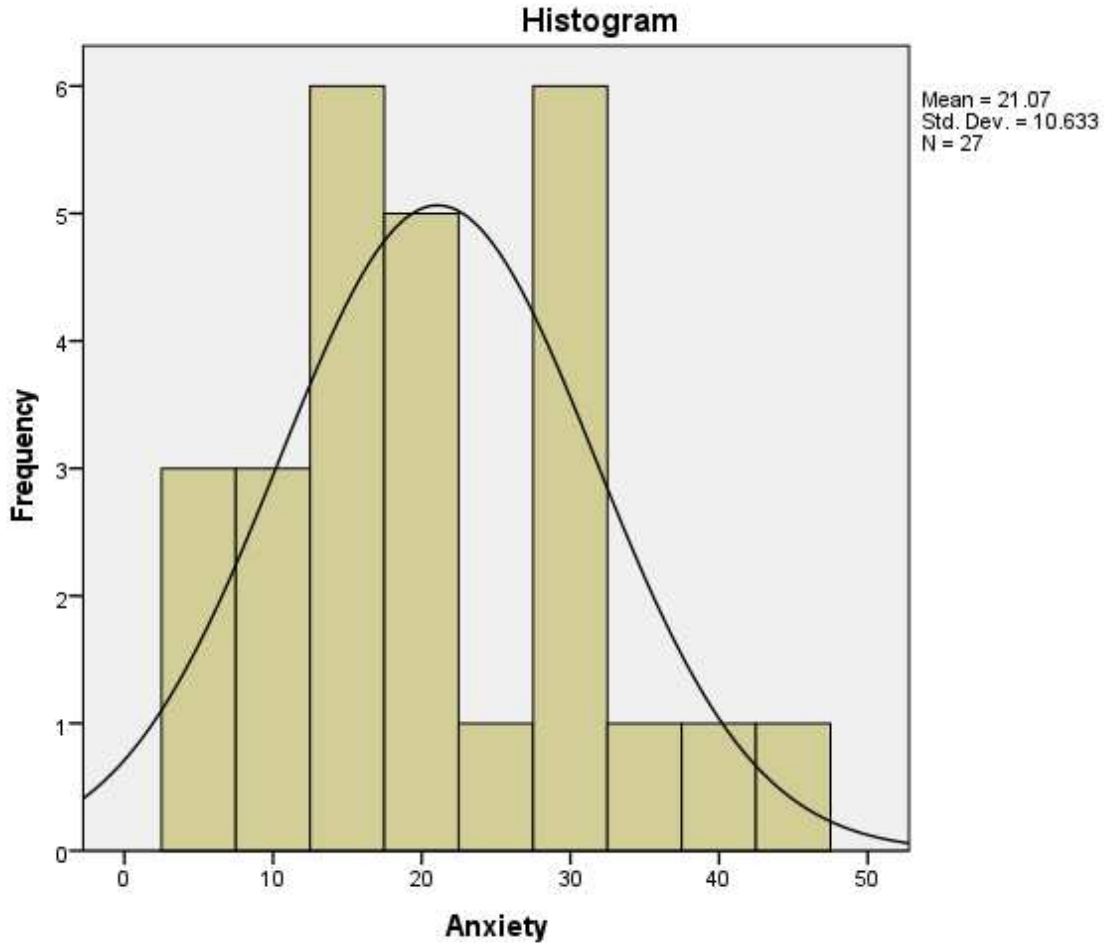
Single linear regression was conducted to predict associations between PRFS Depression and Pre-PRAISE scores. The results were statistically significant, F (1, 25), = 4.831, p = .037. The R Square was .162, meaning that approximately 16% of the variance in depression scores were explained by the Pre-PRAISE scores. Pre-PRAISE scores were found to be a significant predictor of PRFS Depression scores.

Assumptions for Pre PR PRAISE Anxiety

The assumption of normality and outliers was met.

Figure 8

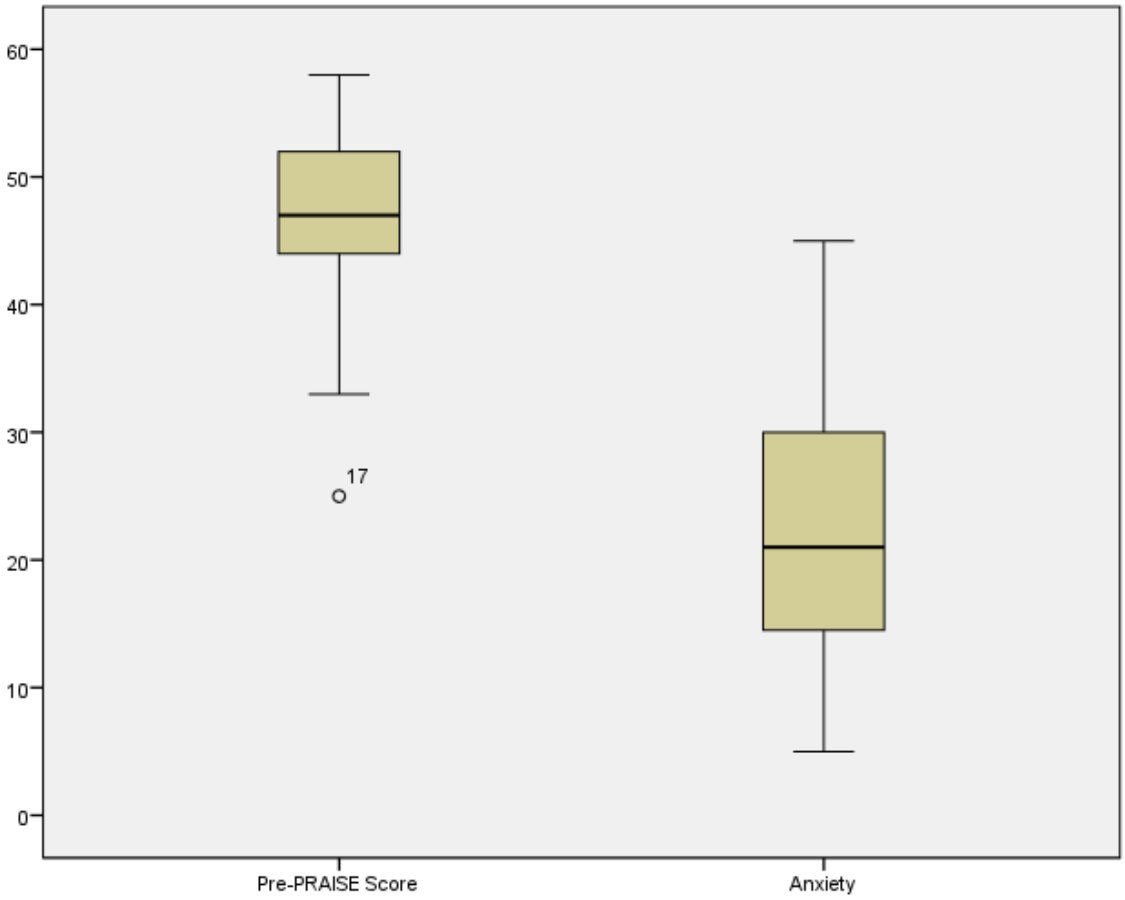
Pre PR PRAISE Anxiety



Note. Skewness for Anxiety = .379.

Figure 9

Pre PR PRAISE Anxiety



Notes. Pre PR PRAISE Outliers= 1
Range- 33
Min- 25
Max- 58

Anxiety Outliers= 0
Range- 40
Min- 5
Max- 45

Table 5

Pre PR PRAISE Anxiety

Predictor Variable	P	R	R Square	a	b
Anxiety	.148	NA	NA	NA	NA

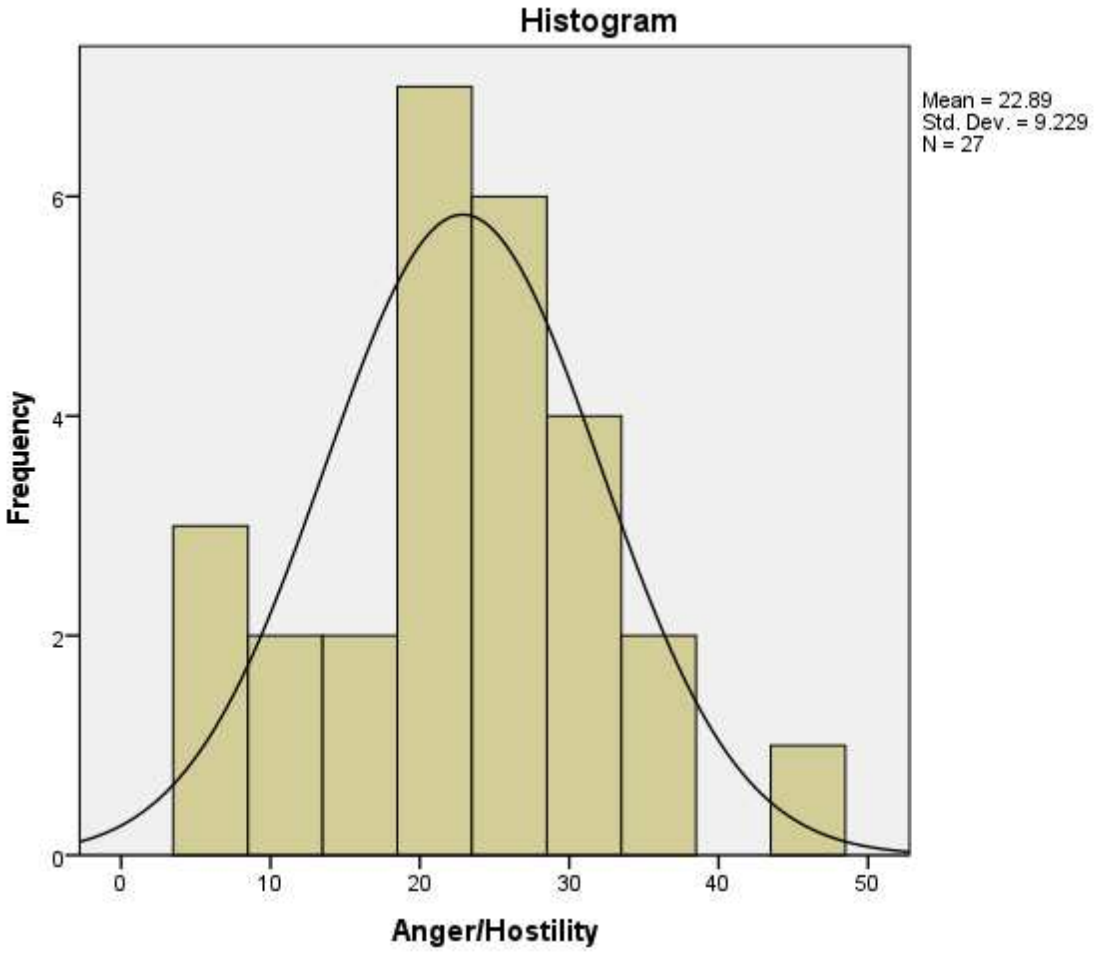
Single linear regression was conducted to test associations between PRFS Anxiety and Pre-PRAISE scores. The results were statistically insignificant, F (1, 25), = 2.223, p= .148. Pre-PRAISE scores were not found to be a significant predictor of PRFS Anxiety scores.

Assumptions for Pre PR PRAISE Anger/Hostility

The assumption of normality and outliers was met.

Figure 10

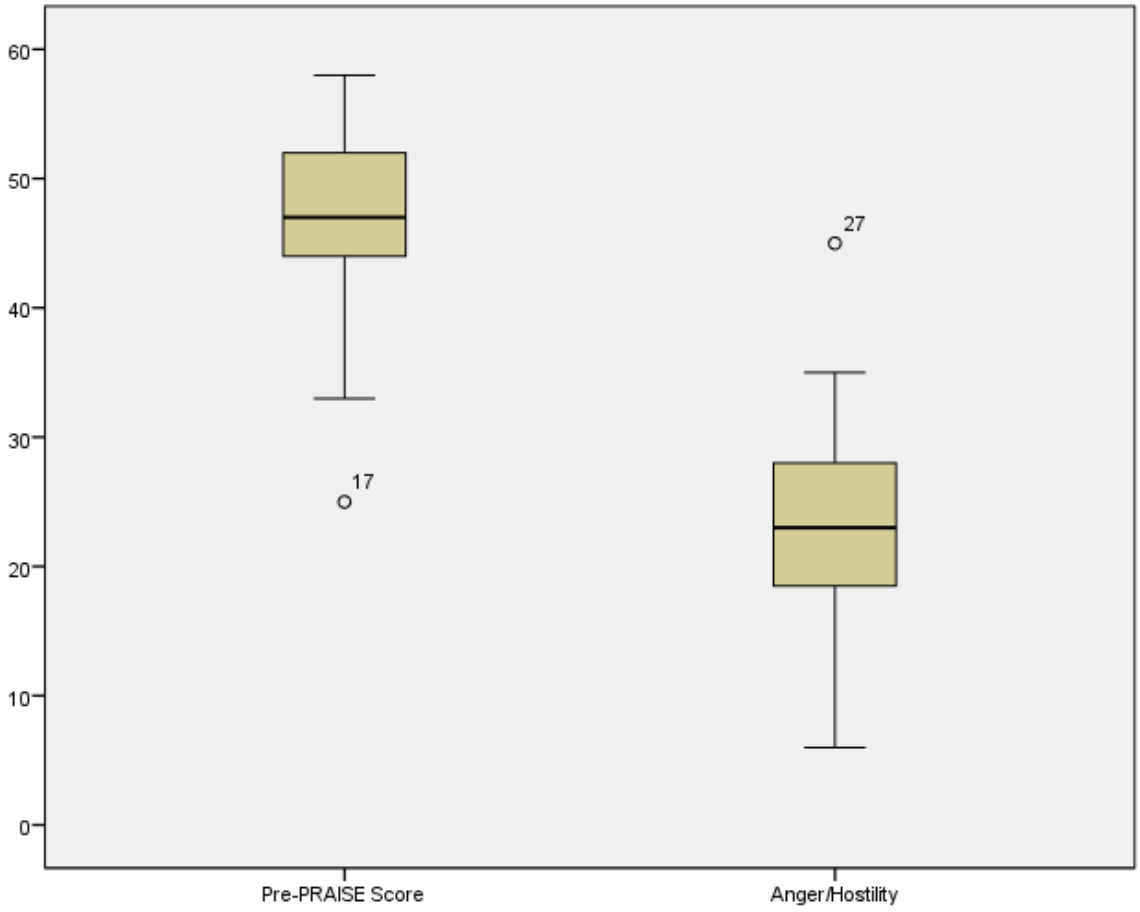
Pre PRAISE Anger Hostility



Note. Skewness = .379.

Figure 11

Pre PRAISE Anger/Hostility



Notes. Pre-PRAISE Outliers= 1
Range- 33
Min- 25
Max- 58

Anger/Hostility Outliers=1
Range- 39
Min- 6
Max- 45

Table 6

Pre PRAISE Anger Hostility

Predictor Variable	P	R	R Square	a	b
PRFS Anger/Hostility	.465	NA	NA	NA	NA

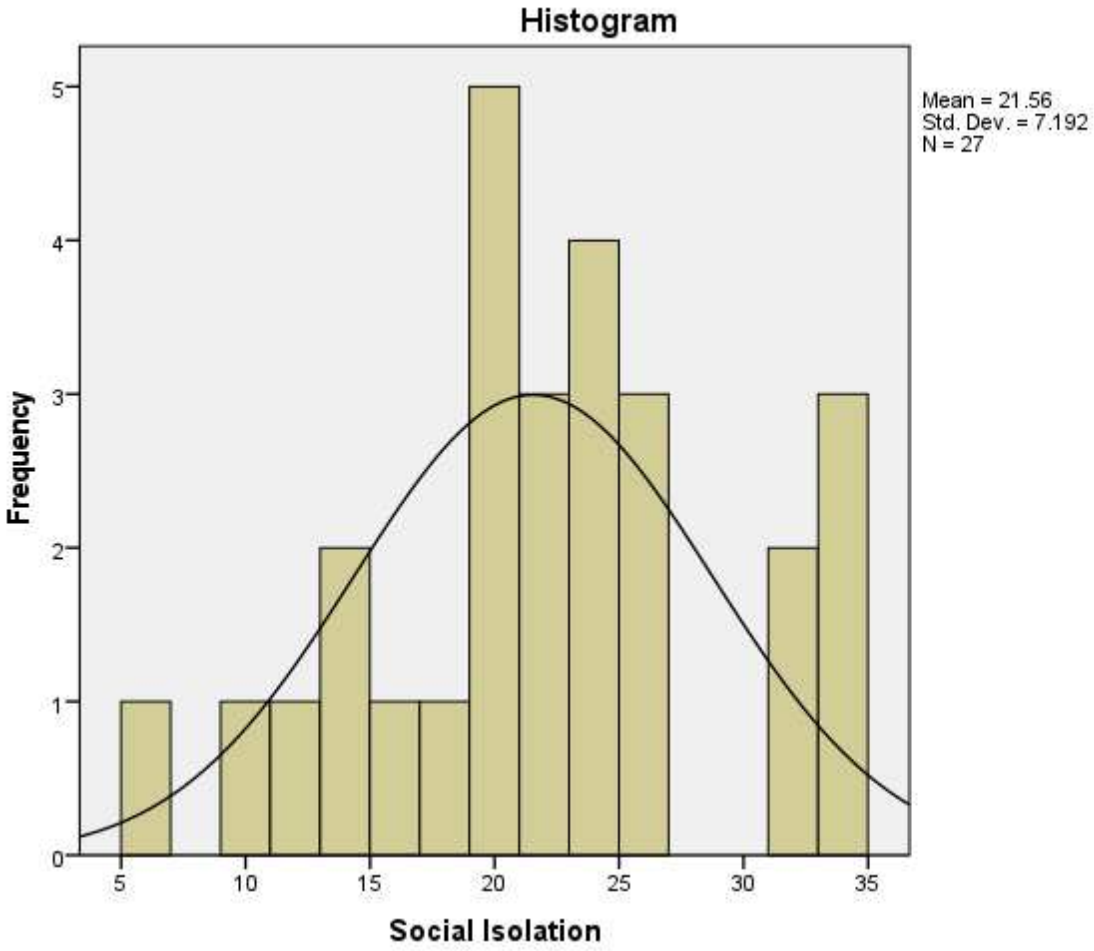
Single linear regression was conducted to predict associations between PRFS Anger/Hostility and Pre-PRAISE scores. The results were statistically insignificant, F (1, 25), = .552, p= .465. Pre-PRAISE scores were not found to be a significant predictor of PRFS Anger/Hostility.

Assumptions for Pre-PRAISE Social Isolation

The assumption of normality and outliers was met.

Figure 12

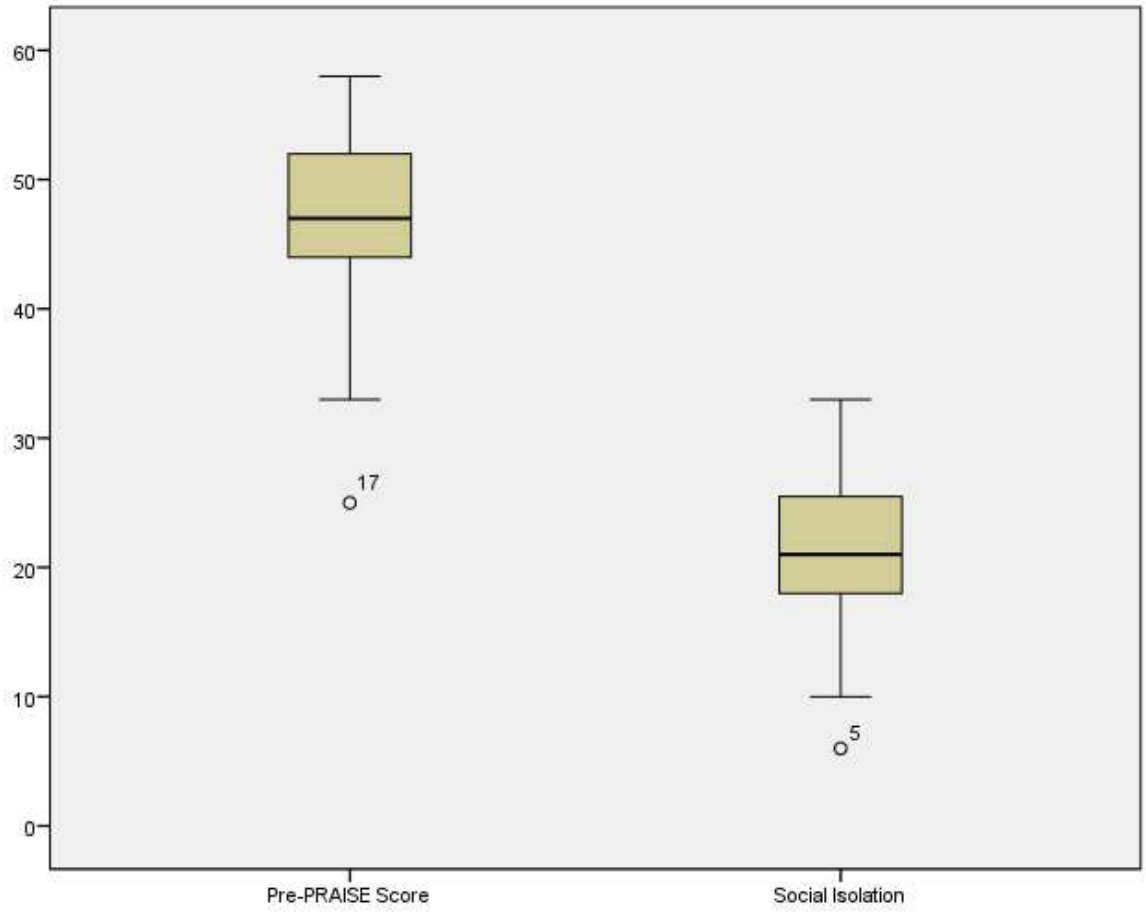
Pre PRAISE Social Isolation



Note. Skewness = .116.

Figure 13

Pre PR PRAISE Social Isolation



Notes. Pre-PRAISE Outliers= 1
Range- 33
Min- 25
Max- 58

Social Isolation Outliers= 1
Range- 27
Min- 6
Max- 33

Table 7

Pre PRAISE Social Isolation

Predictor Variable	P	R	R Square	a	b
PRFS Social Isolation	.412	NA	NA	NA	NA

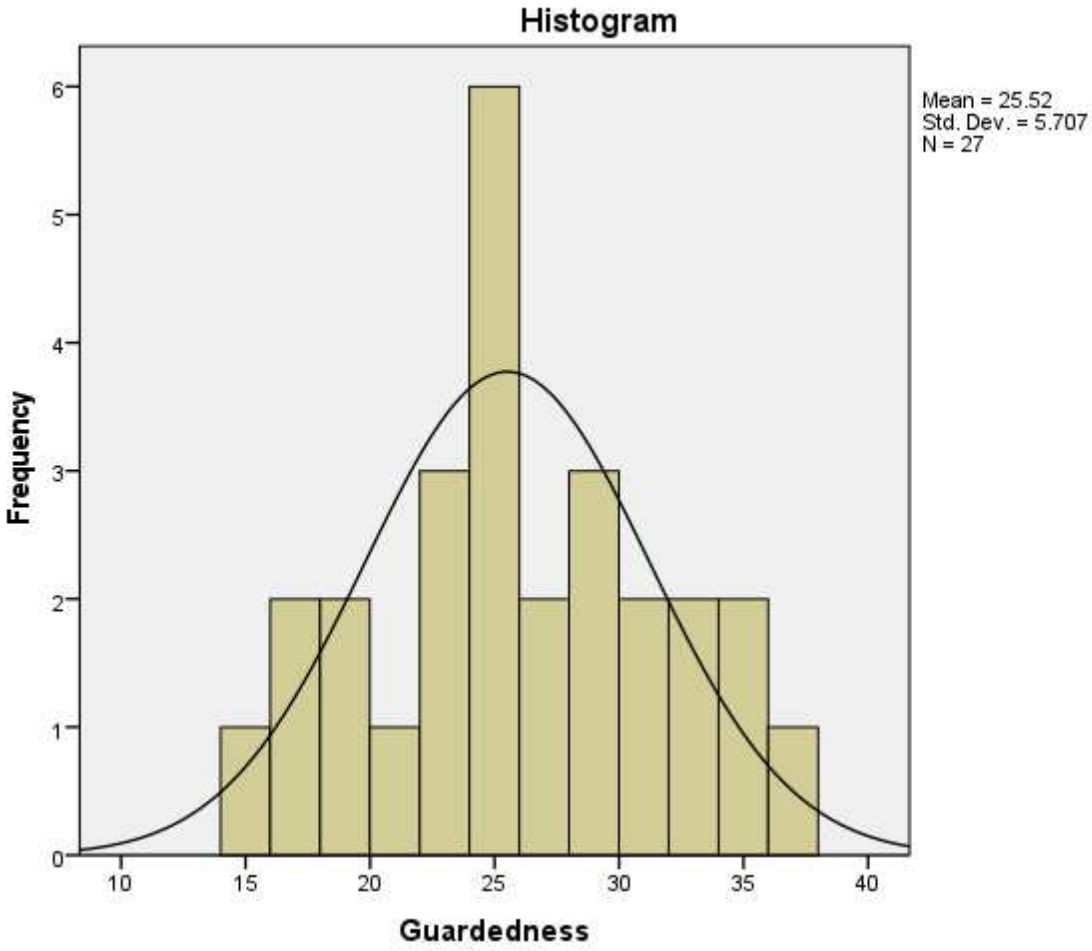
Single linear regression was conducted to predict associations between PRFS Social Isolation and Pre-PRAISE scores. The results were statistically insignificant, F (1, 25), = .698, p= .412. Pre-PRAISE scores were not found to be a significant predictor of PRFS Social Isolation.

Assumptions for Pre PR PRAISE Guardedness

The assumption of normality and outliers was met. Outliers were not excluded from the sample.

Figure 14

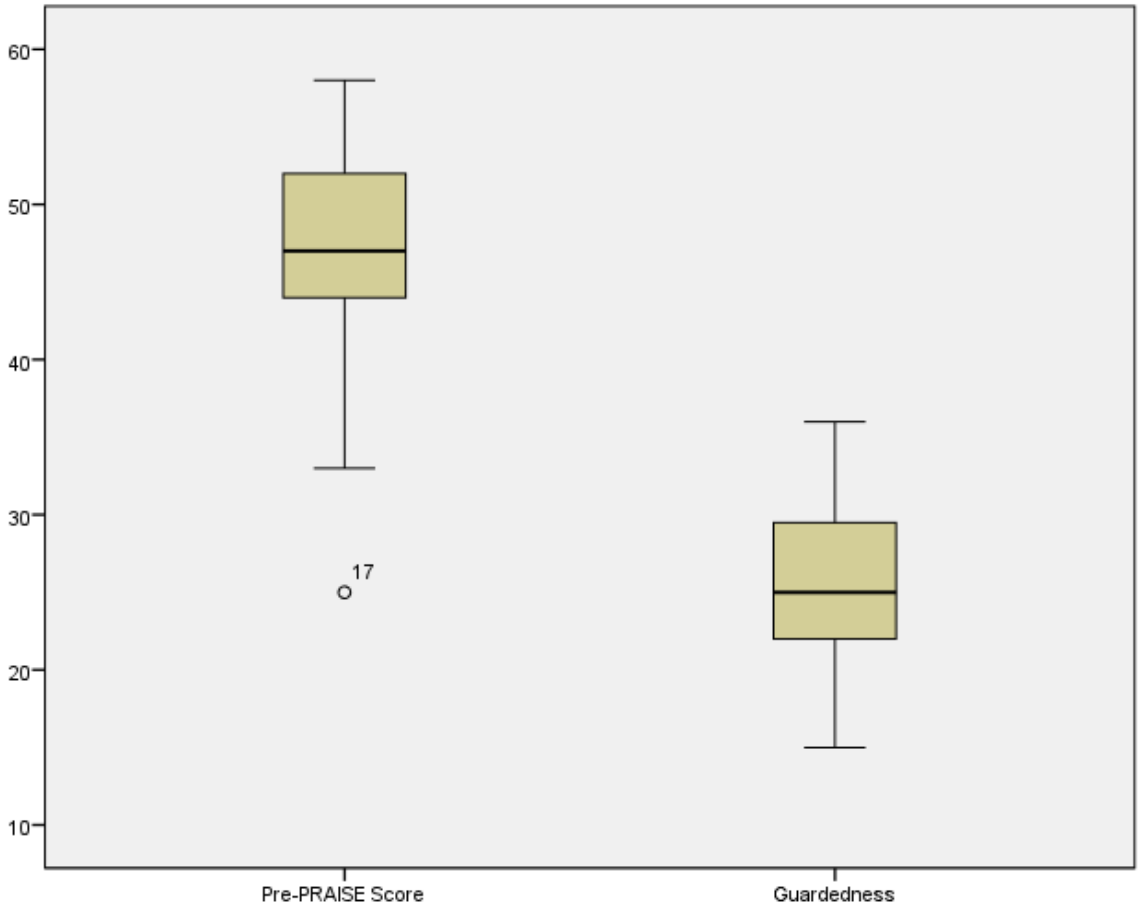
Pre PRAISE Guardedness



Note. Skewness = .057.

Figure 15

Pre PRAISE Guardedness



Notes. Pre-PRAISE Outliers= 1
Range- 33
Min- 25
Max- 58

Guardedness Outliers= 0
Range- 21
Min- 15
Max- 36

Table 8

Pre PRAISE Guardedness

Predictor Variable	P	R	R Square	a	b
PRFS Guardedness	.139	NA	NA	NA	NA

Single linear regression was conducted to predict associations between PRFS Guardedness and Pre-PRAISE scores. The results were statistically insignificant, F (1, 25), = 2.338 p= .139. Pre-PRAISE scores were not found to be a significant predictor of PRFS Guardedness.

Research Question 3

Is there a change in self-efficacy as measured by the PRAISE after completion of pulmonary rehabilitation?

Assumptions

The assumption of dichotomous paired independent variables was met with the Pre-PRAISE and Post-PRAISE scores. The analysis was run on PRAISE results from the same participants before and after the completion of the pulmonary rehabilitation program. The assumption of normality was met with Pre PR PRAISE skewness -.900 and Post PR PRAISE .476. These values were between -1.00 and 1.00 and thus considered acceptably normal (Morgan et al., 2018).

Figure 16

Pre PR PRAISE Scores

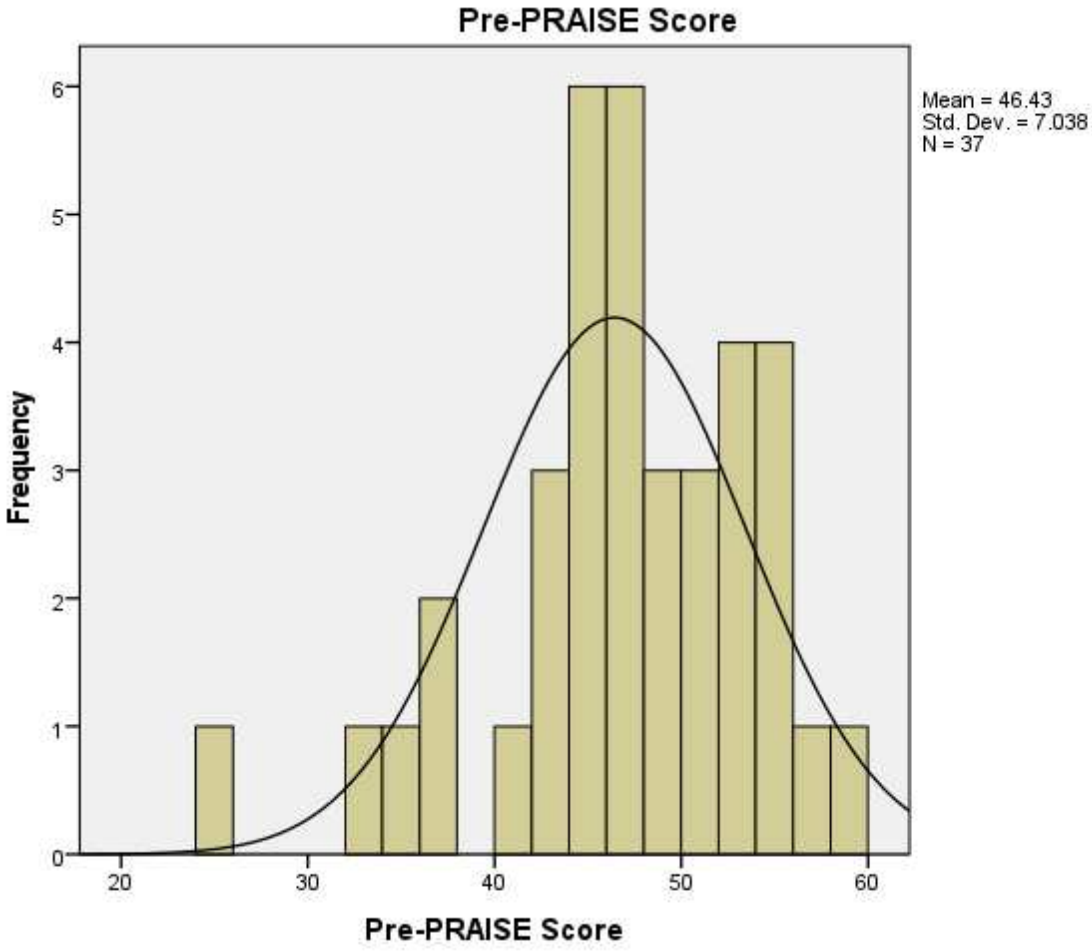


Figure 17

Post PRAISE Scores

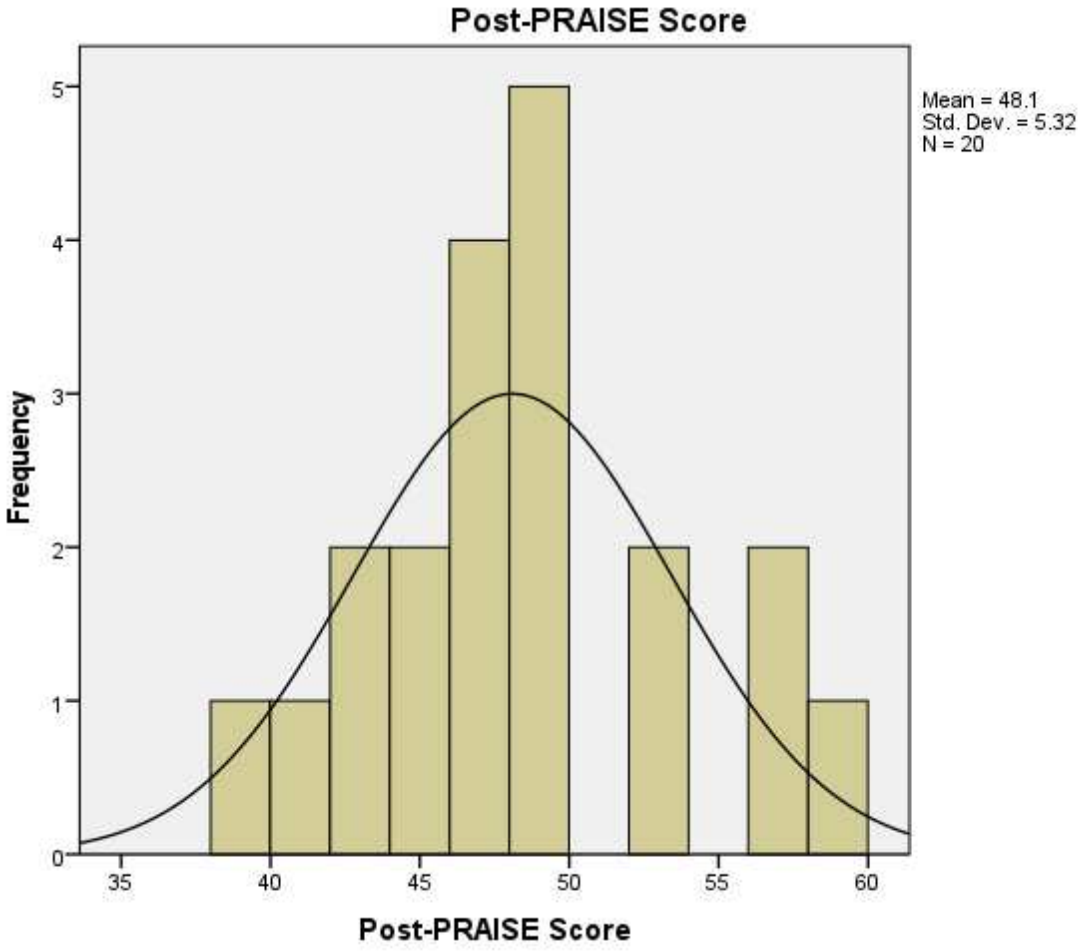


Table 9

Pre PRAISE Post PRAISE

Variable	M	SD	T	Df	P	d
Pre-Praise	46.55	6.817		19	0.054	NA
Post-Praise	48.10	5.320				NA

Table 9 presents the results for a paired samples t-test which was conducted to compare pre- versus post-PRAISE scores. These results revealed no significant difference in the pre-PRAISE scores (M= 46.6, SD= 6.8) and post-PRAISE scores (M= 48.1, SD= 5.3) conditions; t (19)= -1.1, p= .054. However, these results are very promising considering the small sample size.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Thirty-six participants were recruited for this study. All participants completed the PRAISE assessment after phone informed consent was obtained. PRFS were accessed through the medical record of participants. Upon program completion, participants completed a follow-up PRAISE assessment. The PRAISE questionnaire served as the independent variable. Dependent variables included PRFS total, depression, anxiety, social isolation, anger/hostility, as well as pulmonary rehabilitation completion status. No significant results were found between higher levels of self-efficacy on PRAISE and program completion. No significant associations were found between the PRAISE and PRFS total, anxiety, social isolation, and anger/hostility. However, a significant relationship was revealed between low self-efficacy as measured on the PRAISE assessment and the depression domain of the PRFS. The study did not reveal a change in self-efficacy on PRAISE assessment post-pulmonary rehabilitation.

Discussion

The objectives of this study were to determine if self-efficacy was predictive of pulmonary rehabilitation completion, if there was a relationship between self-efficacy and psychosocial factors, and if self-efficacy scores increased after completion of pulmonary rehabilitation. The results did not reveal a significant relationship between

self-efficacy scores and pulmonary rehabilitation completion. While results were promising considering the small sample size, this study did not find an increase in self-efficacy after pulmonary rehabilitation. However, study findings did reveal an association between low levels of self-efficacy and high levels of depression.

Depression is a common psychiatric problem in people with COPD. It is associated with increased morbidity and mortality (Coventry, 2009; Matte et. al., 2016). Moreover, comorbid depression in the COPD population is associated with low levels of self-efficacy. In a study of 207 patients with spirometry confirmed COPD, Coultas and colleagues (2007), found low self-efficacy to be a predictor of both depressive symptoms and low social support. A recent study of US Veterans with COPD found that lower baseline PR self-efficacy and higher baseline depression was associated with lower improvements in post PR fatigue (Bamonti et. al., 2021). A study by Simpson & Jones (2013) found that higher levels of self-efficacy were associated with lower levels of self-efficacy, anxiety, and shortness of breath. The is abundant evidence that a strong association between self-efficacy and depression exists in people with COPD.

Directions for Future Research

Pulmonary rehabilitation improves both exercise capacity and health-related quality-of-life in patients with COPD (McCarthy et al., 2015; Ries et al., 2007). Depression can compromise an individual's participation in pulmonary rehabilitation as well as other treatment regimens required of COPD patients (Brown et al., 2016).

Previous research has found self-efficacy to be protective against depressive symptoms (Maciejeski et al., 2000). Fostering self-efficacy within the sphere of

pulmonary rehabilitation may help reduce depressive symptoms in participants with COPD. Future applications of self-efficacy theory to depression in individuals with COPD may help better understand how to best engage pulmonary rehabilitation participants.

This study did not explore the role of social support. Social support is an important aspect of health and well-being. The distribution of social support differs among gender, age, social class, and marital status. Previous research has demonstrated relationships between low social support, low self-efficacy, and depressive symptoms (Marino et al., 2008). Further research is needed to better understand the role of social support and psychological distress.

Study Limitations

The results of this study must be considered in the context of its limited sample size. The original power analysis called for 66 subjects. Recruitment was difficult. The COVID-19 pandemic presented challenges in terms of study recruitment as we experienced several COVID-19 surges during the recruitment period. To be eligible for this study, participants must first have enrolled in a hospital-based pulmonary rehabilitation program. New COVID-19 safety policies and concerns of contracting COVID-19 in the rehabilitation environment likely contributed to slow pulmonary rehabilitation enrollment, thus affecting study recruitment.

This study relied on self-reported data. Self-reported data is inherently limited as it cannot be verified independently.

Conclusion

While this study did not identify a causal pathway, a clear association between low levels of self-efficacy and high levels of depression was demonstrated. Fostering self-efficacy within the sphere of pulmonary rehabilitation may help reduce depressive symptoms and overall functioning in COPD patients. Future research with larger sample sizes and a focus on self-efficacy as it relates to behavior change will help us better understand ways in which to enhance self-efficacy within the course of pulmonary rehabilitation.

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APPENDIX A

GENERAL SELF-EFFICACY SCALES (GSE)

General Self-Efficacy Scale (GSE)

About: This scale is a self-report measure of self-efficacy.

Items: 10

Reliability:
Internal reliability for GSE = Cronbach's alphas between .76 and .90

Validity:
The General Self-Efficacy Scale is correlated to emotion, optimism, work satisfaction. Negative coefficients were found for depression, stress, health complaints, burnout, and anxiety.

Scoring:

	Not at all true	Hardly true	Moderately true	Exactly true
All questions	1	2	3	4

The total score is calculated by finding the sum of the all items. For the GSE, the total score ranges between 10 and 40, with a higher score indicating more self-efficacy.

References:

Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. In J. Weinman, S. Wright, & M. Johnston, *Measures in health psychology: A user's portfolio. Causal and control beliefs* (pp. 35-37). Windsor, UK: NFER-NELSON.

PRAISE (Pulmonary Rehabilitation Adapted Index of Self-Efficacy)

Adapted from the General Self-Efficacy Scale, Schwarzer R. & Jerusalem M. (1995)

Please circle where you feel you are now.

Statement	Score			
I can always manage to solve difficult problems if I try hard enough.	1	2	3	4
If someone opposes me, I can find the means and ways to get what I want.	1	2	3	4
It is easy for me to stick to my aims and accomplish my goals.	1	2	3	4
I am confident that I can walk for a good distance, at my own pace, despite it making me breathless.	1	2	3	4
I am confident that I could deal efficiently with unexpected events.	1	2	3	4
Thanks to my resourcefulness, I know how to handle unforeseen situations.	1	2	3	4
I feel confident that I will be able to perform the exercises asked of me during the course of rehabilitation, even if I find them difficult.	1	2	3	4
I can solve most problems if I invest the necessary effort.	1	2	3	4
I feel that I have an adequate amount of knowledge about my lung disease, despite it being a complex condition.	1	2	3	4
I can remain calm when facing difficulties because I can rely on my coping abilities.	1	2	3	4
When I am confronted with a problem, I can usually find several solutions.	1	2	3	4
I feel positive that I will be able to complete the exercises at home, despite there being no supervision from a health professional.	1	2	3	4
If I am in trouble, I can usually think of a solution.	1	2	3	4
I can handle whatever comes my way.	1	2	3	4
On a day to day basis I feel in control of my lung disease and how that affects my lifestyle, even when my symptoms become distressing.	1	2	3	4

Response Format.

1= Not at all true **2**= Hardly true **3**= Moderately true **4**= Exactly true

General Self-Efficacy Scale (GSE)

About: This scale is a self-report measure of self-efficacy.

Items: 10

Reliability:
Internal reliability for GSE = Cronbach's alphas between .76 and .90

Validity:
The General Self-Efficacy Scale is correlated to emotion, optimism, work satisfaction. Negative coefficients were found for depression, stress, health complaints, burnout, and anxiety.

Scoring:

	Not at all true	Hardly true	Moderately true	Exactly true
All questions	1	2	3	4

The total score is calculated by finding the sum of the all items. For the GSE, the total score ranges between 10 and 40, with a higher score indicating more self-efficacy.

References:

Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. In J. Weinman, S. Wright, & M. Johnston, *Measures in health psychology: A user's portfolio. Causal and control beliefs* (pp. 35-37). Windsor, UK: NFER-NELSON.

APPENDIX B

PSYCHOSOCIAL RISK FACTOR SURVEY

The Psychosocial Risk Factor Survey PRFS

Name:	Facility:	
DOB: Date:	Primary Dx:	Secondary Dx:
Marital Status: ☐ Married ☐ Single ☐ Divorced ☐ Separated ☐ Widowed	☐ Male ☐ Female	Pre / Post

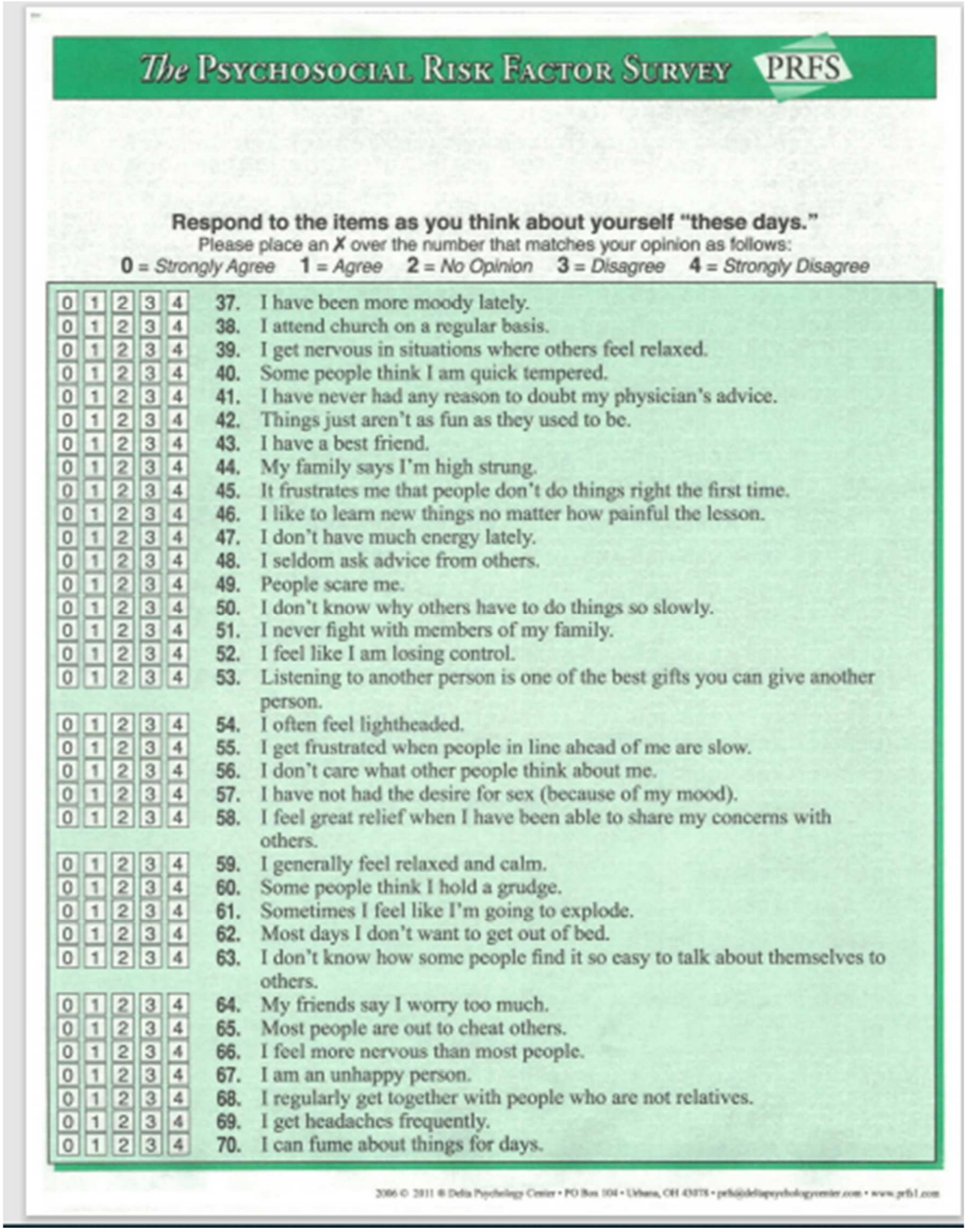
Respond to the items as you think about yourself "these days."

Please place an ✗ over the number that matches your opinion as follows:

0 = *Strongly Agree* **1** = *Agree* **2** = *No Opinion* **3** = *Disagree* **4** = *Strongly Disagree*

0 1 2 3 4	1.	Growing old does not bother me.
0 1 2 3 4	2.	Everything just seems hard these days.
0 1 2 3 4	3.	I prefer being married rather than being single.
0 1 2 3 4	4.	I am confident in my future.
0 1 2 3 4	5.	My family thinks I yell a lot.
0 1 2 3 4	6.	Winning is not really important to me.
0 1 2 3 4	7.	I just want to stay away from other people these days.
0 1 2 3 4	8.	Nobody really wants to hear my problems.
0 1 2 3 4	9.	Sometimes I have to check the front door several times to know it's locked.
0 1 2 3 4	10.	People don't know how to drive.
0 1 2 3 4	11.	I usually drive under the speed limit.
0 1 2 3 4	12.	I think more about ending my life lately.
0 1 2 3 4	13.	I have several friends.
0 1 2 3 4	14.	I don't like crowds lately.
0 1 2 3 4	15.	I get angry at the drop of a hat.
0 1 2 3 4	16.	I have always learned from my mistakes.
0 1 2 3 4	17.	Sometimes I'm not sure what I'm doing with my life.
0 1 2 3 4	18.	I frequently feel all alone in my life.
0 1 2 3 4	19.	I can't sleep because there is too much on my mind.
0 1 2 3 4	20.	I get really steamed when someone cuts me off in traffic.
0 1 2 3 4	21.	I appreciate peoples' criticism of my flaws.
0 1 2 3 4	22.	I have a hard time making decisions lately.
0 1 2 3 4	23.	I have someone to share my innermost concerns with.
0 1 2 3 4	24.	My jaw or shoulders feel tense more than I like.
0 1 2 3 4	25.	I have thrown things out of anger.
0 1 2 3 4	26.	No matter what the temperature, I am content.
0 1 2 3 4	27.	My thoughts feel so scattered lately.
0 1 2 3 4	28.	I spend much of my time alone.
0 1 2 3 4	29.	My stomach feels tied up in knots a lot.
0 1 2 3 4	30.	I have been told I get angry over little things.
0 1 2 3 4	31.	I have wronged others and not admitted to it.
0 1 2 3 4	32.	I don't like where my thoughts lead me these days.
0 1 2 3 4	33.	I prefer to be alone.
0 1 2 3 4	34.	I wish I didn't get uptight so much.
0 1 2 3 4	35.	If someone treats me unfairly, I will make sure they know about it.
0 1 2 3 4	36.	I have always told the truth about what I have eaten.

Please complete reverse side.



The Psychosocial Risk Factor Survey PRFS

Respond to the items as you think about yourself "these days."

Please place an ✗ over the number that matches your opinion as follows:

0 = *Strongly Agree* **1** = *Agree* **2** = *No Opinion* **3** = *Disagree* **4** = *Strongly Disagree*

0 1 2 3 4	37.	I have been more moody lately.
0 1 2 3 4	38.	I attend church on a regular basis.
0 1 2 3 4	39.	I get nervous in situations where others feel relaxed.
0 1 2 3 4	40.	Some people think I am quick tempered.
0 1 2 3 4	41.	I have never had any reason to doubt my physician's advice.
0 1 2 3 4	42.	Things just aren't as fun as they used to be.
0 1 2 3 4	43.	I have a best friend.
0 1 2 3 4	44.	My family says I'm high strung.
0 1 2 3 4	45.	It frustrates me that people don't do things right the first time.
0 1 2 3 4	46.	I like to learn new things no matter how painful the lesson.
0 1 2 3 4	47.	I don't have much energy lately.
0 1 2 3 4	48.	I seldom ask advice from others.
0 1 2 3 4	49.	People scare me.
0 1 2 3 4	50.	I don't know why others have to do things so slowly.
0 1 2 3 4	51.	I never fight with members of my family.
0 1 2 3 4	52.	I feel like I am losing control.
0 1 2 3 4	53.	Listening to another person is one of the best gifts you can give another person.
0 1 2 3 4	54.	I often feel lightheaded.
0 1 2 3 4	55.	I get frustrated when people in line ahead of me are slow.
0 1 2 3 4	56.	I don't care what other people think about me.
0 1 2 3 4	57.	I have not had the desire for sex (because of my mood).
0 1 2 3 4	58.	I feel great relief when I have been able to share my concerns with others.
0 1 2 3 4	59.	I generally feel relaxed and calm.
0 1 2 3 4	60.	Some people think I hold a grudge.
0 1 2 3 4	61.	Sometimes I feel like I'm going to explode.
0 1 2 3 4	62.	Most days I don't want to get out of bed.
0 1 2 3 4	63.	I don't know how some people find it so easy to talk about themselves to others.
0 1 2 3 4	64.	My friends say I worry too much.
0 1 2 3 4	65.	Most people are out to cheat others.
0 1 2 3 4	66.	I feel more nervous than most people.
0 1 2 3 4	67.	I am an unhappy person.
0 1 2 3 4	68.	I regularly get together with people who are not relatives.
0 1 2 3 4	69.	I get headaches frequently.
0 1 2 3 4	70.	I can fume about things for days.

APPENDIX C

UNIVERSITY OF ALABAMA AT BIRMINGHAM INSTITUTIONAL REVIEW BOARD LETTER OF APPROVAL

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM
Office of the Institutional Review Board for Human Use

470 Administration Building
701 20th Street South
Birmingham, AL 35294-0104
205.934.3789 | Fax 205.934.1301 |
irb@uab.edu

APPROVAL LETTER

TO: Anderson, Erica

FROM: University of Alabama at Birmingham Institutional Review Board
Federalwide Assurance # FWA00005960
IORG Registration # IRB00000196 (IRB 01)
IORG Registration # IRB00000726 (IRB 02)
IORG Registration # IRB00012550 (IRB 03)

DATE: 11-Mar-2021

RE: IRB-300006593
IRB-300006593-005
"Self-Efficacy Assessment in Pulmonary Rehabilitation"

The IRB reviewed and approved the Initial Application submitted on 10-Mar-2021 for the above referenced project. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services.

Type of Review:	Expedited
Expedited Categories:	7
Determination:	Approved
Approval Date:	11-Mar-2021
Approval Period:	Expedited Status Update (ESU)
Expiration Date:	10-Mar-2024

Although annual continuing review is not required for this project, the principal investigator is still responsible for (1) obtaining IRB approval for any modifications before implementing those changes except when necessary to eliminate apparent immediate hazards to the subject, and (2) submitting reportable problems to the IRB. Please see the IRB Guidebook for more information on these topics.

Documents Included in Review:

- PRFS (1).pdf
- Consent
- PRAISE
- IRB EPORTFOLIO