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Effectiveness of three strengths of education and exercise on self-efficacy for walking and self-efficacy for managing dyspnea in patients with chronic obstructive pulmonary disease

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EFFECTIVENESS OF THREE STRENGTHS OF EDUCATION AND EXERCISE ON SELF-EFFICACY FOR WALKING AND SELF-EFFICACY FOR MANAGING DYSPNEA IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

by

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DISSERTATION

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[redacted]

ABSTRACT

Effectiveness of Three Strengths of Education and Exercise on Self-Efficacy for Walking and Self-Efficacy for Managing Dyspnea in Patients with Chronic Obstructive Pulmonary Disease

By

Amy Hui-Jiun Tsang

Self-efficacy, the belief in one's capabilities to control, organize, and execute the course of action required to achieve desired outcomes, is an important determinant of human behavior. Few investigators have examined self-efficacy related to dyspnea management and physical function and patient's efficacy beliefs about self-care dyspnea management strategies in patients with Chronic Obstructive Pulmonary Disease (COPD). No instrument is available to measure patients' efficacy beliefs in dyspnea management strategies. **Purposes**: 1) To compare the effectiveness of three different strengths of education and exercise on self-efficacy for walking and for managing dyspnea; 2) To develop and test an instrument, Self-Efficacy and Dyspnea Strategies Scale (SEADS), that measures patients' efficacy beliefs of dyspnea management strategies. **Methods**: 102 subjects with COPD were included (57 women, 45 men; mean age 66 $\pm$ 8, mean FEV1 in liters 1.09 $\pm$ 0.33L, FVC % predicted 77 $\pm$ 15). Subjects were randomized to one of three groups: Home Walking Control (education about dyspnea management strategies [ED] and a home walking prescription [HWP]; Exposure [ED + HWP] and four coached treadmill exercise sessions (EX); and Training [ED + HWP] and 24 EX. Self-efficacy for walking (SEWALK) and measures of self-efficacy for managing dyspnea (COPD Self-

Efficacy Scale [CSES], Stanford's Self-Efficacy for Managing Shortness of Breath question [SEMSOB], and SEADS) were administered at baseline and posttest.

Results: SEWALK (baseline mean 7.2 ± 2.5, posttest 8.0 ± 2.1; $p<.0005$), SEMSOB (mean 5.4 ± 2.7 and 6.4 ± 2.4; $p<.0005$), and SEADS (mean 7.3 ± 1.8 and 7.9 ± 1.6; $p<.0005$) significantly improved in all groups. CSES did not change over time (mean $3.11 \pm .78$ and $3.15 \pm .77$, $p=.53$). There were no significant differences among the groups for any measures of self-efficacy. SEADS demonstrated evidence of construct validity with significant correlations to physical performance and physical function ($r= -.20$ to $-.31$; $p<.05$ to $p<.01$), dyspnea severity ($r=.25$ to $.33$; $p<.05$ to $p<.01$), mastery ($r= .34$ to $.39$; $p<.001$), and measures of self-efficacy for managing dyspnea ($r= .22$ to $.46$; $p<.05$ to $p<.001$).

Conclusion: Education and a home walking prescription is as effective as providing 4 or 24 additional supervised exercise sessions in improving self-efficacy for walking and self-efficacy for managing dyspnea in patients with COPD.

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CHAPTER ONE: PROBLEM AND SIGNIFICANCE

Dyspnea is a symptom in which the signals arising from the respiratory system are interpreted as abnormal or threatening. Since individuals are active in the processing of information and can vary in their selective process, similar stimuli, such as bronchoconstriction, breathholding or irritation of the tracheobronchial tree, may produce different respiratory sensations and varying amounts of dyspnea in different individuals (Schwartzstein, 1998). Therefore, dyspnea is defined as a subjective experience of uncomfortable, difficult or labored breathing (Comroe, 1966).

Although precise prevalence data is not available for dyspnea, it is a common and troublesome symptom for patients with a variety of health and disease states, such as obstructive, vascular, and restrictive pulmonary diseases, congestive heart failure, pregnancy, anxiety, anemia, obesity, neuromuscular and skeletal disorders (Stulbarg & Adams, 1994). Dyspnea is also a common complaint in the general population. In the Framingham study, 6 to 27 percent of the general population had complaints of dyspnea (O'Connor et al., 1987). In one community hospital study, dyspnea accounted for 2.7 percent of all emergency room visits (Fedullo, Swinburne, & McGuire-Dunn, 1986). Elderly patients may be affected by dyspnea at a higher rate due to their gradual decline in lung function with 10 percent of those who never smoked complaining of exertional dyspnea (Enright, 1994). In general medicine clinics, dyspnea ranked as high as the third most common complaint after fatigue and back pain as the reason for visiting an internal medicine clinic (Kroenke, 1990). For patients with chronic obstructive pulmonary diseases (COPD), dyspnea is the primary reason given by patients for seeking healthcare and also the major cause of disability (Gift & Cahill, 1990). Chronic obstructive pulmonary diseases include emphysema, chronic bronchitis and asthma. They are the most common diseases that can lead to chronic airflow obstruction in the western world and are characterized by a process of reduction in maximal expiratory airflow (Ries, 1997). Emphysema and chronic bronchitis often occur together and may be difficult to detect in their early stages since these diseases may be present without notable airway obstruction. Asthma is characterized by reversible airway obstruction and may also occur together with chronic bronchitis and emphysema. Long standing asthma may lead to chronic airway obstruction (Snider, 1994).

Emphysema is defined anatomically by evidence of abnormally enlarged airspace distal to the terminal bronchioles, with destruction of the alveolar walls, without apparent fibrosis. Chronic bronchitis is defined clinically by the presence of a productive cough, for at least three months, in each of the previous two consecutive years when other causes such as mycobacterium tuberculosis, carcinoma of the lung and chronic congestive heart failure have been excluded (Murray, Johnston, Dolce, Lee, & O'Hara, 1995). Due to immutable underlying pathophysiology, many COPD patients suffer persistent, debilitating dyspnea with exertion even after appropriate medical treatment of the disease.

In general, the degree of pulmonary pathophysiology corresponds moderately to the amount of dyspnea experienced by individuals (Mahler, 1996). However, it is notable that, physiological indicators of disease severity and oxygenation, such as forced expiratory volume in one second (FEV_1), partial pressure of oxygen (PaO2) and arterial oxygen saturation (SaO2) are less sensitive than dyspnea severity in predicting a patients' exercise tolerance and quality of life (Curtis, Deyo, & Hudson, 1994). Experiencing dyspnea with exertion can cause physiological discomfort and psychological reactions of fear, frustration, anxiety or panic in many individuals (Dudley, Glaser, Jorgenson, & Logan, 1980). As a result, a person may gradually abandon activities that require exertion. The resultant inactive lifestyle, in turn, produces negative physiological and psychological consequences, more dyspnea with subsequent exertion and a further reduction in daily activities. This cycle of dyspnea-inactivity-dyspnea contributes to the physical disability (Casaburi, 1993), psychological distress and decreased quality of life of patients with COPD (Carrieri-Kohlman, 1993). In these individuals, concurrent treatment of dyspnea with various symptom management strategies is equally important as management of the disease process (Stulbarg & Adams, 1998).

Significance

Dyspnea is a complex psychophysiological phenomenon. The quality and intensity of the symptom varies from individual to individual and is modulated by a variety of factors (Altose, 1985). For a given amount of path physiological change, the "expression" of dyspnea is not only shaped by a mismatch of sensory afferent receptors input and central motor output, but also by an individual's past experience, behavior, personality, emotional state, and the context in which dyspnea occurs (Stulbarg, 1998). A variety of physiological, cognitive-behavioral and social-environmental dyspnea management strategies have been proposed and incorporated in patient education to modulate dyspnea perception and interpretation (Altose, 1985; Carrieri-Kohlman, 1998).

Educating patients about dyspnea management strategies has some apparent benefits. Studies have shown that patients use many strategies to manage their dyspnea (Carrieri & Janson-Bjerklie, 1986). Patients may increase the number of strategies they use to manage dyspnea after only an educational program (Scherer, 1989) on management strategies or after just an exercise training program (Kwiatkowski, Carrieri-Kohlman, Janson, Gormley, & Stulbarg, 1995). Also, one investigator reported that the type of strategies patients use after an educational program might become more focused on problem solving instead of being focused on managing emotions (Scherer, 1989).

In a controlled study investigating the effect of dyspnea management strategies on dyspnea, anxiety, depression and quality of well being, 89 COPD patients were randomized to a treatment and a control group (Sassi-Dambron, Eakin, Ries, & Kaplan, 1995). The treatment group received education specifically focused on dyspnea management whereas the control group received education on general medical topics. The investigators hypothesized that using dyspnea management strategies may decrease the discomfort, frustration, anxiety, and panic that accompanies dyspnea on exertion and may also interrupt the decrease in activities and physical deconditioning seen in COPD patients. Interestingly, the investigators included education about exercise in the control group and not in the treatment group. Outcome measures of dyspnea, anxiety, depression and quality of well being were used. The results showed that both groups had improved dyspnea scores on the University of California San Diego Shortness of Breath Questionnaire (UCSD SOBQ) after the six-week treatment and at the six-month follow-up. However, the treatment group also had a significant improvement in their dyspnea ratings at the six-month follow-up period as measured by the Transitional Dyspnea Index (TDI) (Sassi-Dambron et al., 1995).

These findings are inconclusive since the investigators did not control for subject's knowledge level. It is not known if the treatment group actually applied the dyspnea management strategies or if subjects believed strategies were effective. Few investigators have examined patients' efficacy beliefs of dyspnea management strategies. Personal efficacy beliefs influence a person's motivation, course of action, amount of perseverance, thought pattern, emotional response, and attribution of accomplishment and failure (Bandura, 1997). Self-efficacy for managing dyspnea was not measured. Inclusion of exercise in the general education group and not the treatment group may also confound the results since exercise has been shown to decrease dyspnea (Meek, 1999; Ries, 1997).

Other investigators have demonstrated that after either an education only or a combination of education and exercise program aimed to manage dyspnea, patients' self-efficacy for managing dyspnea in a variety of situations increases (Zimmerman, Brown, & Bowman, 1996; Scherer & Shimmel, 1996; Scherer & Schmieder, 1997). Self-efficacy is a person's belief in their capabilities to perform a given task to produce the desired result. Efficacy beliefs are derived from information gathered through enactive mastery experiences (personal experience), vicarious experiences (seeing others model the experience), verbal persuasion (social influences), and physiological and affective states (somatic information). These various sources of information are then integrated and processed to formulate efficacy beliefs for tasks within a specific domain of functioning (Bandura, 1997).

The increase in self-efficacy for managing dyspnea, measured by the COPD Self-Efficacy Scale (CSES), has been correlated to a decrease in dyspnea ($r = -0.56$) and an increase in exercise endurance ($r = 0.43$), measured by walk distance in 12 minutes, after attendance of an education and exercise program (Scherer & Schmieder, 1997). During and after participation in a 12-session exercise training only program, subjects reported an increase in their self-efficacy for walking on the treadmill that correlated with their improvement in exercise performance measured by speed and grade walked on the treadmill (Gormley, Carrieri-Kohlman, & Douglas, 1993). These and findings of others (Carrieri-Kohlman et al., 1993; Kaplan, 1984; Toshima, Kaplan, & Ries, 1992) suggest that educating patients about dyspnea management strategies and / or exercise training may be effective in increasing a person's confidence in his or her ability to perform an activity, increasing the activity, and decreasing dyspnea for a given level of activity. Thus the cycle of dyspnea-inactivity-dyspnea may be interrupted in this patient population. What is unclear is which of the combination of treatment strategies presented increases self-efficacy the most? Would education with a home walking program increase self-efficacy as much as education with a supervised walking program? How many supervised walking sessions, if any, would produce the greatest improvement in self-efficacy? Should education about exercise be included as a dyspnea management strategy? What of the strategies taught are patients actually implementing? Which strategies do they belief is efficacious? Since patients' efficacy beliefs are powerful predictor of behavior and influence adherence to prescribed management strategies (Eakin, 1992), a better understanding of the actual treatment delivered and the strength of treatment required to boost perceived efficaciousness of the strategies is essential in improving dyspnea management approaches.

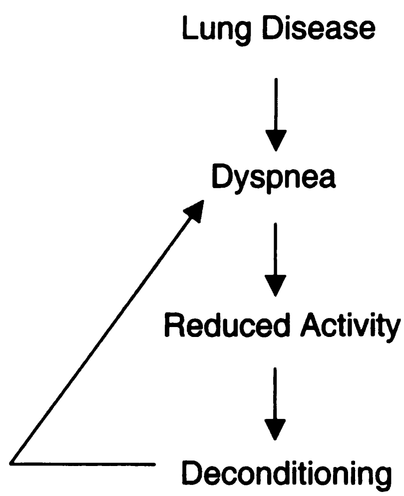
Statement of the Problem

Although the negative impact of dyspnea is prominent in a number of clinical states, it is particularly evident for patients with COPD. The physiological sensation of dyspnea and the associated affective responses to dyspnea leads patients to avoid activities that require exertion and produce dyspnea. It has been observed that patients may gradually eliminate, from their lives, activities that elicit dyspnea (Schwartzstein, 1998). As referred to earlier, some investigators have described the phenomenon of a self-perpetuating cycle of dyspnea-inactivity-dyspnea in COPD patients (Figure 1 & Figure 2).

Physiologically, inactivity leads to deterioration of the cardiovascular, respiratory and skeletal muscles, as well as reduced efficiency in mechanical movements, for instance, a shorter stride length (McArdle, 1996). Deconditioning of the cardiopulmonary system results in a smaller stroke volume, lower cardiac output, arterio-venous oxygen difference (a-v O_2 diff), maximum oxygen extraction (VO_2 max) and higher heart rates (McArdle, 1996). Inactivity can also lead to diminished muscle mass and strength, a reduction of the major enzymes of aerobic respiration and capillary density, an accelerated accumulation of lactic acid, an increased carbon dioxide (CO_2) output inducing higher levels of ventilation. Deterioration of the physiological system requires that greater effort be extended for the performance of a particular task. This demand of greater effort may contribute to a magnified perception of dyspnea; increased anxiety and distress related to the task, lower one's confidence in their ability to perform the task, discouraging subsequent attempts at exertion (Figure 1).

Figure 1. Cycle of Deconditioning.

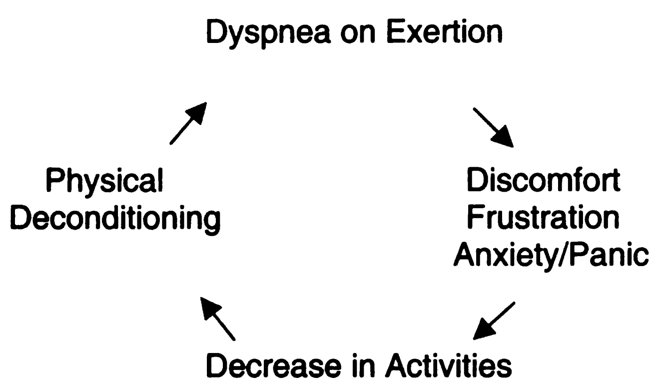
Lung disease contributes to the development of dyspnea, leads to inactivity and deconditioning that can worsen lung function and causes more dyspnea. Reference: Schwartzstein, R. (1998). The Language of Dyspnea. In D. Mahler (Ed.), *Dyspnea* (Vol. 111, pp. 427). New York: Marcel Dekker.



Theoretically, dyspnea can lead to inactivity and inactivity can lead to social isolation, anxiety and depression (Jones, 1998). These negative social and psychological states may contribute to further decline in activity levels independently, causing the person to be less motivated to participate in activities. Anxiety or depression can also influence symptom perception and contribute to more perceived dyspnea (Carrieri-Kohlman, 1993; Gift & Cahill, 1990). Therefore, dyspneic patients are prone to inactivity due to interacting physiological and psychological factors and the physiological and psychological consequences of inactivity serve as reinforcers to the behavior of inactivity (Figure 2).

Figure 2. Dyspnea Model

Experiencing dyspnea with exertion causes physical and emotional discomfort that reinforces inactivity and can lead to further debilitation and dyspnea. Reference: Sassi-Dambron, D. E., Eakin, E. G., Ries, A. L., & Kaplan, R. M. (1995). Treatment of dyspnea in COPD. A controlled clinical trial of dyspnea management strategies. *Chest, 107*(3), 724-9.



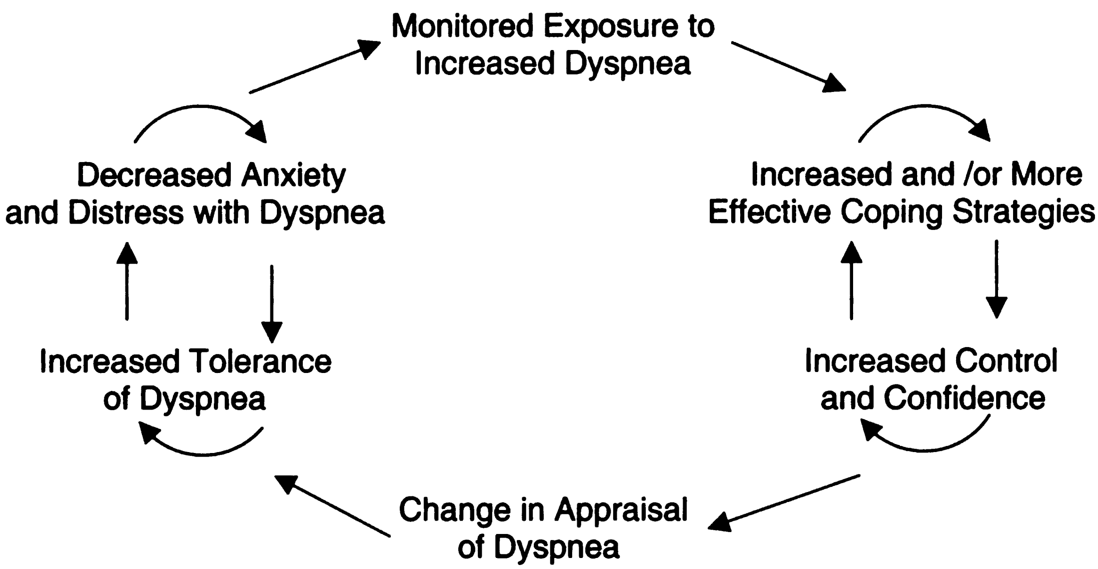
A primary focus of symptom management is aimed at interrupting this dyspnea-inactivity-dyspnea cycle by increasing activity and decreasing dyspnea and thus circumventing the negative consequences of inactivity. Two of several methods that have been proposed to decrease dyspnea include the desensitization process and use of dyspnea management strategies. One definition of desensitization is a process by which, through repeated exposure to the stimulus, a given amount of a stimulus is perceived to be less threatening or at a lower intensity than before the exposure treatments (Bandura, Blanchard, & Ritter, 1969; Carrieri-Kohlman, 1993). By gradually and repeatedly exposing patients to higher than their usual levels of dyspnea, using a stimulus such as exercise, in a safe, monitored environment, desensitization to dyspnea may occur (Carrieri-Kohlman, Gormley, Douglas, Paul, & Stulbarg, 1996).

The other intended means to decrease dyspnea employs dyspnea management strategies. Breathing retraining, positioning, medication regimens, activity planning, energy conservation, relaxation and distraction, visual imagery, social support, self-talk, biofeedback and exercise are some of the many dyspnea management strategies for which patients may receive instruction. These management strategies have been routinely included as part of a comprehensive pulmonary rehabilitation program (Ries, 1997).

One treatment program proposed to interrupt the cycle of dyspnea-inactivity-dyspnea incorporates components of desensitization, use of management strategies, and exercise training (Carrieri-Kohlman, Douglas, Gormley, & Stulbarg, 1993). First, patients are instructed in strategies for managing their dyspnea. Then, patients are repeatedly exposed to a stimulus, for instance exercise, which produces increasing levels of dyspnea. During these repeated exposures to dyspnea, patients are encouraged to practice using dyspnea management strategies to modulate their perception of dyspnea severity and to build a sense of confidence and control in using the strategies and in managing their dyspnea. This modulated dyspnea perception and heightened self-efficacy has been hypothesized to decrease the patients' anxiety and distress about experiencing dyspnea and allow them to feel in control and to be able to tolerate increased levels of dyspnea during subsequent exposures (Figure 3).

Figure 3. Mechanisms to Decrease Dyspnea

Monitored exposure to increased levels of dyspnea leads to more effective coping strategies and confidence that changes the appraisal of dyspnea, reduce anxiety and distress and increase tolerance to dyspnea.
Reference: Carrieri-Kohlman, V., Douglas, M., Gormley, J.M., Stulbarg, M.S. (1993). Desensitization and guided mastery: Treatment approaches for the management of dyspnea. *Heart & Lung, 22*(3), 226-234.



Although management strategies such as, breathing retraining, positioning, medication regimens, activity planning, energy conservation, relaxation and distraction, visual imagery, social support, self-talk, biofeedback, and exercise training have been in clinical use and are taught to patients in pulmonary rehabilitation programs, these strategies have not been well studied (Sassi-Dambron et al., 1995). Investigators have shown that a multi-faceted program can increase self-efficacy for managing dyspnea (Scherer & Schmieder, 1996; Scherer & Schmieder, 1997; Zimmerman et al., 1996) and that exercise training alone can increase self-efficacy for walking (Gormley et al., 1993). However, the strategy or the combination of strategies most effective for increasing self-efficacy is not known (Ries, 1997).

Efficacy beliefs in the prescribed strategies are important in predicting whether patients will be persistent in the use of the strategies and will help determine the overall usefulness and effectiveness of the strategies (Bandura, 1997). If patients have low efficacy beliefs in a given strategy, they will likely not use the strategy or use it haphazardly, minimizing its effectiveness. This proposition relating efficacy with compliance is particularly important for strategies that are more cumbersome, time consuming, may not be immediately effective, require practice and persistence, and may initially induce more dyspnea, such as exercise training (Bandura, 1997; Kaplan, Atkins, & Reinsch, 1984). Currently, there is no instrument available to measure patients' efficacy beliefs in dyspnea management strategies. Furthermore, since one of the most influential sources of efficacy information is mastery experiences or performance successes, it follows that, interventions designed to provide mastery experiences with dyspnea management strategies and with walking, would increase a person's efficacy beliefs for these management approaches.

However, it is not known what is the optimal combination of education and/ or exercise, or the optimal strength of each, needed to increase patients' efficacy beliefs in the strategies for managing dyspnea and in their self-efficacy for walking. In essence, this line of inquiry addresses how the patient perceived the intervention, and if it changed their beliefs about whether they could control their shortness of breath with management strategies. Additionally, understanding patients' perspectives of the clinical effectiveness of the interventions, and what is the optimal strength of education or exercise intervention required to enhance the perceived efficacy of the intervention, is vital in the development of effective dyspnea management plans for individuals and for groups of patients.

Purpose

The primary aim of this study is to compare the effectiveness of three different strengths of education and exercise in self-efficacy for walking and self-efficacy for managing dyspnea in patients with COPD. The nature of the three treatments is the following:

1. Education about dyspnea management strategies and a home walking prescription (Home Walking Control [HWC])
2. Education about dyspnea management strategies, a home walking prescription and four coached treadmill sessions (Exposure [EXP])
3. Education about dyspnea management strategies, a home walking prescription and 24 coached treadmill sessions (Training [TRG])

A secondary aim is to further develop and test an instrument for measuring the use of and the self-efficacy for dyspnea management strategies, the Self-Efficacy and Dyspnea Strategies Scale (SEADS), in patients with COPD (Figure 4).

Figure 4. Conceptual Model of Research Study

The three treatments provide different amounts of efficacy building information, through the four sources to affect subject's self-efficacy for walking and self-efficacy for managing dyspnea.

Education + Home Walking Prescription

Eduation + Home Walking Prescription + 4 Coached Treadmill Sessions

Education + Home Walking Prescription + 24 Coached Treadmill Sessions

Enactive Mastery
Vicarious Experience
Verbal Persuasion
Physiologica/Affective States

Self-Efficacy for Walking

Self-Efficacy for Managing Dyspnea

Treatment Effects

<u>Research Questions: Primary Aim</u>

<u>Self-Efficacy for Walking</u>

Research Question # 1: Are there differences among the three strengths of exercise treatments in the change in self-efficacy for walking between baseline and post-treatment (2 months)?

Research Question # 2: What is the relationship between self-efficacy for walking, performance of physical activities, and reported physical functioning?

a. What is the relationship between baseline self-efficacy for walking and baseline performance of physical activities, and reported physical functioning?
b. What is the relationship between post-treatment (2 months) self-efficacy for walking and post-treatment performance of physical activities, and reported physical functioning?
c. What is the relationship between changes in self-efficacy for walking and changes in performance of physical activities, and reported physical functioning from baseline to post-treatment?

<u>Self-Efficacy for Managing Shortness of Breath</u>

Research Question # 3: Are there differences among the three strengths of exercise treatments in the change in self-efficacy for managing SOB between baseline and post-treatment?

Research Question # 4: What is the relationship between self-efficacy for managing SOB and measures of dyspnea and mastery?

a. What is the relationship between baseline self-efficacy for managing SOB and baseline measures of dyspnea and mastery?

b. What is the relationship between post-treatment self-efficacy for managing SOB and post-treatment measures of dyspnea and mastery?

c. What is the relationship between changes in self-efficacy for managing SOB and changes in measures of dyspnea and mastery?

Instrument Development: Self-Efficacy and Dyspnea Strategies Scale (SEADS)

Research Questions: Secondary Aim

Convergence Testing (CSES, SEMSOB, CRQ-Mastery)

Research Question # 5: What is the relationship between the SEADS Scale and the CSES Scale at baseline and post-treatment?

Research Question # 6: What is the relationship between the SEADS Scale and the SEMSOB Questionnaire at baseline and post-treatment?

Research Question # 7: What is the relationship between the SEADS Scale and Mastery (CRQ-M) at baseline and post-treatment?

Divergence Testing (SEWALK)

Research Question # 8: What is the relationship between the SEADS Scale and the SEWALK Scale at baseline and post-treatment?

Measures of Dyspnea

Research Question # 9: What is the relationship between the SEADS Scale and Perceived SOB Severity at baseline and post-treatment?

Research Question # 10: What is the relationship between the SEADS Scale and SOB interference at baseline and post-treatment?

Research Question # 11: What is the relationship between the SEADS Scale and reported SOB at the end of the six-minute walk at baseline and post-treatment?

Research Question # 12: What is the relationship between the SEADS Scale And the CRQ-Dyspnea at baseline and post-treatment?

Measure of Physical Performance

Research Question # 13: What is the relationship between the SEADS scale and the 6MW distance at baseline and post-treatment?

Measures of Physical Function

Research Question # 14: What is the relationship between the SEADS scale and reported physical function at baseline and post-treatment?

Research Question # 15: What is the relationship between the SEADS scale and role limitation related to physical function at baseline and post-treatment?

CHAPTER TWO: THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Theoretical Framework

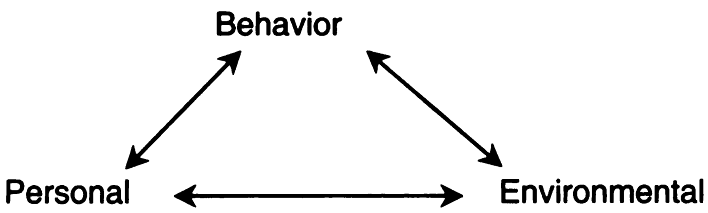
Healthcare encompasses various dimensions. Whether the intervention focus is on prevention of diseases, promotion of healthy behaviors, treatment or eradication of diseases, or management of symptoms, the patients' role is central to each of these interventions. Patients are asked to perform a myriad of tasks ranging from learning new knowledge, changing their current behavior, adopting new thoughts and lifestyles, complying with complex medication or treatment schedules or enduring uncomfortable interventions or side effects of treatment. How can care providers ensure that patients will present themselves for care in a timely manner, take the medication at the prescribed intervals and in the recommended way, and for the length necessary to obtain a therapeutic effect even in the face of obstacles? In order to facilitate these changes in patients' thoughts and actions, an understanding of the complex interactions between human cognition and behavior, based on a sound theoretical framework, can be extremely helpful in guiding the design, implementation and assessment of interventions.

Social Cognitive Theory

Social cognitive theory strives to understand human cognition, action, motivation, and emotion. The major assumption of the theory is that people function in a triadic reciprocating process, where behaviors are intimately related to personal factors and environmental influences (Bandura, 1986) (Figure 5). As shown in Figure five, behavior interacts with personal and environmental influences in a bi-directional manner. The strength of the bi-directional influences may not be symmetric and can include multiple influences from each point of the triangle. The social cognitive perspective of a person emphasizes particular observations that are considered defining human capabilities. These five capabilities include symbolization, forethought, vicariousness, self-regulation, and self-reflection (Bandura, 1977; Maddux, 1995).

Figure 5. Triadic Reciprocating Process

Person, Behavior and Environment influences each other bi-directionally.
Reference: Bandura, A. (1986). *Social Foundations of Thought & Action: A Social Cognitive Theory*. Englewood Cliffs: Prentice-Hall.



Symbolizing Capability

The capacity to use symbols such as words, pictures or objects as representation of thought allows people to transform a single transient experience into a future reference point. Problems can be explored by enacting options and considering possible outcomes. The use of symbols helps people to alter and adapt to their environment, communicate with others at a distance or in a different time, plus provide meaning and form to their experiences that can then be passed to future generations (Bandura, 1986).

Forethought Capability

Forethought capability relies on symbolizing and pertains to the purposefulness of a person's actions. The assumption is that humans are not solely driven by immediate stimulus in the environment or bridled by past experiences. By plotting a course of action, people can motivate and guide themselves through behavior changes. Intentional actions are strongly influenced by forethought and representations of the conceived outcome. The future is thus represented in the present, prompting action to acquire or to avoid the preconceived outcome (Bandura, 1986; Maddux, 1995).

Vicarious Capability

Other than learning through a person's own experiences, humans have the capability to learn vicariously by observing others' performance. This capability is advantageous in that people do not necessarily need to personally suffer the negative or sometimes fatal consequences of an action. Observing others modeling a positive experience or outcome can serve to motivate an individual to action. Vicarious learning through modeling is essential for linguistic acquisition and shortens the process for accrual of other complex skills (Bandura, 1986; Maddux, 1995).

Self-Regulatory Capability

Social cognitive theorists ascribe strongly to the notion that much of human cognition and behavior is internally motivated and regulated. The belief in self-regulatory capability rejects the claim that people behave simply as others dictate, rather, internal standards are set and humans adjust their performance and even alter their environment to meet those standards (Bandura, 1986; Maddux, 1995).

Self- Reflective Capability

The ability of individuals to contemplate about their thought process and to analyze the intricacies of their experiences is considered uniquely human. This reflective self-consciousness is a dynamic process and allows the person to evaluate the situation, decide on a course of action, act them out, evaluate their cognitive process and outcome, and restructure their thoughts and future actions. The most powerful form of thought, that influences human behavior is the individual's appraisal of their own capabilities in managing diverse predicaments. This self-perception of efficacy is processed through self-referent thought and a basis of self-knowledge is established to govern expectations and behavior (Bandura, 1986; Maddux, 1995).

Social cognitive theory emphasizes these human capabilities of symbolization, forethought, vicariousness, self-regulation and self-reflection. Underlying the triadic relationship of personal and environmental influences with cognition and behavior is the assumption that these capabilities are present, innate and defining of humans (Bandura, 1986; Maddux, 1995). Assuming that these human capabilities are present, a key concept in social cognitive theory is the belief that expectations of positive or negative outcome governs whether an individual will perform a behavior.

Expectancy

Expectancy is a central concept in the originally described social cognitive theory (Rotter, 1954). Social cognitive theorists believe that expectations of reward or punishment govern the probability that a behavior will be performed. This perspective essentially focuses on the performance of behavior as a function of outcome expectation. Rotter (1954) discussed two forms of expectancy, general and specific.

General expectancy. General expectancy refers to how people view the relationship between reward and punishment to their behavior in general. Those individuals who believe that generally outcome is contingent upon their behavior are said to operate with an internal locus of control, whereas; individuals who generally expect that positive or negative outcomes are unrelated to their actions have an external locus of control. Identifying a person's general disposition was thought to be predictive of performance of a behavior. Rotter (1954) felt that generalized expectancy is the best predictor of performance of a novel task. Much of the earlier works in the health psychology and education disciplines followed the concept of general expectancy and focused on the determination of locus of control using personality tests (Kaplan, 1984; Maddux, 1995).

Specific expectancy. The other component of expectancy proposed by Rotter (1954) was the concept of specific expectancy. He argued that as persons gain experience with a particular task, expectancy specific to a given situation and not generalized personality trait is a better predictor of performance of a behavior. Some social learning theorists, such as Bandura, felt that expectancies are not generalized personality traits and must be assessed separately with each unique situation (Kaplan, 1984). It is from this specific expectancy perspective Bandura (1977) described his self-efficacy theory that further delineated the relationship between cognition and behavior.

Self-Efficacy Theory

The self-efficacy theory is a component of the social cognitive theory and is primarily concerned with the personal cognitive factors (self-beliefs) and its relationship to the environmental and behavior components in the triadic model of the social cognitive theory (Figure 1). Social cognitive theory proposes that human behavior is cognitively driven. However, behavior interventions have been observed to have a greater influence on affecting behavior change. To explain this divergence in theory and practice, Bandura (1977), in a landmark article, proposed the self-efficacy theory. He asserts that, working in concert with the assumptions of human capability and expectancy, all human cognitive and behavior changes operate through an individual's perceived self-efficacy (Bandura, 1997).

Self-efficacy is defined, as beliefs in one's capabilities to control, organize and execute the course of action required in performing specific tasks or obtaining certain outcomes (Bandura, 1997). Personal efficacy beliefs determine one's basis for action; influence their motivation, effort, thought process, emotional state, persistence, and amount of accomplishment realized. Not only do individuals need to believe that their behavior can affect a positive outcome, they also need to believe that they have the capability to accomplish the behavior before they would have the motivation to try, the capacity to persist and the ability to celebrate their success (Bandura, 1977). Believing in one's capability promotes success in performance attainments by positively affecting qualities that promote success, such as motivation, persistence, resilience and effort. Of import is the concept that efficacy beliefs are specific, therefore, changes in efficacy beliefs are particular to the specific domain of functioning and generally not transferable to dissimilar situations or tasks (Kaplan, 1984). The self-efficacy theory does not assume that determinants of behavior are uni-directional, such as cognition precedes behavior or that behavior causes cognition, rather, it is an evolving, reciprocal, relationship (Kaplan, 1984). In this manner, cognition (perceived self-efficacy) can influence behavior and successful experiences (behavior) can, in turn, affect self-efficacy (cognition).

Self-efficacy theory proposes that efficacy beliefs be structured from four primary sources of information; enactive mastery experiences, vicarious experiences, verbal persuasion and social influences, and physiological and affective states. Efficacy beliefs can vary in the dimensions of magnitude, strength and generality. Efficacy information gathered through these four sources are then cognitively integrated and interpreted through three cognitive processes: attending to, weighing and attributing (Bandura, 1997).

Sources of Efficacy Information

Enactive mastery experiences. Enactive mastery experiences are the most powerful ways of acquiring efficacy-determining information (Bandura, 1977; Gist, 1989; Taylor, 1985). Enactive mastery refers to the experiential information that individuals obtain. This mode of information offers individuals the greatest assurance in the authenticity of the information obtained. A successful performance experience generally enhances personal efficacy beliefs, validating to the person their capabilities. If a negative performance experience is interpreted as lacking the required capabilities to succeed, the experience will undermine one's efficacy beliefs. It is important to emphasize that efficacy beliefs reflect individual's confidence in their capabilities and may not necessarily predict level of performance. Therefore, although performance success or failure is an important source of efficacy information, the degree that performance influences self-efficacy beliefs depends on an individual's cognitive processing of the strength of association between performance and personal capability (Bandura, 1982; Bandura, 1997; Williams, 1989).

Vicarious experience or modeling. Vicarious experience is another source of self-efficacy information. Models represent events or people that an individual can learn from through imitation or observation. People partially judge their own capabilities in comparison with others. Models seen as similar to oneself have the strongest effect in delivering efficacy information since the similarities facilitate identification with the model (Bandura, 1982). Self-efficacy information can be vicariously derived through experiences of others by noting others' performance and their consequences (Schunk, 1987). Although modeling has a weaker influence on self-efficacy as compared to enactive mastery experiences, it can nevertheless affect observer's self-efficacy. Positive influences on self-efficacy are more likely when the rewarding outcomes are apparent and the model is seen defeating difficulties through determined effort and perseverance rather than succeeding with ease (Bandura, 1977; Maddux, 1995; Strecher, McEvoy DeVellis, Becker, & Rosenstock, 1986).

Verbal persuasion or social influence. Verbal persuasion is convincing people that they have the capability to achieve their goals. Verbal persuasion can be used as the primary motivator for action or given through evaluative feedback to promote continued effort (Gortner, 1990; Gormely, 1993). The goal of verbal persuasion for either purpose is to enhance personal efficacy or convey that the individual possesses the ability to succeed (Bandura, 1997). Health care providers, parents and teachers are often placed in the powerful position that offers them the opportunity to influence patients', students' or children's thought and behavior. Verbal persuasion or social influence is probably the most readily available and commonly used method to exert such influences.

However, to be effective, the persuader or evaluator must be respected, knowledgeable and provide feedback in a manner that enhances rather than diminishes personal efficacy. Highlighting progress and achievements promote efficacy and encourage future efforts, whereas underscoring what still needs to be accomplished convey deficiencies in capability and discourages action. Evaluative feedback that emphasizes improvement in skill acquisition through hard work is less effective than conveying the efficacy information without addressing the amount of effort set forth (Schunk, 1983). Although positive feedback alone does not produce sustained enhancement of personal efficacy, criticism can undermine efficacy beliefs. This method is useful when the persuader uses proper techniques and is seen as credible and knowledgeable.

Verbal persuasion should be used only when there is a reasonable chance of success if the recipient is persuaded to take action. It is important to keep in mind that increasing a person's efficacy for unrealistic goals will set the person up for failure, discredit the persuader, and undermine personal efficacy for future events (Chambliss, 1979a; Chambliss, 1979b).

Physiological and affective states. Physiological and affective states can be a source of self-efficacy information. High physiological arousal tends to impair performance if symptoms such as dyspnea, fatigue, aches and weakness is interpreted as signs of vulnerability and physical inefficacy rather than a normal response to physical activity (Toshima, Kaplan, & Ries, 1992). Similarly, emotional states that activate negative thinking or stress responses may hinder performance or otherwise convey efficacy information to the individual that they are inept (Bandura, 1985; Bandura, 1997). For example, patients with COPD who experience high physiological arousal when starting an exercise program may lower their self-efficacy for exercise and abandon the activity before self-efficacy enhancing interventions can be instituted (Toshima et al., 1992). High physiological arousal may also be accompanied by anxiety and emotional distress that can also lower patients' self-efficacy (Carrieri-Kohlman, Douglas, Gormley, & Stulbarg, 1993). As with other sources of efficacy information, the final effect physiological or emotional arousal has on perceived efficacy is affected by cognitive processing. If COPD patients attribute their dyspnea with activity solely as a result of their lung function, they may neglect to recognize the contribution of inactivity to their dyspnea (Toshima, Kaplan, & Ries, 1992).

Therefore, strategies to reduce physiological arousal, such as exercise training, or to reshape negative interpretation of sensory information through education, could positively influence self-efficacy (Carrieri-Kohlman et al., 1996; Ries, Kaplan, Limberg, & Prewitt, 1995; Scherer, Schmieder, & Shimmel, 1998).

Dimensions of Self-Efficacy

Level. Level of self-efficacy refers to ordering of a task in steps according to difficulty. Depending on the situation, a task within a domain of functioning may vary in its perceived magnitude of difficulty and influence efficacy beliefs (Bandura, 1997). For example, a person with COPD may feel confident in maintaining a regular exercise program only if they can attend a supervised pulmonary rehabilitation program and does not feel confident in doing the same type of exercise program in a home environment. This difference in setting may affect a person's sense of safety due to the presence of health care workers or it may exert its influence through a person's self-regulatory capability in that supervised programs offer more structure. Conversely, a person who does not like to be observed or one who has a busy work schedule may find it more difficult to follow a supervised program than a home exercise program. Therefore, the setting and structure of the program may present levels of threat or self-regulatory requirements for each individual. Depending on the perceived level of difficulty of the task, efficacy beliefs vary.

Strength. Strength refers to the strength of self-efficacy expectation. This is the degree of conviction that people have or how certain they are of their ability to perform the task described in a particular domain (Bandura, 1997). Efficacy expectations do not follow an all or none principal, rather they exist in a multitude of ranges. A person may have 100 percent or only 60 percent confidence that they can maintain a regular exercise program in a given situation. The strength dimension of self-efficacy has been correlated to the degree to which a person will persist through barriers to reach their goals (Bandura, 1977).

Generality. This dimension of the self-efficacy theory addresses the degree that efficacy beliefs can be generalized from one task or domain to another. Generality of efficacy beliefs depends on the similarity of task performed, capabilities required and the context involved. By structuring commonalties cognitively across diverse activities, generality of efficacy beliefs is achievable. Cardiac patients who believed in the robustness of their heart (cardiac capability) after exercising on the treadmill in the hospital generalized their efficacy belief to other activities at home that presumably required cardiac robustness (Taylor, Bandura, Ewart, Miller, & DeBusk, 1985).

However, efficacy beliefs may not be similar with a different activity or even with the same activity in a different context that may demand capabilities from a dissimilar domain of functioning (Bandura, 1977; Strecher et al., 1986). For example, patients may feel confident in doing a corridor walk in the hospital, but have less confidence in walking at home without supervision if they have trouble regulating, on their own, their anxiety or distress associated with physical activity. Likewise, patients may find walking on the treadmill more difficult when their exhaled gases are being collected through a mouthpiece as compared to walking on the treadmill without additional monitoring equipment if their difficulty lies in having to breath through their mouth instead of their nose.

Mediating processes

Efficacy information is gathered through the four sources; enactive mastery experience, vicarious experience, verbal persuasion or social influences, and physiological or affective feedback and influenced by the three dimensions including level, strength and generality. However, the significance of efficacy information is in understanding how self-efficacy regulates human functioning. Efficacy information becomes meaningful and affects human functioning through certain processes. The four primary processes through which self-efficacy regulates human functioning include cognitive, motivational, affective and selective (Bandura, 1997).

Cognitive processes. Cognitive processes include cognitive construction and inferential thinking. Thought frequently precedes courses of action. *Cognitive construction* is the scenario people mentally conjure up before the actual event. People with a healthy sense of self-efficacy will tend to construct successful scenarios and conceive courses of action that can serve as a guide to obtaining positive outcomes in a given scenario (Bandura, 1986). Positive outcome stemming from one's action can increase efficacy beliefs. Whereas, those with low self-efficacy may construct failure scenarios that can disrupt performance and beget negative results (Powell, 1973). The negative results can reinforce self-doubt and lower efficacy beliefs. Therefore cognitive construction operates in a bi-directional process with efficacy beliefs where it can be influenced by the initial level of self-efficacy and also contribute to subsequent efficacy building information.

Another form of cognitive process is *inferential thinking.* Inferential thinking refers to judging how actions predict outcome. Inferential thinking requires the ability to effectively process and sort through complex information. Predictions of outcomes are fraught with ambiguities and the potential for mistakes and setbacks since multiple predictors may contribute to an outcome and a single effect may produce multiple outcomes. Strong efficacy beliefs enhance cognitive processing by keeping the person focused on the task rather than being derailed by self-doubt when ambiguities abound (Bandura, 1997).

<u>Motivational processes</u>. Efficacy beliefs also regulate behavior through motivational processes. Theories on human motivation have primarily concentrated on *causal attributions, outcome expectancies, and cognized goals* as motivators for action. *Attribution theory* of motivation states that individuals are more motivated to act when past accomplishments are attributed to personal ability and failures to lack of effort (Weiner, 1985). The constant relationship between ability and effort depicted by the attribution theory requires ability to be an inert trait.

However, people do not all view ability as an innate trait or maintain that the relationship between ability and effort is constant. Ability is sometimes perceived as the accumulation of practice and effort that is acquired rather than endowed (Dweck, 1988). The import of perceived causes of successes and failures exerts its effect through personal efficacy beliefs. If one fails after mounting extraordinary effort in an attempt to accomplish a task, the conclusion drawn may not be that more effort is required or even possible. Conversely, if success was achieved after tremendous effort, one may conclude that the feat can not be repeated. Efficacy beliefs influence causal attribution. Those with high self-efficacy related to that domain of functioning will tend to impute failure to situational hindrance or deficient effort, whereas those with low self-efficacy within the domain will more likely attribute failure to an inherent lack of ability (Bandura, 1997).

Another form of motivation is based on the concept of *outcome expectancies* where people act in accordance with expected outcomes and the attractiveness of the outcomes. However, people with a low sense of self-efficacy may not believe that they have the ability to achieve success and will not make the attempt regardless of the attractiveness of the outcome. Given similar ability, people with higher self-efficacy set higher goals and outperform those with lower self-efficacy irrespective of the incentive to perform (Bandura, 1997).

The third form of cognitive motivator refers to *cognized goals.* Goals are equivalent to a personal standard. People direct their actions by providing self-incentives and self-evaluation to reach their goals for self-satisfaction (Bandura, 1997). Goals with explicit evaluative properties provide clear feedback for accomplishments are motivating, build personal efficacy and boost performance. Whereas, a generalized goal to do one's best, without specific markers of success, has minimal efficacy building and motivational effect (Bandura, 1983). Furthermore, challenging goals elicit more interest and effort than easily attainable goals. However, if goals are seemingly unattainable or distal, motivation and efficacy building require structuring more proximate and attainable sub-goals, so that advancement can be evaluated (Stock, 1990).

Efficacy beliefs contribute to motivation by influencing the degree of challenge one incorporates in setting initial goals, whether shortfalls in goal attainment are construed as motivating or discouraging and how goals are readjusted after performance feedback. Those with a strong sense of self-efficacy sets more challenging goals, use discontent as a motivator when falling short of their goals and gains only temporary satisfaction after making considerable strides before adopting new challenges to motivate oneself further (Earley, 1991).

<u>Affective processes.</u> Anxiety is anticipatory fear of potentially adverse outcomes. People's efficacy beliefs in their ability to control these outcomes play an important role in their emotional experiences. Anxiety can be self-generated through a train of perturbing thoughts and perpetuated by lack of perceived control, inefficacious coping and negative construction of the affective or physiological arousal. The belief in one's ability to regulate negative thought, action and affect greatly influences the occurrence of stressful reactions (Bandura, 1985; Bandura, 1997). Beliefs in one's coping efficacy are needed so actions will be taken to circumvent negative emotions or situations. Given the same situational stimulus or physiological arousal, individuals may interpret the arousal as either positive or negative (Bandura, Cioffi, Taylor, & Brouillard, 1988). Even when individuals were misled in the amount of control they have in a given

situation, higher efficacy beliefs of this illusory control were effective in curtailing negative emotional arousal (Litt, Nye, & Shafer, 1993; Litt, Nye, & Shafer, 1995; Sanderson, Rapee, & Barlow, 1989).

Depression occurs with a sense of irreparable loss and the perceived inefficacy to alter despairing circumstances or acquire highly desirable outcomes (Bandura, 1997). Cognitive, behavioral and environmental factors can contribute to and sustain depression. Negative cognitive bias is prominent in people with low sense of efficacy. They tend to organize, construe and recall events in a negative light. An inability to control negative thoughts or ruminating over discouraging events contributes to depression (Nolen-Hoeksema, 1991). Personal efficacy can affect level of depression directly or through social support. People with high-perceived social efficacy behave in a manner that begets more support and reduce the impact of negative life events (Holahan, 1987).

<u>Selective processes</u>. Choices people make are partially based on beliefs of their capabilities. Therefore, efficacy beliefs can influence the type of activity one chooses and affect selection of environment and interpersonal association. On the other hand, choices of activity, environment and personal association can shape efficacy evolvement producing a lasting aftereffect. Understanding the influence of self-efficacy in the selection process requires mindfulness to both choices selected and ones evaded. Certain options may be so promptly discarded due to low efficacy beliefs that cognitive, motivational and affective processes never have an opportunity to be mobilized.

Rehabilitation programs for patients with COPD generally include multiple interventions such as education about the disease, medication usage, symptom management, and an exercise program. Although exercise is a key component in pulmonary rehabilitation, many patients with COPD experience dyspnea with activity and therefore avoid exercise. It is important to explore how self-efficacy in areas such as, disease management, symptom management, and exercise tolerance influence the life and health behaviors of patients with COPD, so that interventions might be designed to enhance their treatment.

Literature Review of Self-Efficacy in Dyspneic COPD Patients

Self-efficacy theory, derived from studies of phobic and anxiety disorders, has been validated in many areas of human functioning such as student learning, biological responses, health promotion, affectivity, athletics, and organizational and career development (Allen, 1996; Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Bandura et al., 1988; Conn, 1997; Jourden, Bandura, & Banfield, 1991; Matsui, 1991; Waldersee, 1994; Wiedenfeld, O'Leary, Bandura, Brown et al., 1990). These studies have provided evidence of the utility of self-efficacy theory in the description and explanation of the relationship between thought and action. Self-efficacy theory has shown significant predictive power in human behavior in a variety of circumstances. Grounded in social cognitive theory, self-efficacy theory has greater utility than many other models of health behavior, which mostly predicted health habits. This is because it provides a conceptual framework, specification of determinants of behavior, origins and process of these determinants, and most importantly, a basis for effecting behavioral change. Therefore, self-efficacy theory has both the power to predict behavior and the operative power to guide change in behavior (Bandura, 1997).

Although the power of prediction of self-efficacy theory and its wide applicability in various areas of human functioning has been clearly established in the literature, relatively few studies have examined its usefulness in understanding and treating dyspneic patients with COPD. Two crucial and interrelated areas of function in this patient population are focal points of patient complaints since they severely decrease quality of life. These areas are managing the symptom of dyspnea and activity intolerance. Given the present limitations in the ability to predict symptom severity and degree of activity intolerance from tests of pulmonary function and the lack of curative medical treatments for the underlying disease of COPD, treatment options from various perspectives must be considered.

One line of research showed that after an education program, many patients reported better management of their dyspnea, and following an exercise program, patients increased their activity tolerance and many patients reported less dyspnea. These findings suggest viable treatment options for the two crucial areas of symptom management and activity tolerance in this patient population. However, we need to better understand the interventions and the process through which the interventions produce their effects to define their sensitivity and specificity and to refine the strength and external validity of our treatments (Ries, 1997). The primary focus of this review is to examine research that used self-efficacy as the theoretical foundation to address the domains of symptom management or activity tolerance in patients with COPD.

Self-Efficacy Related to Symptom Management

The primary symptom of interest in the COPD population is dyspnea. Education about dyspnea management is incorporated into many current pulmonary rehabilitation programs under the psychosocial, behavioral and educational component of the program. Stress management, yoga and anxiety control through relaxation techniques, are considered psychosocial components. Smoking cessation, weight control and adherence are behavioral interventions.

Breathing retraining, energy conservation, inhaler technique and strategies for managing dyspnea are educational interventions. Despite the lack of well-controlled studies and scientific evidence to support the effectiveness of these interventions, expert opinion supports the inclusion of educational and psychosocial interventions as an integral part of pulmonary rehabilitation (Ries, 1997).

In practice, all these interventions could be thought of as strategies to manage the symptom of dyspnea. Since dyspnea is a complex and multi-dimensional symptom, it would be difficult to determine whether a single or an array of strategies would be most efficacious. Furthermore, whether a psychosocial, behavioral or an educational intervention is being applied, the goal is to change patients' cognition or behavior, in order to change their symptom perception. Studies in this area have frequently suffered from a lack of conceptual clarity, uncontrolled study design and absence of a guiding theory. This section of the review addresses the area of dyspnea management in patients with COPD in studies that used self-efficacy as the guiding theory (Table 1).

Consistent with self-efficacy theory, education about dyspnea management appears to enhance patients' confidence in controlling their breathing difficulties. Scherer and colleagues (1996) examined the effect of an outpatient pulmonary education program on self-efficacy in the management or avoidance of breathing difficulties. Two studies using a pretest-posttest design were reported.

Table 1. Self-Efficacy and Symptom Management in Patients with COPD

Author/ Source	Purpose	Sample	Design	Intervention	Measurement	Statistical Analysis	Results
Scherer & Shimmel (1996), Rehabil Nurs. 21(5), 262-266	Examine effect of outpatient pulmonary rehab program on self-efficacy for managing or avoiding shortness of breath	n= 1 Male, Age=65 FEV_1 =1.08L (35% predicted)	case study	2 hr class, once a week, for four weeks.	CSES at baseline, 1 month and 6 months after intervention	none	At 1 month, improvements in sub-scales of negative affect, intense emotional arousal, and weather/environment At 1 month, decline in sub-scales of physical exertion and behavioral risk factors At 6 months, improvements in sub-scales of negative affect, intense emotional arousal, weather/environment, and physical exertion At 6 months, improvement in sub-scale of behavioral risk factors from 1 month, but still less than baseline
Scherer & Schmieder (1996), Clin Nurs Res. 5(3), 343-355.	Examine effects of outpatient pulmonary rehab program on self-efficacy	n= 29 14 men, 15 women Age= Mean 66	Un-controlled, one group	2 hrs a week, for four weeks	CSES at baseline, 1 month and 6 months after intervention	Repeated measures ANOVA	Improvement in CSES total score and sub-scales of negative affect, physical exertion, and weather/environment at 1 and 6 months. No change in sub-scales of emotional arousal and behavioral risk factors at 1 and 6 months

Table 1. Self-Efficacy and Symptom Management in Patients with COPD

Author/ Source	Purpose	Sample	Design	Intervention	Measurement	Statistical Analysis	Results
Zimmerman, Brown & Bowman (1996), Rehabil Nurs, 21(5), 253-257	Determine effects of nurse-directed self-management program on dyspnea and self-efficacy	n= 10 3 men 7 women Age= Mean 67	Un-controlled, one group	2 hrs a week for six-weeks	CSES at baseline and last session Dyspnea VVAS at 2nd and last session	Paired *t*-test	Significant improvements in CSES ($p<0.001$) No changes in Dyspnea
Scherer, Schmieder & Shimmel (1998), Rehabil Nurs, 23(2), 71-77	Compare effect of education alone versus education plus exercise on self-efficacy	n= 59 Ed= 22 14 men 8 women, Age= Mean 64, Ed+Ex=37 11 men 26 women Age= Mean 66	Un-controlled, two groups	Ed= 2 hrs a week, for 4 weeks Ed + Ex = Ed for 1 hr, 3 times a week for 12 weeks and Ex for 20-30 minutes 3 times a week for 12 weeks	CSES at baseline, 1 month and 6 months after intervention	Paired *t*-test	Ed only group improved total score and sub-scales of physical exertion and weather/environment at 1 month and only physical exertion at 6 months Ed + Ex group improved total score and sub-scales of negative affect, intense emotional arousal, weather/environment and physical exertion at 1 month and at 6 months, no change in behavior risk sub-scale

The first was a case study of a 65-year-old man with COPD (Scherer & Shimmel, 1996) and the second studied 29 patients with COPD (Scherer & Schmieder, 1996).

In these studies, patients' perceived ability to manage or avoid their breathing difficulties in various situations was measured by the COPD Self-efficacy scale (CSES) (Appendix A) before and after a pulmonary education program designed to improve self-efficacy for managing shortness of breath (SOB). The CSES was designed to measure a person's confidence in managing or avoiding SOB under certain situations and considered five factors: negative affect, intense emotional arousal, physical exertion, weather/environment and behavioral risk factors (Wigal, Creer, & Kotses, 1991).

The subjects in these studies attended a two-hour class, once a week, for four weeks. A multidisciplinary team provided patients with information on a wide range of topics. These included anatomy, physiology, breathing techniques, proper exercise, energy conservation, respiratory irritants, relaxation and stress management techniques, medication, nutrition, and use of home equipment. Specific medications and equipment were not reported. In both studies, patients showed a significant improvement ($p < 0.05$) in their CSES scores after the education program. The higher CSES scores represented higher self-efficacy for managing or avoiding breathing difficulties in the situations specified in the questionnaire. The improvements were still evident at both one and six months after the education program (Scherer & Schmieder, 1996; Scherer & Shimmel, 1996). Although neither the case study nor the single-group pretest and posttest study design included any controls for internal validity, the findings provided nascent support that education alone can increase self-efficacy for the management of dyspnea.

Zimmerman and colleagues (1996) contributed further understanding of the relationship between self-efficacy in managing dyspnea and dyspnea intensity by measuring dyspnea levels, in addition to measuring self-efficacy for managing dyspnea with the CSES, before and after a six-week nurse-directed self-management program. The self-management program was two hours a week for six weeks and was taught in a group format. The program focused on teaching patients coping strategies to manage exercise or activity, environmental factors of weather and pollution, infections, and mental or emotional factors. Areas of low self-efficacy were specifically targeted; however, the approach for enhancing self-efficacy was not specified. The CSES was given to patients at baseline and prior to the last session. Before the second and again before the final session, dyspnea was measured with a 10-millimeter vertical visual analogue scale (VVAS) after patients walked from the parking lot to the classroom, (Zimmerman et al., 1996).

Significant improvement was noted for self-efficacy after the treatment ($p < 0.001$). Again, the single-group design confounded the internal validity of the study, and it would be argued that self-efficacy might also have improved in a control group. It is important to note that the CSES does not distinguish between self-efficacy measured in managing dyspnea and in avoiding dyspnea by avoiding a particular situation (Wigal et al., 1991). In regard to desirable or necessary activities, eliminating or avoiding the activity might be detrimental rather than beneficial. For example, patients might report high self-efficacy in avoiding breathing difficulties while exercising or exerting physically when actually they avoided such activities.

In this single group of ten COPD patients, dyspnea levels did not change between baseline and posttest. Although a single dyspnea measurement after patients walked from the parking lot was not the best assessment, it was interesting to note that dyspnea levels did not change after treatment whereas self-efficacy for managing dyspnea was sensitive to an education treatment in the above-described study (Zimmerman et al., 1996). Therefore, it is possible that the most sensitive outcome measure for an educational program on dyspnea management might be self-efficacy for dyspnea management rather than dyspnea levels. The researchers identified their theoretical framework as an integration of the health belief model and the self-efficacy theory; however, the research questions were designed to determine improvements in dyspnea and efficacy levels. It was unclear how the inclusion of the health belief model affected the intervention or the outcomes (Zimmerman et al., 1996).

Scherer and associates (1998) continued their line of inquiry into the effect of pulmonary rehabilitation on COPD patients' self-efficacy in managing dyspnea. They compared patients' ability to manage or avoid breathing difficulties in various situations as measured by the CSES in two groups of patients. One group (11 men, 26 women) received a pulmonary rehabilitation program (PRP) with an education component followed by an exercise component. The education component consisted of three one-hour sessions over 12 weeks, for a total of 36 contact hours. Most of the education was based on participant identified needs and covered a range of topics from pathophysiology of COPD, nutrition, self-care instruction, breathing retraining, smoking cessation, and stress management. The exercise component lasted 20-30 minutes. Depending on individual patients' capabilities, exercise might only have included stretching, breathing retraining, relaxation, and chest mobility exercises. Other exercises might have included weight training, walking on the floor or on the treadmill, stationary bicycling and recumbent stepping. The other group (14 men, 8 women) received only the education components (ED), in two-hour sessions, once a week, over four weeks for a total eight contact hours. Baseline demographics and CSES were completed before the start of the programs and the CSES was repeated by mail at one month and again at six-months after patients completed the program (Scherer et al., 1998).

Although the authors stated that the baseline demographic variables were not different between the two groups, it was unclear what characteristics were compared since they were not reported. Of the available information, there were obvious significant differences in the gender composition of the two groups, possible differences in the length of time since diagnosis with COPD (PRP = 1 to 20 years, ED = 1 to 12 years) and in their severity of shortness of breath (PRP = 3% mild SOB, ED = 23% mild SOB). Objective disease severity variables, such as FEV_1 and oxygen saturation were not reported (Scherer et al., 1998).

This study found that both groups improved their overall self-efficacy for managing dyspnea. The PRP group showed improvement in the total mean score of the CSES and the sub-scales of negative affect, intense emotional arousal, physical exertion and weather/environment, but not the behavioral risk factors sub-scale at one-month and six-month follow-ups. The ED group showed improvement in the total mean score of the CSES and the sub-scales of physical exertion and weather/environment at the one-month follow-up. At the six-month follow-up, improvement only in the sub-scale of physical exertion remained significant from baseline. Comparison of the CSES scores between the two groups, at baseline, showed no significant difference. The authors did not report comparisons of CSES scores between the two groups at one-month or six-months after intervention to ascertain whether the changes found within the groups over time were significantly different between the two groups (Scherer et al., 1998).

Since the education treatments differed tremendously in contact time (8 versus 36 hours) and possibly in topics covered, it was not possible to attribute with confidence the variation in findings to the exercise component of the program. Also, the exercise program was poorly specified. With a wide range of activities listed and performed at different intensity, frequency and duration by individual patients, it was not possible to determine what the exercise intervention was in this study. Furthermore, variables of gender, disease severity and symptom severity might influence patients' efficacy expectations and confound the findings of this study (Gormley et al., 1993; Kaplan, 1984; Toshima et al., 1992).

Few studies focused on self-efficacy for managing dyspnea as a distinct domain of functioning. Only one study included a second group, and none of these were controlled studies. Often, in these studies, the treatments were not well described and neither outlined which of the four determinants of self-efficacy the intervention was designed to affect nor examined the effect of different intensities of treatment. Nevertheless, the uniform positive findings of these uncontrolled studies substantiated the relevance of investigating self-efficacy related to symptom management in the COPD population. The design deficiencies limited the strength of the findings and highlighted the need for a controlled study.

Also, no study looked into patients' belief in the efficacy of the symptom management strategies taught to them or if patients actually used the strategies. It is not known if efficacy beliefs in the symptom management strategies affected patients' usage of the strategies or how it affected their perception of their ability to manage or avoid dyspnea in various situations. Without complimentary information on the specific strategies, it would be difficult to improve symptom management interventions based purely on patients' general efficacy to either avoid or manage their dyspnea in different situations. Therefore, it would be important to understand which strategy patients believe in and which they actually adopted and used in their daily lives.

Self-Efficacy Related to Walking

One of the proposed treatments for decreasing dyspnea was to interrupt the dyspnea-inactivity-dyspnea cycle (Carrieri-Kohlman, 1993; Sassi-Dambron et al., 1995; Schwartzstein, 1998). In an evidence-based guideline published by a joint panel of the ACCP/AACVPR (Reis, 1997), lower extremity exercise training provided both physiological and psychological benefits for patients with COPD. However, the specific exercise prescription and the mechanisms of improvement were unclear. Inactivity was a critical issue in dyspneic patients with COPD. Although evidence suggested benefit from lower extremity exercise, such as walking, it was not known how such activity could best be promoted in this patient population (Ries, 1997).

Since self-efficacy is a predictor of performance, it is important to understand how self-efficacy for activity performance relates to patients' actual performance in activities such as walking (Bandura, 1997; Strecher et al., 1986). Also, it is important to determine the type and intensity of treatments necessary to enhance self-efficacy and performance. Improving a person's self-efficacy for performing activities such as walking would be expected to improve their walking performance. This section of the review will address the area of activity performance in studies that used self-efficacy as the guiding theory (Table 2).

Several authors have examined the relationship between self-efficacy and activity. Scherer and Schmieder (1997) studied sixty COPD patients' perceptions of dyspnea, self-efficacy, and exercise endurance before and after an outpatient pulmonary rehabilitation (OPR) program that included education and exercise.

The patients received a total of four to six hours of education about the pathophysiology of COPD, medication, nutrition, control of dyspnea, stress management and breathing retraining. Patients exercised three times a week for 12 weeks, and the modalities included arm cycling or arm lifts, treadmill walking, stationary bicycling and step exercises. Sources to build efficacy information such as performance accomplishment, vicarious experiences, verbal persuasion, and minimizing emotional and physiologic arousal were incorporated into the treatment (Scherer & Schmieder, 1997).

Significant improvements were found between pre-program and post-program scores for self-efficacy ($p < 0.01$), dyspnea with activities ($p = 0.01$), and physical endurance ($p = 0.04$). Self-efficacy was measured by the CSES. Dyspnea was measured on a scale that assessed shortness of breath during eight physical activities such as walking on level ground, walking uphill and carrying groceries. A 12-minute walk distance was used to measure physical endurance. A significant negative correlation was noted for CSES scores and dyspnea ($r = -0.56$, $p = 0.01$), while there was a positive correlation between CSES scores and the 12-minute walk distance ($r = 0.43$, $p = 0.05$). A major limitation of this study was the lack of a control group. The one-group, pretest-posttest design was plagued with numerous confounding variables that threatened the internal validity of the study. For example, a control group receiving only attention might also have improved in the measures studied (Atkins, Kaplan, Timms, & Reinsch, 1984).

Table 2. Self-Efficacy and Walking in Patients with COPD

Author/ Source	Purpose	Sample	Design	Intervention	Measurement	Statistical Analysis	Results
Scherer & Schmieder, (1997) Heart & Lung, 26(1), 15-22	Determine effect of pulmonary rehab on changes in self-efficacy, dyspnea and exercise endurance	60 COPD mean ratio 47%, 43% O2, 23% Xray, R heart or cor pulmonale	One group pre/post 1hr/3x/wk 12wks, small group 5-8	-36 1hr class, 3x/wk for 12wks -didactic 4-6, breathing retraining -exercise, workout, 20-30min individualized, treadmill,bike,step -THR Karvonen, Borg exertion	CSES- pre and by mail within 1 month post Dyspnea Scale- 4 point Likert 8 physical tasks r/t walking and carrying -pre and by mail within 1 month post	Paired t-tests -pre/post Correlations -CSES with dyspnea & 12MWD	CSES total & sub-scales ↑ Dyspnea ↓ 12MWD ↑ Post CSES & dyspnea $r = -.55$ Post CSES & 12MWD $r = .43$
Kaplan & Atkins, (1984), Health Psych, 3(3), 223-242	Examine specific & general expect-ancies mediators of change in exercise behavior	60 COPD 22 men, 38 women Age= Mean 65	RCT of 4 treatment groups	-cognitive, -behavioral, -cognitive /behavioral, -attention control 4 sessions in 1st month, and 2 sessions 2nd month	Baseline and 3 months -locus of control -Self-efficacy for walking, climbing, pushing, exerting, carrying, anger, depression	ANOVA- treatment effect Correlations- efficacy scale to treadmill performance, & disease severity	Baseline SE not related to treadmill walk, baseline treadmill related to FEV_1 All 3 treatments ↑ walking & post treatment SE more related to treadmill walk than FEV_1 Δ SE specific to intervention SE mediated compliance

Table 2. Self-Efficacy and Walking in Patients with COPD

Author/ Source	Purpose	Sample	Design	Intervention	Measurement	Statistical Analysis	Results
Gormely, Carrieri-Kohlman, Douglas, Stulbarg (1993), J Cardio Pulm Rehab,13, 424-431	Describe patterns of change & relationship for SE & performance Examine treatment group & gender	52 COPD 25 men, 27 women Age= Mean 67 FEV_1% pred = 37.5 FEV_1/FVC = 41.7	RCT 2 groups combined	Treadmill exercise 3X/wk for 4 wks, total 12 sessions -coached group & monitored group	Before each session, SE for walking on the treadmill for 5 minutes, speed/grade confidence 0-10 Actual Walked on treadmill for 5 minutes	Correlations related SE & performance RMANOVA SE & performance 12 sessions Friedman-changes over time in SE & performance	SE and Performance ↑ SE relation to Performance r = .4 - .8 (12tx) SE always < Performance with ↑ in congruency after 9 sessions Performance 1-12 session Women > Men SE at baseline Women < Men (3.2, 4.5) SE at end Women > Men (7.0, 5.7)
Toshima, Kaplan, & Ries (1990), Health Psych, 9(3), 237-252	Examined effect of treatments on SE & activities & exercise performance	N=119 COPD 87 men 32 women Age= Mean 63 FEV_1% pred = 52	RCT 2 groups -rehab -education control	Education-lecture & video tape about lung disease Rehabilitation-education, physical/respiratory care, psychosocial support and supervised exercise training	Baseline, 2 months, 6 months, 1 year 7 SE scales -walking,climbing, lifting, exerting, pushing, anger, stress treadmill endurance, quality of well being, depression	RMANOVA-difference between groups in exercise endurance,	Significant ↑ SE for rehabilitation group over time, not for education group Significant ↑ exercise endurance over time & group by time, rehabilitation > education No difference between groups for quality of well being and depression scores SE for physical activity related to pulmonary function

Nevertheless, findings of this study suggested that an OPR program with education and exercise could be beneficial for the patient with COPD. In contrast to findings of Zimmerman and colleagues (1996) where dyspnea did not change after treatment, this study found that an improvement in self-efficacy for managing dyspnea was related to a decrease in dyspnea during certain activities and an increase in the 12-minute walking distance. Since self-efficacy is specific to each functional domain and can not be generalized across dissimilar domains, it would have been more appropriate in this study to directly measure patients' self-efficacy for performing various activities or for walking rather than using the CSES, which measured patients' self-efficacy for managing or avoiding dyspnea. The findings suggested that self-efficacy for symptom management and self-efficacy for activity tolerance might have overlapping sub-domains since CSES, being a less specific measure, still had enough sensitivity to detect a significant relationship between CSES scores and the outcome measures of dyspnea with activities and the 12-minute walking distance.

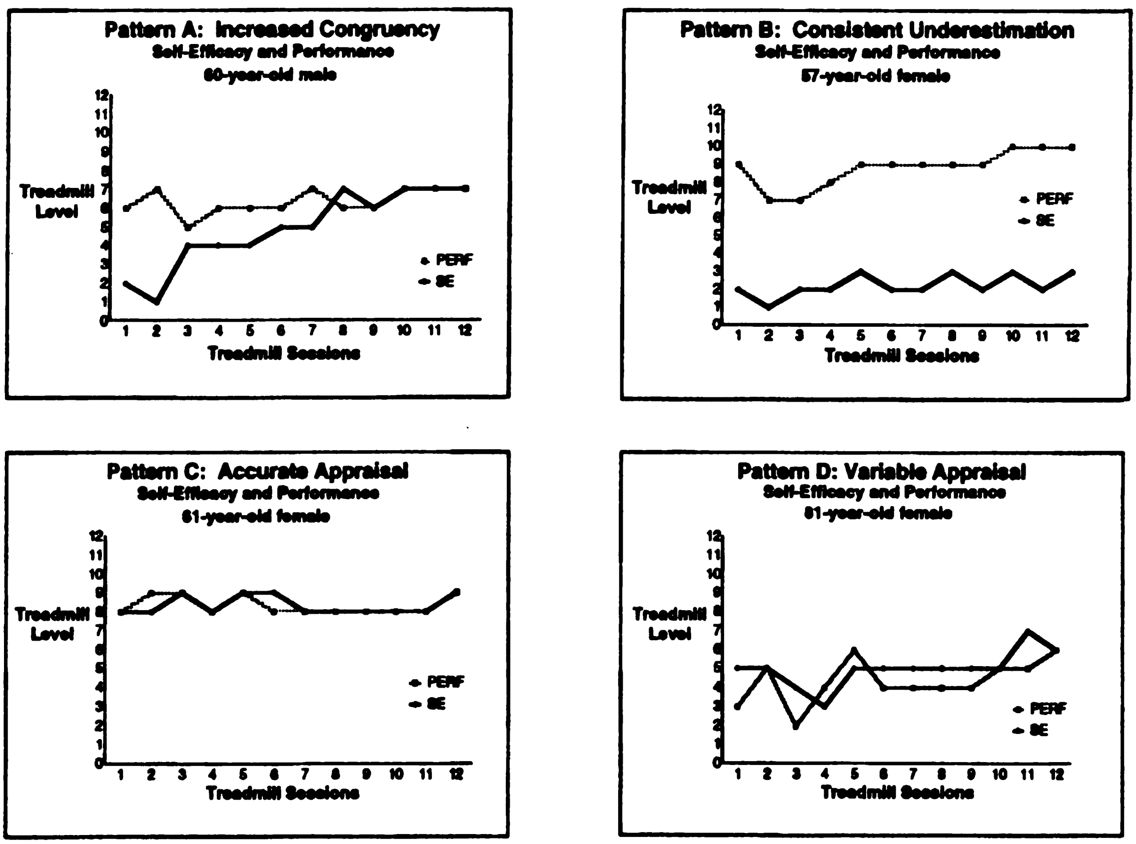
Another study specifically investigated the relationship between treadmill self-efficacy and treadmill walking performance in 52 patients (25 men, 27 women) with moderate to severe COPD (Gormley et al., 1993). Patients completed 12 treadmill-walking sessions over a period of four to six weeks. Treadmill self-efficacy was measured before each of the 12 sessions. Self-efficacy for treadmill walking was defined as the highest treadmill speed and grade that subjects indicated they could walk for five minutes. Walking performance was the highest treadmill speed and grade that the subjects actually completed for five continuous minutes.

In this study treadmill self-efficacy was significantly correlated with walking performance in all 12-treadmill sessions ($r = 0.40$ to 0.79, $p < 0.005$) with the later treadmill sessions demonstrating progressively higher correlation. This exercise intervention resulted in a significant increase in self-efficacy and in performance across the 12 sessions ($p < 0.0001$) demonstrating that self-efficacy was consequential in understanding improvements in physical performance in dyspneic COPD patients. The authors also described four patterns of change in the relationship between self-efficacy and performance (Figure 6). Eighty-three percent ($n = 43$) of the sample demonstrated a pattern of improvement in self-efficacy for treadmill walking, six subjects stayed the same, and three decreased in self-efficacy from session 1 to session 12. Although toward the end of the 12 sessions, subjects rated their self-efficacy and their performance more congruently, the lack of confidence in their walking ability persisted until around the ninth session. This interesting observation offered insight into the number of exercise sessions required to affect a change in self-efficacy for walking and perhaps for increased walking performance in this patient population.

Despite higher lung function (FEV_1 41.7 % predicted versus 33% predicted) and higher treadmill performance scores, women in this sample had substantially lower self-efficacy than men for treadmill walking. Women's self-efficacy increased significantly more than men's did over the 12 sessions but remained lower than men's overall ($p < 0.05$). Among both men and women in this sample, self-efficacy for walking at home also increased significantly ($p < 0.01$) after the 12 training sessions and was maintained at 2 months after treatment (Carrieri-Kohlman et al., 1996). Low self-efficacy for walking was particularly evident in this sample of women. However, they were responsive to the treatment and might need stronger strengths of the intervention to reach similar efficacy levels as the men in this sample. These findings highlighted the need to better understand the interventions and to specify sample characteristics that would be most sensitive to treatment.

Figure 6. Four Patterns of Change

Reference: Gormley, J., Carrieri-Kohlman, V., & Douglas, M. (1993). Treadmill Self-Efficacy and Walking Performance in Patients With COPD. *Journal of Cardiopulmonary Rehabilitation, 13*(6), 424-431.



Overall, subjects in this study consistently underestimated their performance for walking. This was the only study in patients with COPD that compared self-efficacy between genders. Women in this sample had lower treadmill self-efficacy than men despite better performance, but they gained more self-efficacy than men did after the treadmill sessions. Studies in other areas such as career choices, child development and mathematical efficacy corroborate that women might initially have lower self-efficacy than men for non-traditional roles or endeavors regardless of women's actual ability or level of performance (Matsui, 1989); (Matsui, 1991); (Schunk, 1984). It was important to recognize that these impediments on women's self-efficacy were mainly due to social influences and were modifiable with the appropriate interventions. A plausible explanation for the lower treadmill self-efficacy for the women in this sample would be that they were older (mean age = 66 years) and walking on the treadmill or even exercise per se were not a part of their socialization.

Findings of this study were that patients with COPD had a diminished self-efficacy for walking when compared to their actual performance, and that initial higher lung function or performance did not dictate walking efficacy. Furthermore, enactive mastery experiences obtained by exercising on the treadmill, without a separate educational component on dyspnea management, was effective in improving self-efficacy for walking and for walking performance. However, appreciable improvements in self-efficacy were not evident until at least the ninth exercise training session (Gormley et al., 1993). More intensive or comprehensive treatment in exercise training and dyspnea management might be required to produce an expeditious positive effect on self-efficacy in dyspneic patients with COPD.

In a study conducted by Kaplan and colleagues (1984), the relationship between exercise tolerance on a treadmill and self-efficacy for seven activities were studied in 60 patients (22 men, 38 women) with moderate to severe COPD. All patients completed a baseline incremental treadmill stress test and were given an exercise prescription based on the maximum exercise tolerance achieved on the treadmill. Patients' baseline self-efficacy for the seven activities was measured after assignment of the walking prescription. The seven activities were walking, general exertion, moving things, lifting, climbing stairs, tolerate stress and tolerate anger.

The patients were randomly assigned to four groups. All groups received attention. In addition, the three experimental groups received specific training to increase their walking with either behavior, cognitive, or both cognitive and behavior modification. Each group attended weekly sessions for the first four weeks and biweekly sessions for the next four weeks for a total of six sessions. All measures were re-evaluated three months after the initial assessment.

Baseline correlation of walking self-efficacy with exercise tolerance on the treadmill was non-significant ($r = 0.05$, $p > 0.05$). Interestingly, none of the seven efficacy scales correlated with actual treadmill performance at baseline testing but walking efficacy correlated with FEV_1 ($r = 0.44$, $p < 0.05$). In this sample of patients, confidence in walking and in doing the other activities was not related to actual ability as measured by their exercise tolerance on the treadmill, but did relate to FEV_1. The authors speculated that the correlation between lung function and efficacy for walking might be due to patients' belief, either from prior experiences or from their physicians, that their lung function dictated their physical ability. Perhaps patients who were told their lung function was 50% of normal inferred that their ability to function in walking and other activities was also reduced by half. The authors noted that misperception could discourage patients from attempting or persevering in physical activity or exercise.

Contrary to the traditionally held view of health locus-of-control (a general measure of whether a person believes that his/her behavior is related to health) as a personality trait (Rotter, 1972), the findings of Kaplan (1984) suggest that health locus-of-control is possibly malleable with cognitive intervention. While not reaching statistical significance, subjects in the treatment groups that included a cognitive component did show a trend toward internal locus of control changes. Self-efficacy judgments were also more strongly correlated with behavior in those with an internal locus-of-control. Although locus-of-control did not predict initial performance or the change in performance after treatment, efficacy judgments for physical activities such as walking, general exertion, and climbing were correlated to exercise tolerance, health status, and pulmonary function only in people with an internal locus of control.

Interventions aimed at promoting behavior change through enhancing self-efficacy might be more effective in those who believed their ability to perform was not dictated by factors they could not control, such as FEV_1. These findings might have implications for designing future treatment approaches for the dyspneic COPD patient. That is, cognitive interventions could positively influence patients' internal locus-of-control. Patients who believe that their behavior can influence their health might be more willing to adopt and persevere in treatment recommendations and more responsive to treatments designed to increase walking behavior.

After the treatment program, the three treatment groups increased their efficacy for walking, whereas the attention control group did not. For the treatment groups, efficacy expectations for walking correlated more with actual exercise tolerance ($r = 0.47$, $p < 0.05$) and less with FEV_1 ($r = 0.36$, $p < 0.05$). Since the intervention was directed at increasing the behavior of walking, self-efficacy for activities that had more resemblance to walking were also improved by the intervention, whereas activities with less resemblance to walking did not improve. This finding also validated the effectiveness of the cognitive and behavioral interventions for walking.

Other findings of this study showed that compliance to the home walking prescription was significantly related to walking efficacy ($r = 0.63$, $p < 0.01$) and to the improvement in walking efficacy from baseline to the three-months follow-up ($r = 0.32$, $p < 0.05$). This study supported the predictions of the self-efficacy theory in COPD patients in that enactive mastery was associated with enhanced efficacy, the correlation between efficacy and performance increased with experience, and the changes in efficacy specific to the activity targeted for intervention (Bandura, 1977; Bandura, 1997).

Toshima and colleagues (1990, 1992) examined the role of self-efficacy in predicting exercise performance in 119 patients (87 men, 32 women) with mild to severe COPD. Pulmonary function, exercise tests, treadmill endurance walks, and psychosocial measures were measured at baseline, immediately following the intervention at two months, and at six months and one year. Patients were randomly assigned to rehabilitation or to an education control group. The rehabilitation group received education about their disease, instructions on physical and respiratory care, psychosocial support, and supervised exercise training. Lectures and videotapes about the disease were provided to the education group (Toshima, Kaplan, & Ries, 1990; Toshima et al., 1992).

Seven self-efficacy categories were measured: walking, climbing, lifting, exerting, and pushing as well as anger and stress. Within each scale, patients were asked to rate their degree of confidence in performing progressively more difficult activities. The two groups were not significantly different at baseline in self-efficacy ratings, treadmill performance, quality of well-being scores (QWB), number of symptoms, or depression scores. The mean depression score, based on the Centers for Epidemiological Studies depression scale (CES-D), was 14.2 ± 8.74 for the rehabilitation group and 15.34 ± 10.03 for the education group (Toshima et al., 1992). According to this scale, CES-D scores can range from 0 – 60 with scores greater than 18 being suggestive of clinical depression.

As shown in Table 3, baseline self-efficacy expectations for physical activities such as walking, climbing, and exertion significantly correlated with pulmonary function test variables (residual volume [RV]/total lung capacity [TLC],

FEV_1, diffusion limitation of carbon monoxide [DLCO]), exercise variables (maximal oxygen consumption [VO_2 max]), and the QWB score. Self-efficacy expectations for climbing, exertion, and anger were negatively related to depression. Correlation of self-efficacy scales for physical activities with pulmonary function and exercise variables were consistently observed. In contrast, stress and anger self-efficacy scales did not consistently correlate with pulmonary function variables. These findings supported the specificity of self-efficacy and suggested that physiological feedback might be an important determinant of self-efficacy related to physical activity (Toshima et al., 1992).

However, psychosocial variables had a low but statistically significant correlation with endurance time on the treadmill. Furthermore, self-efficacy for stress and anger was not related to QWB and had a low correlation with depression (Table 3). Reasons for these unexpected findings were unclear. The variation in the CES-D scores indicated that some subjects in the sample were clinically depressed, but it was not known how their depression would influence their judgments of self-efficacy.

Table 3. Correlation Among Pulmonary Function Test, Psychosocial Variables and Self-Efficacy Scores for Each Efficacy Category

	Self-Efficacy Category						
	Walk	Climb	Lift	Exert	Push	Stress	Anger
FEV1	.42**	.35**	.17*	.18*	.11	.04	.04
RV/TLC	-.44**	-.39**	-.28**	-.17*	-.15*	-.08	-.08
DLCO	.46**	.37**	.18**	.34**	.17*	.05	.06
VO2max	.50**	.41**	.15**	.45**	.28**	.02	.03
Treadmill Endurance	.42**	.35**	.27**	.19**	.27**	.17*	.18*
QWB	.31**	.42**	.31**	.18*	.42**	.09	.09
CES-D	-.24**	-.19*	-.27**	-.07	-.10	-.20*	-.24**

Note. *$p < .05$; **$p < .01$.

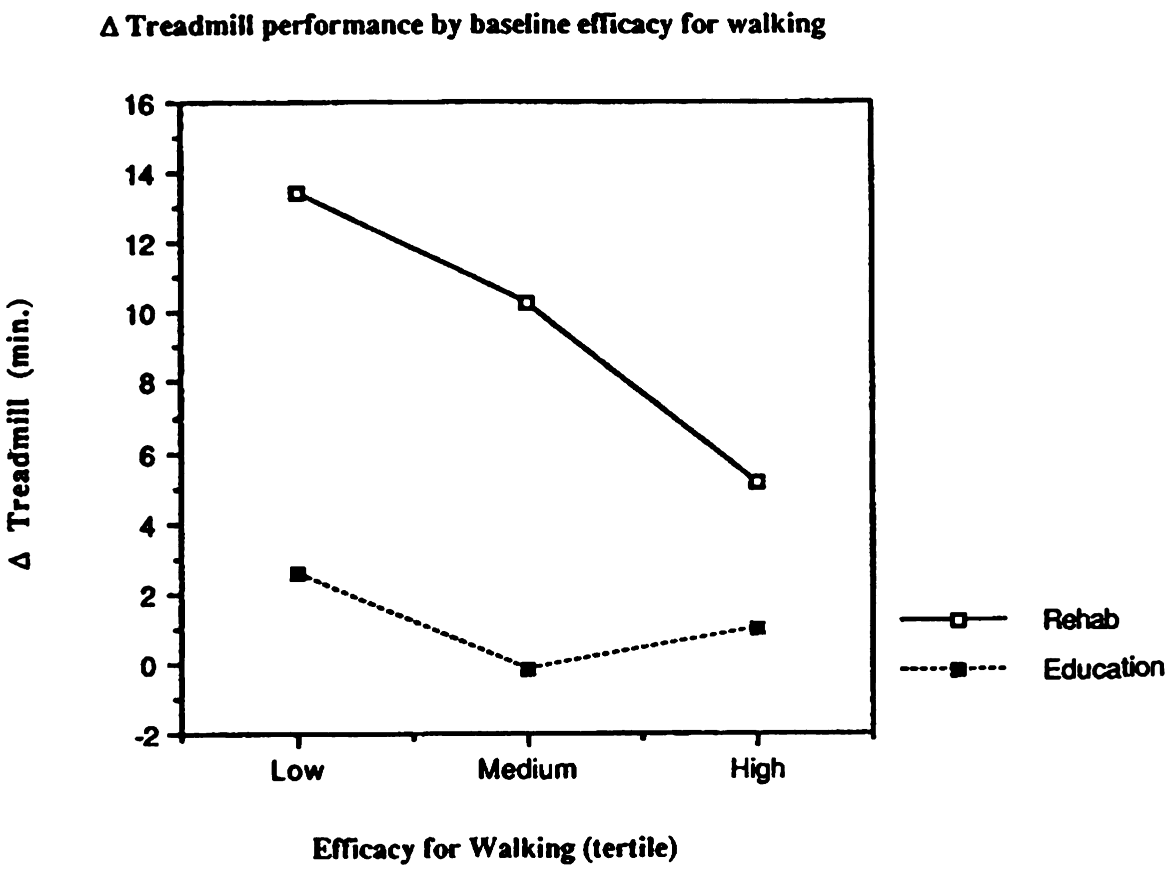
The effect of patients' self-efficacy expectations on outcome and changes in self-efficacy through participation in a rehabilitation program were also evaluated in this study. Although patients in the rehabilitation group achieved higher performance on the treadmill after treatment and maintained the higher performance at one-year follow-up, their self-efficacy judgments were not statistically different from the education control group (Toshima et al., 1992).

Further explorations were done using microanalysis. Subjects were separated into three levels of initial self-efficacy expectancy (low efficacy, medium efficacy, and high efficacy) and the relationship between initial expectancy and behavior change was examined. A group difference was observed between rehabilitation patients and education control patients (Figure 7). Those patients in the rehabilitation group with high self-efficacy for walking had the greatest endurance on the treadmill. However, initially high self-efficacy for walking in the rehabilitation group was related to less improvement in treadmill performance, which suggested a ceiling effect. Initially low self-efficacy for walking in the rehabilitation group was related to the greatest improvement. Patients in the education control group had minimal changes in treadmill performance and self-efficacy for walking regardless of initial self-efficacy ratings for walking (Figure 7).

Findings of this study supported the construct validity of self-efficacy in COPD patients in that self-efficacy for physical activities was associated with physiological variables of pulmonary function and exercise performance and less associated with psychosocial variables. Self-efficacy theory predicted that

Figure 7. Relationship between Self-efficacy and Treadmill Walking

Initial Efficacy Expectations and Subsequent Improvements in Treadmill Performance for Rehabilitation and Education Patients.
Reference: Toshima, M. T., Kaplan, R. M., & Ries, A. L. (1992). Self-efficacy expectancies in chronic obstructive pulmonary disease rehabilitation. In R. Schwarzer (Ed.), *Self-Efficacy: Thought Control of Action* (pp. 325-354). Washington: Hemisphere.



performance accomplishment or mastery would have the strongest influence on subsequent perception of self-efficacy, thus influencing future performance. However, contrary to the prediction of the self-efficacy theory, mastery experiences of increased performance on the treadmill, in this sample, did not result in statistically significantly higher self-efficacy judgment for walking.

Non-significant changes in self-efficacy after treatment, in this sample, might be a result of the study design. Since the study was designed to have the power to detect a moderate effect, presence of a small effect would not have been detected. The self-efficacy assessment tool for walking also might not have been adequately specific to treadmill performance since the self-efficacy questions asked subjects to rate their confidence in walking one block (5 minutes) to three miles (90 minutes) rather than their confidence on a treadmill. Furthermore, 12 supervised exercise sessions in 8 weeks might have been a sub-optimal intervention strengths for enhancing self-efficacy for walking. Additionally, the authors postulated that a cognitive behavior intervention used in a previous study (Kaplan, 1984), rather than the medical model rehabilitation intervention used in this study, might be more effective in affecting changes in internal attributions for behavior change. In other words, although the rehabilitation group did better on the treadmill, this improvement did not give the group overall more confidence in their ability to walk.

The rehabilitation group received education about their disease, instructions on physical and respiratory care, psychosocial support and supervised exercise training but did not receive cognitive behavior intervention that might have helped them to attribute the success in a manner that raised their confidence for walking. Consequentially, in this sample, mastery experiences themselves, without cognitive intervention, failed to increase patients' self-efficacy for walking. Therefore, in this population of COPD patients, strong physiological feedback might have attenuated efficacy building information derived from performance accomplishments.

Gaps in Knowledge

Despite a plethora of studies confirming the utility of the self-efficacy theory, in various domains of human functioning, relatively few studies have examined the concept of self-efficacy in dyspneic patients with COPD. Of these, the two main areas of functioning studied are symptom management and physical performance. Studies that researched the effectiveness of education on dyspnea management found that self-efficacy for managing or avoiding dyspnea improved with treatment, but dyspnea intensity might not be a sensitive outcome to the treatment (Scherer & Schmieder, 1996; Scherer & Schmieder, 1997; Scherer et al., 1998; Scherer & Shimmel, 1996; Zimmerman et al., 1996). A wide array of information was included in the educational treatments given to patients in these studies, but how all these components of the treatment were related to symptom management was inconclusive since these studies were not controlled. In particular, no study examined the specific strategies taught to patients for managing their symptoms. It was not known whether patients used the strategies taught to them and what were their efficacy beliefs about the strategies. Therefore, the actual effectiveness of the treatments was poorly delineated and requires further study.

Studies that investigated self-efficacy related to physical performance typically addressed self-efficacy for walking and other activities, such as general exertion, moving objects, lifting and climbing stairs. Research findings in this area of functioning supported self-efficacy as a significant mediator of activity performance. Although cognitive, behavioral and pulmonary rehabilitation programs, based on the medical model, all improved patients' exercise performance, cognitive behavioral interventions appeared more effective in enhancing self-efficacy (Kaplan, 1984; Toshima et al., 1992). In two studies, physiological feedback as defined by FEV_1 was perhaps even a stronger determinant of self-efficacy for activity tolerance than mastery experiences (Kaplan, 1984; Toshima et al., 1992). In addition, gender might be an important variable to include in this population, as one study found significant differences in self-efficacy for walking between men and women (Gormley et al., 1993).

Therefore, future studies need to include physiological measures of disease severity and exercise performance to determine the relationships between physiological feedback, self-efficacy and physical performance. Future studies must measure self-efficacy specific to the domain of functioning, include methods for controlling confounding variables such as randomization and use comparison groups. Research in self-efficacy needs to explore the most effective methods and strength of treatment to increase self-efficacy and identify patient characteristics that would predict the usefulness of enhancement measures in the dyspneic COPD patient population.

Conclusions

The concept of self-efficacy has been studied and identified as an important determinant of behavior in diverse areas of normal human functioning and health and clinical functioning. Normal human functions that have been studied include student learning, teaching effectiveness, athletic skills development, career choice and development and organizational decision making (Bandura, 1997). Moreover, health and clinical functioning, such as biological effects of self-efficacy, health promoting behaviors, prognostic judgments, anxiety and phobic dysfunction, depression, eating disorders and alcohol and drug abuse have also been studied. Researchers have also found self-efficacy to be an important predictor of behavior in patient populations such as those with cardiovascular disease and arthritis (Ewart, Taylor, Reese, & DeBusk, 1983; Gortner & Jenkins, 1990; Lorig, Chastain, Ung, Shoor, & Holman, 1989).

Self-efficacy theory holds conceptual validity in the COPD population in that self-efficacy for a particular behavior is strongly reflective of the actual performance of the behavior. Enhancements in self-efficacy appear to improve compliance for the sustained performance of a behavior. Efficacy enhancement interventions appeared effective in those with low self-efficacy and in those who underestimated their actual ability.

To improve the treatment of the dyspneic COPD patient, it is imperative to further understand the relationship between physiological determinants of disease severity, mechanisms of dyspnea, perception of dyspnea and self-efficacy. Symptom management and physical function are domains that are extremely important for patients with COPD, and further understanding of self-efficacy in these domains could be the key to the development of valuable treatment options. From this understanding, patient characteristics could be identified and appropriate efficacy enhancement strategies applied. Increasing self-efficacy in these domains could also enhance patients' compliance to currently available treatments, such as complex medication regimens, initiation of a home exercise program or attendance at a comprehensive pulmonary rehabilitation program. Higher self-efficacy could lead to increased effort and perseverance by the patient, contributing to the effectiveness of treatments and better outcomes (Kaplan, 1990). Self-efficacy theory offers a theoretically based, empirically tested approach in the development, testing and refinement of interventions in treating the dyspneic COPD patient population.

CHAPTER THREE: METHODS

Research Design

This study is part of a larger randomized clinical trial examining three treatments for dyspnea in patients with COPD. This study focused specifically on the effectiveness of three exercise treatments on patients' self-efficacy for walking and self-efficacy for managing dyspnea. This is a quasi-experimental study. Following completion of three baseline exercise stress tests, subjects were randomized to one of three treatment groups within three strata: gender, reaching anaerobic threshold (AT) and desaturating below 85%. Variables of interest were measured at baseline and following subjects' completion of treatment (2 months).

Setting

Subjects were seen in the general clinic research center (GCRC), adult pulmonary function laboratory (PFL), physical therapy department (PT), and ambulatory care center's chest and allergy clinic (ACC) at the University of California San Francisco (UCSF) Medical Center, and the satellite research laboratory in UCSF School of Nursing. The University of California, San Francisco is a health science campus, and the UCSF Medical Center is an urban, tertiary referral center and teaching hospital.

Sample

A convenience sample of patients with COPD experiencing dyspnea with activities of daily living was recruited within the San Francisco Bay using various means such as mailings to physicians, residents, advertisement in newspapers on the radio and visits to clinics or senior centers.

Inclusion criteria

1. Adults 40 years of age or older
2. Ability to understand English
3. Diagnosis of chronic bronchitis, emphysema or irreversible airflow obstruction
4. $FEV_1 < 60\%$ predicted, or $FEV_1/FVC < 60\%$
5. Experiencing shortness of breath with daily activities
6. Able to walk on a treadmill
7. No formal pulmonary rehabilitation within the last six months

Exclusion criteria

1. Diagnosis of angina
2. Diagnosis of aortic stenosis
3. Myocardial infarction or coronary artery bypass graft surgery within the last six months
4. Hypertension > than 180/100 mmHg
5. Major arrhythmias
6. Active infectious disease
7. Musculo-skeletal limitation to walking

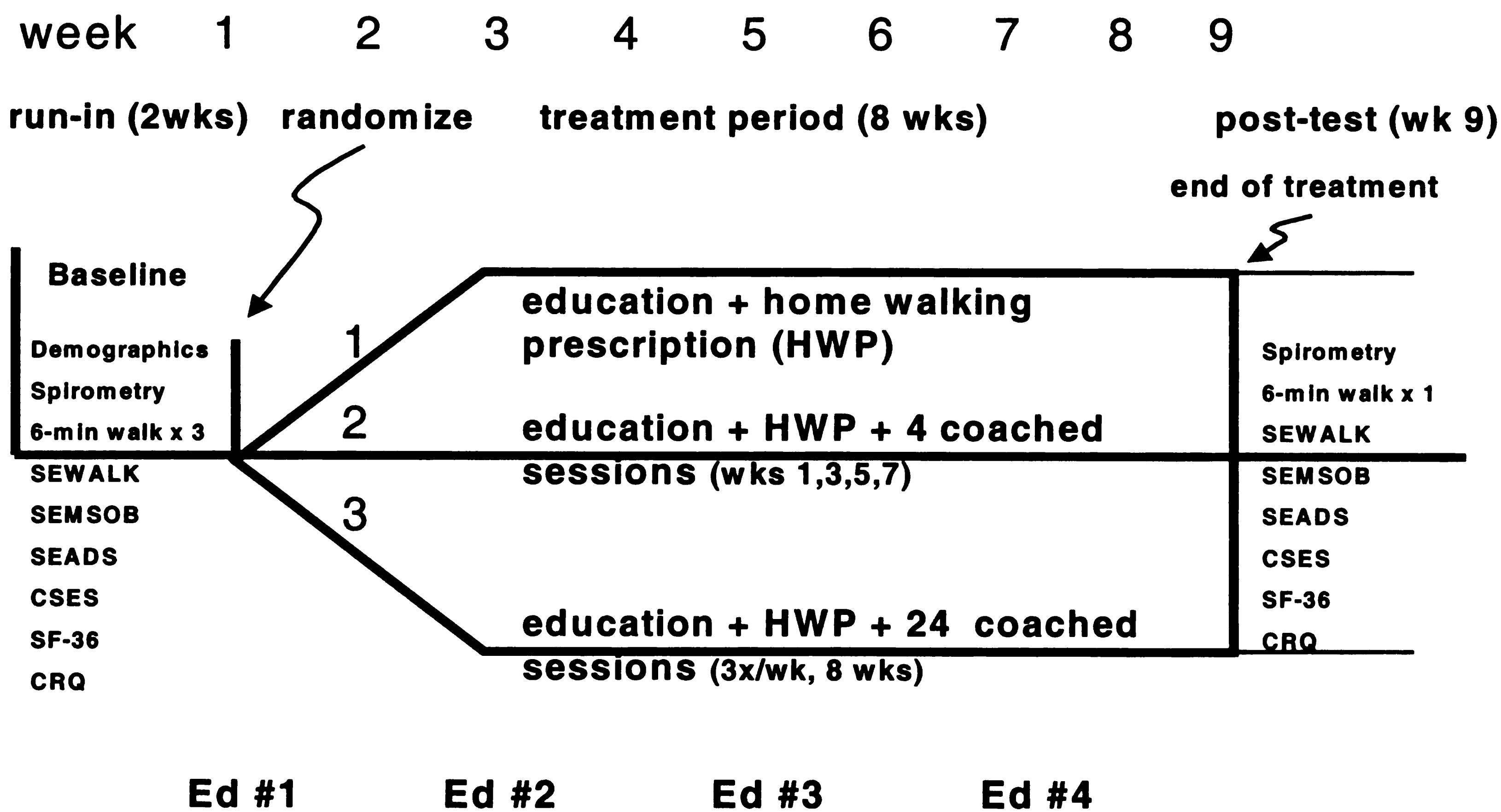
Methods

Potential subjects were screened by phone. Preliminary information such as subjects' age, medical diagnosis, medication, activity limitation and co-morbid conditions were obtained. Previous pulmonary function tests, if available, were obtained to assess qualification. Those patients who did not have accessible pulmonary function test records came to UCSF Medical Center or the satellite research laboratory at UCSF School of Nursing for a spirometry screening. Patients passing initial evaluation were scheduled for baseline testing that was completed over three days within a two-week period.

Written informed consent was obtained from each subject before study participation. Institutional Review Board (IRB) approval # H353-09538-04, from the University of California, San Francisco was given on September 11, 1998. After informed consent was given, baseline measurements were obtained. If subjects completed baseline measurements successfully, they were stratified by gender, AT, $SaO2 > 85\%$, then randomized into one of three groups for a 2-month treatment period.

Subjects randomized to the home-walking control group (HWC) received education about dyspnea management and a home walking prescription. Subjects in the exposure group (EXP) received education about dyspnea management, a home walking prescription and four-coached treadmill sessions. Subjects in the training group (TRG) received education about dyspnea management, a home walking prescription and 24 coached treadmill sessions. Following completion of the 2-month treatment period, subjects returned for a post-treatment visit (see Figure 8).

Figure 8. Study Design



Procedure

Baseline Day 1

Patients were seen at the GCRC. First, written consent to participate as a research subject was obtained. A research assistant, who is a registered nurse, performed a physical assessment. The following tests and instruments were administered (Appendix A-F):

1. Chronic Respiratory Questionnaire (CRQ) (Appendix F)
2. Spirometry
3. Two puffs of inhaled bronchodilator
4. Medical outcome study 36-items short form (SF-36) (Appendix E)
5. Spirometry after medicating with inhaled bronchodilator
6. Self-Efficacy for Walking scale (SEWALK) (Appendix C)
7. Six-Minute Walk # 1 (6MW1)
8. Demographic Questionnaire
9. Six-Minute Walk # 2 (6MW2)
10. Self-Efficacy and Dyspnea Strategies Scale (SEADS) (Appendix D)
11. COPD Self-Efficacy Scale (CSES) (Appendix A)
12. Self-Efficacy to Manage Shortness of Breath questionnaire from Stanford Patient Education Research Center (SEMSOB) (Appendix B)
13. Six-Minute Walk # 3 (6MW3) only if the difference in distance walked between 6MW1 and 6MW2 is greater than 10%

Baseline Day 2

Patients were seen at UCSF's Adult Pulmonary Function Laboratory for measurements of total lung capacity, maximal voluntary ventilation, and diffusion capacity. After completion of the pulmonary function tests, patients completed a symptom-limited incremental exercise test on a treadmill in a manner consistent with the research protocol. Subjects did two practice walks on the treadmill before the start of the test. During the incremental test, the speed or grade of the treadmill advanced every 80 seconds. The increments were denoted as stages in the following manner:

Stage 1 = 1.0 miles per hour and 0 % grade
Stage 2 = 1.4 miles per hour and 0 % grade
Stage 3 = 1.7 miles per hour and 0 % grade
Stage 4 = 2.0 miles per hour and 0 % grade
Stage 5 = 2.5 miles per hour and 0 % grade
Stage 6 = 3.0 miles per hour and 0 % grade
Stage 7 = 3.0 miles per hour and 2 % grade
Stage 8 = 3.0 miles per hour and 4 % grade
Stage 9 = 3.0 miles per hour and 6 % grade
Stage 10 = 3.0 miles per hour and 8 % grade
Stage 11 = 3.0 miles per hour and 10 % grade
Stage 12 = 3.0 miles per hour and 12 % grade
Stage 13 = 3.0 miles per hour and 14 % grade
Stage 14 = 3.0 miles per hour and 16 % grade
Stage 15 = 3.0 miles per hour and 18 % grade
Stage 16 = 3.0 miles per hour and 20 % grade

Baseline Day 3

Patients completed a symptom-limited incremental exercise test and an endurance exercise test on the treadmill. The tests were performed based on written protocols. The advancement of speed and grade of the treadmill for the incremental test was done in the same manner as the incremental test on

baseline day 2. Patient rested for 30 minutes after completion of the incremental exercise test before performing the endurance exercise test. Research personnel, depending on the maximal speed and grade achieved by the patient on the two incremental exercise tests, selected the endurance level. The endurance speed and grade was one stage below the maximal stage achieved by the patient in either of the two incremental exercise tests.

The speed and grade of the treadmill for the endurance test advanced after an initial warm up of 80 seconds at one mile per hour (MPH) to the designated endurance level. For example, if a patient's maximal speed and grade completed for the two incremental tests is 2.5 miles per hour and 0% grade, the maximal stage completed is stage 5. The endurance level for this patient was one stage below the maximum completed, which was stage 4 or 2.0 miles per hour and 0% grade. Subjects then walked at their endurance level for the duration of the test. The patient therefore warmed up at 1 mph for 80 seconds and then was advanced to 2.0 mph where they remainder the duration of the endurance test.

Randomization

To ensure that the potential confounding variables of gender, AT and oxygen desaturation (SaO_2 < 85%) were balanced among the three conditions, randomization was done within strata. The random assignment to groups within these strata was generated with the aid of SPSS random generator. After subjects complete baseline day 3, their gender, anaerobic threshold and oxygen saturation data from the stress tests were extrapolated and they were randomized into the next open position within these strata. Subjects were notified by phone of their group assignment and scheduled for treatment.

Treatment Phase (2 months)

Each subject received four education sessions and a home walking prescription. The four education sessions were scheduled for week one (90 minutes), week three (30 minutes), week five (30 minutes), and week seven (30 minutes). The home walking prescription was individualized according to subject's performance on the three treadmill exercise tests. The goal was for subjects to walk, a minimum of three times a week, 20 minutes each time, at or above their endurance exercise level. A pedometer was provided for each subject and they recorded their symptoms and walks in a daily diary. Also, research personnel telephoned the subjects every two weeks to assess adherence to the home walking prescription and to answer any questions regarding their exercise prescription or completion of the daily diary.

The contents for the four education sessions were structured in the following manner:

Education Session # 1

1. Seven dimensions of a symptom
2. Questions related to subject's experience with shortness of breath
3. Factors related to shortness of breath
4. Major causes of shortness of breath
5. Strategies for managing shortness of breath
    - Pursed-lips breathing

- Exercise
- Desensitization

6. Exercise prescription for home walking
7. Instruction on taking pulse

<u>Education Session # 2</u>

1. Review exercise prescription
2. Strategies for managing shortness of breath
   - Positioning
   - Diaphragm breathing
   - Medications

<u>Education Session # 3</u>

1. Review exercise prescription
2. Strategies for managing shortness of breath
   - Relaxation techniques
   - Biofeedback
   - Music
   - Guided imagery
   - Self-talk
   - Social support

<u>Education Session # 4</u>

1. Review exercise prescription
2. Strategies for managing shortness of breath
   - Activity modification

- Energy conservation

For subjects in the exposure group, an exercise treatment session consisted of walking on the treadmill with the guidance of research personnel accompanied each of the four education sessions. Subjects in the training group had three exercise treatment sessions per week for eight weeks (total = 24 exercise sessions) walking on the treadmill with the guidance of research personnel.

The intensity of the exercise treatment sessions was individualized according to patients' performance on the three baseline exercise tests. The goal of each exercise sessions was for subjects to walks for at least 20-25 minutes, as well as gradually increases the intensity of their walk to at or above their designated endurance level. The exercise sessions started with a two-minute warm up at 1.0 mph and increased by 1-2 stages every 1-3 minute until subject was at their endurance exercise level, or at the highest stage completed at their last exercise treatment session. At the end of the walk, subjects cooled down at 1.0 mph for three minutes. Guided mastery techniques such as establishment of short-term goals, mastery of graduated subtasks, modeling of effective coping strategies, provision of protective aids, modulating severity of threat, gradual extension of time coping with symptom, use of social persuasion and emotional support were provided at each treadmill treatment session.

<u>Post Test (week 9)</u>

Patients were seen at the GCRC. A research assistant, who is a registered nurse, performed a physical assessment of the subject. Either a

research assistant or a GCRC nurse, trained in this research protocol administered the following:

1. CRQ
2. Two puffs of inhaled bronchodilator
3. SF-36
4. Spirometry after medicating with inhaled bronchodilator
5. SEWALK
6. Six-Minute Walk
7. CSES
8. SEMSOB
9. SEADS

Measurement of Variables

Antecedents

Demographic information such as age, gender, ethnicity, education level, income, smoking history, shortness of breath and exercise history were obtained using a demographic questionnaire. Information needed for stratification was obtained during baseline exercise tests. Measurements of VO_2 and VCO_2 were obtained every 20 seconds during exercise tests. Anaerobic threshold was determined by at least two raters, using the V-slope method, described by (Wasserman, Hansen, Whipp, & Casaburi, 1994). Oxygen saturation was measured continuously and recorded every 80 seconds with a pulse oximeter during each exercise test.

The incremental and endurance exercise tests and exercise treatment sessions were performed using a treadmill (Quinton 645). Lung disease severity was assessed by physical assessment and pulmonary function test variables including forced vital capacity (FVC), forced expiratory volume in one second, ratio of FEV_1/FVC, % predicted, maximal voluntary ventilation, total lung capacity and diffusion capacity for carbon monoxide.

Patient Outcomes

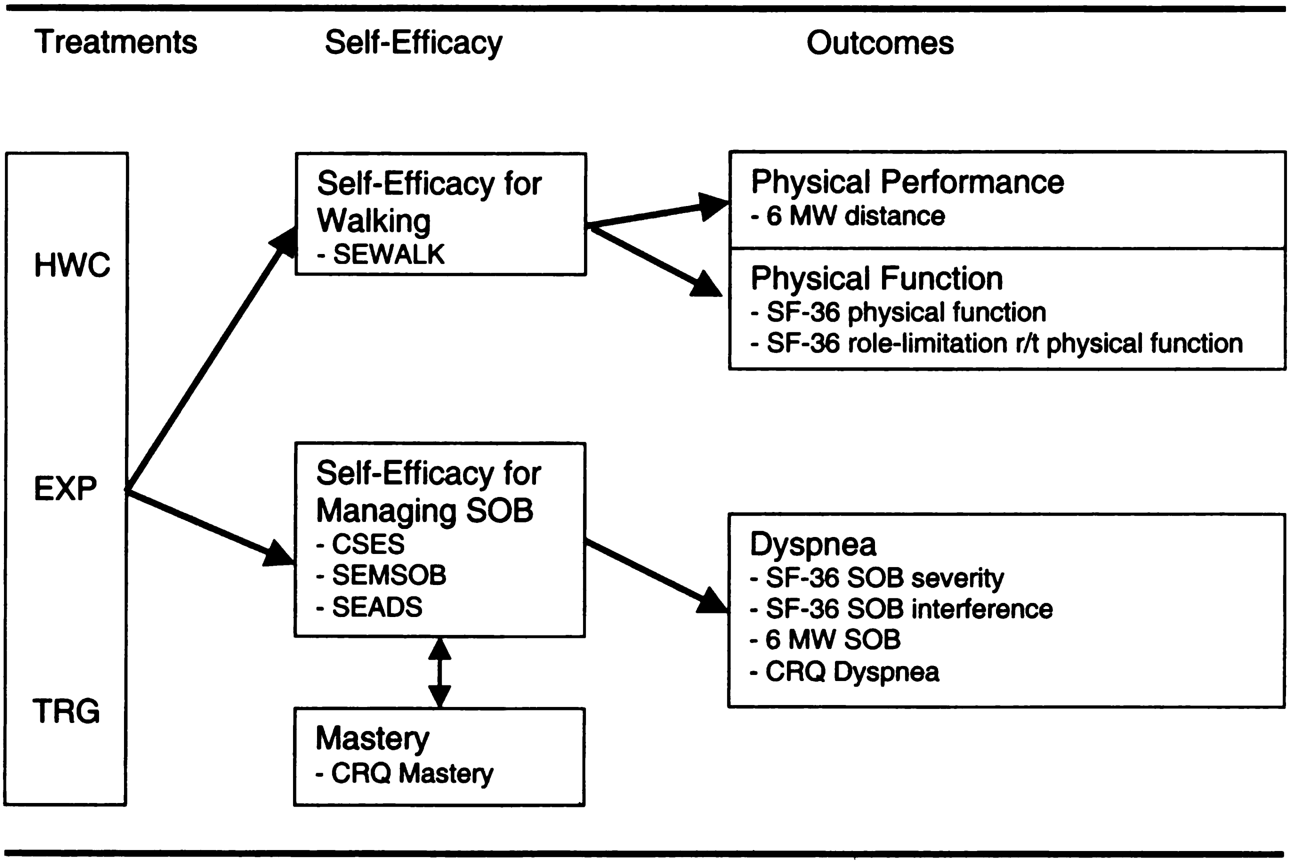
Self-efficacy for walking was measured by the self-efficacy for walking questionnaire, on which subjects rate their strength of confidence for walking various distances. A mean self-efficacy for walking score was obtained from the confidence rating for walking various distances. Since self-efficacy is dynamic, reliability measurement is inappropriate. The self-efficacy for walking questionnaire has demonstrated construct validity with increasing scores reflected by increased walking performance (Carrieri-Kohlman et al, 1996).

Subjects' **physical performance** was measured by the distance covered in six minutes on a 100-foot course in a corridor. **Physical function** was measured by physical function and role-limitation related to physical function of the SF-36.

Self-efficacy for managing dyspnea was measured with three instruments to capture different dimensions of this domain of functioning. The CSES scale measures subjects' self-efficacy for managing or avoiding dyspnea in various situations. The SEADS scale measures subjects' self-efficacy for different dyspnea management strategies. The SEMSOB measures subjects'

self-efficacy to keep dyspnea from interfering with what they want to do. The mastery sub-scale of the CRQ (CRQ-M) measures patients' sense of control over their illness and was included as a related measure to self-efficacy for managing SOB. Measures of dyspnea included questions modified from the SF-36 of SOB severity (SF-36 SOB Severity) and the degree to which SOB interfered with daily life (SF-36 SOB Interference), dyspnea reported at the end of the six-minute walk (6MW SOB), and the CRQ Dyspnea sub-scale (CRQ-D) (Figure 9).

Figure 9. Study Concepts and Variables.



COPD Self-Efficacy Scale (CSES)

The CSES is a 34-item questionnaire that measures subjects' self-efficacy to manage or avoid dyspnea under various situations. The CSES has five factors: negative affect, intense emotional arousal, physical exertion, weather and environment, and behavioral risk. Internal consistency for the CSES is high ($r = 0.95$), and test-retest reliability over two weeks is adequate ($r = 0.77$) (Wigal et.al., 1991). The CSES has been correlated to dyspnea intensity ($r = -0.56$) and has been sensitive to changes after education and exercise treatments for dyspnea management (Scherer & Schmieder, 1997).

Self-Efficacy for Managing Shortness of Breath Question (SEMSOB)

The SEMSOB is a single item scale that measures subjects' self-efficacy to keep dyspnea from interfering with what they want to do. Internal consistency testing is inappropriate. Test-retest reliability of the SEMSOB was 0.87. Tests of construct validity showed that SEMSOB was correlated with self-efficacy to manage symptoms ($r = 0.62$), self-efficacy to do social and recreational activities ($r = 0.48$), and shortness of breath intensity ($r = -0.54$) (Lorig et al., 1996).

Self-Efficacy and Dyspnea Strategies Scale (SEADS)

The SEADS scale is a 35-item new instrument being tested in this study. The SEADS was developed from an instrument designed to measure coping strategies patients use for their dyspnea. Reliability testing with the previous version of the instrument (29 items), without the self-efficacy component, demonstrated adequate internal consistency (Cronbach alpha = 0.74).

The current instrument demonstrated good internal consistency

(Cronbach alpha = 0.81). To test for evidence of construct validity, the SEADS scale was related to: other measures of self-efficacy for managing SOB (CSES and SEMSOB); mastery (CRQ-M); a measure of self-efficacy for walking (SEWALK); measures of dyspnea (SOB severity, SOB interference [SF-36], 6MW SOB, and CRQ-Dyspnea); and measures of physical performance (6MW distance), physical functioning (SF-36), and role limitation related to physical functioning (SF-36).

Chronic Respiratory Questionnaire (CRQ)

The CRQ is a measure of health-related quality of life for patients with respiratory disease. The CRQ has 20 items divided into four sub-scales, emotion, fatigue, dyspnea and mastery (Guyatt, 1987). The mastery sub-scale has four items that measure patients' belief in their ability to master, control or manage their disease. The mastery dimension has a high test-retest reliability of $p = 0.91$. Internal consistency reliability coefficient Cronbach's alpha for mastery was $p = 0.88$. The dyspnea sub-scale includes five activities that are the most important to patients in their daily lives in which they experience dyspnea. The dyspnea dimension has an adequate test-retest reliability of $p = 0.73$. Internal consistency reliability coefficient Cronbach's alpha for dyspnea was $p = 0.53$ (Wijkstra, TenVergert, Van Altena, & al, 1994). Content, criterion and construct validity have been reported for the CRQ.

Short-Form 36-Item Questionnaire (SF-36)

The SF-36 was derived from the Medical Outcome Study to survey general health status. Health concepts related to both physical and emotional

dimensions are included. Questions about dyspnea severity, the degree to which dyspnea interferes with daily life, physical function, and role-limitation related to physical function was the focus of this study. Content, criterion and construct validity have been reported for the SF-36 ((Ware & Sherbourne, 1992). Both the physical and emotional scales have strong convergent and discriminant validity.

Data Analysis

Primary Aim: Treatment Effects

Self-Efficacy for Walking

Research question # 1: Are there differences among the three strengths of exercise treatments in the change in self-efficacy for walking between baseline and post-treatment (2 months)?

Analyses of research question # 1: To determine the difference among the three strengths of exercise treatments in the change in self-efficacy for walking, a two-way repeated measures analysis of variance (RMANOVA) with one between subjects factor (treatment strength) and one within subjects factor (measurement time, with two levels, baseline and two months) was performed. This procedure allowed for testing the main effect of treatment, the main effect of time, and the treatment by time interaction. It was the test of interaction that answered the research question. The test used the alpha criteria of 0.05. If the test of the interaction was significant, a post hoc analysis using the Scheffe criteria was performed to determine where the significant interaction were among the three treatments.

Research question # 2: What is the relationship between self-efficacy for walking, performance of physical activities, and reported physical functioning at baseline, post-treatment (2 months), and change measured from baseline to post- treatment?

Analyses of research questions # 2: To measure the strength of the relationship between self-efficacy for walking, performance of physical activities, and reported physical functioning, Pearson correlation analyses were performed between self-efficacy for walking and performance of physical activities, and reported physical functioning at baseline and two months, as well as the change in self-efficacy for walking and the change in performance of physical activities, and reported physical functioning from baseline to two months.

<u>Self-Efficacy for Managing Shortness of Breath</u>

Research Question # 3: Are there differences among the three strengths of exercise treatments in the change in self-efficacy for managing SOB between baseline and post-treatment (2 months).

Analyses of research question # 3: To determine the difference among the three strengths of treatment in the change in self-efficacy for managing dyspnea, a two-way repeated measures analysis of variance (RMANOVA) with one between subjects factor (treatment strength) and one within subjects factor (measurement time, with two levels, baseline and two months) was performed. The test used the alpha criteria of 0.05. If the

test of the interaction was significant, a post hoc analysis using the Scheffe criteria was performed to determine where the significant interaction are among the three treatments.

Research Question # 4: What is the relationship between self-efficacy for managing SOB and measures of dyspnea and mastery at baseline, post-treatment (2 months), and change measured from baseline to post- treatment?

Analyses of research questions # 4: To measure the strength of the relationship between self-efficacy for managing dyspnea and measures of dyspnea and mastery, Pearson correlation analyses were performed among self-efficacy for managing dyspnea and measures of dyspnea and mastery at baseline and two months, as well as the change in self-efficacy for managing dyspnea and the change in measures of dyspnea and mastery from baseline to two months.

Secondary Aim: Instrument Development (SEADS)

Convergence Testing (CSES, SEMSOB, CRQ-Mastery)

Research Question # 5: What is the relationship between the SEADS Scale and the CSES Scale at baseline and post-treatment?

Research Question # 6: What is the relationship between the SEADS Scale and the SEMSOB Questionnaire at baseline and post-treatment?

Research Question # 7: What is the relationship between the SEADS Scale and Mastery (CRQ-M) at baseline and post-treatment?

Divergence Testing (SEWALK)

Research Question # 8: What is the relationship between the SEADS Scale and the SEWALK Scale at baseline and post-treatment?

Measures of Dyspnea

Research Question # 9: What is the relationship between the SEADS Scale and Perceived SOB Severity at baseline and post-treatment?

Research Question # 10: What is the relationship between the SEADS Scale and SOB interference at baseline and post-treatment?

Research Question # 11: What is the relationship between the SEADS Scale and reported SOB at the end of the six-minute walk at baseline and post-treatment?

Research Question # 12: What is the relationship between the SEADS Scale And the CRQ-Dyspnea at baseline and post-treatment?

Measure of Physical Performance

Research Question # 13: What is the relationship between the SEADS scale and the 6MW distance at baseline and post-treatment?

Measures of Physical Function

Research Question # 14: What is the relationship between the SEADS scale and reported physical function at baseline and post-treatment?

Research Question # 15: What is the relationship between the SEADS scale and role limitation related to physical function at baseline and post-treatment?

Data Analysis for Questions 5 through 15: To test the validity of the SEADS scale, Pearson r correlations were determined between measures of self-efficacy for managing SOB, self-efficacy for walking, mastery, dyspnea, physical performance, and physical function at baseline and post treatment. An alpha criterion of 0.05 was accepted as a significant correlation.

Power Analysis

A power analysis performed based on a estimated sample size of 90 (30 in each of the three treatment groups), an alpha significance level of 0.05, and a beta level of 0.80, showed that a sample size of 90 would have provided adequate power to detect slightly less than a median effect size group by time interaction ($f = 0.19$ or eta^2 0.04). The final sample size for this study was 102 (Cohen, 1988).

CHAPTER FOUR: RESULTS

Sample

The recruitment process for the larger randomized clinical trial took place over 36 months. 814 subjects with COPD were screened by phone. Of these, 183 subjects met initial screening criteria. After spirometry testing, 41 subjects were excluded and 142 subjects progressed to baseline evaluation, which included completion of exercise testing and questionnaires. Twenty-seven of these subjects did not meet inclusion criteria during baseline testing. The 115 subjects who did meet inclusion criteria were randomly assigned to one of three groups, education-home walking control (HWC), exposure (EXP), and training (TRG) (Table 4). Thirteen subjects failed to complete the study (four from group one, five from group two, and four from group three). Eleven subjects dropped for the following reasons; death (2); exacerbation of COPD (2); back and leg pain (1); multiple medical problems (5); and diagnosis of cancer (1). Two subjects were excluded due to missing data.

The final sample consisted of 102 subjects: 57 women and 45 men with a mean age of 66 ± 8 and an age range of 46 to 84 years. Eighty-six subjects were Caucasian (84%); three were Hispanic (3%); five were Asian (5%); and eight were African-American (8%). The mean FEV1 in liters was 1.09 ± 0.33L and the FEV1 % predicted was 45 ± 14%. The mean FVC in liters was 2.6 ± .60L and the FVC % predicted was 77 ± 15%. FEV1/FVC was 42 ± 11.6%. Subjects who demonstrated an improvement (12% or 200ml) in airflow obstruction after bronchodilator treatment were equally distributed among the three groups (Table 4). As displayed in table four, there were no significant differences in baseline characteristics among the three groups except for FVC in liters. The mean FVC in liters was lower for the TRG group, however, post hoc tests using the Scheffe criteria showed that the TRG was not significantly different from the HWC (p = .097) or the EXP group (p = .086).

Table 4: Sample Characteristics

	HWC	EXP	TRG	Total	p
Gender M/F	19/17	14/18	12/22	45/57	.35
Age	66±9	67±8	66±6	66±8	.83
FEV1 (liters)	1.06±.38	1.17±.31	1.03±.30	1.09±.33	.21
FEV1 % predicted	44±19	49±13	44±10	45±14	.29
FVC (liters)	2.7±.43	2.7±.68	2.4±.61	2.6±.60	.04*
FVC % predicted	77±16	81±16	73±13	77±15	.13
FEV1/FVC %	40±14	43±9	44±11	42±11.6	.28
FEV1 Δ 12%	5	3	6	14	.65
FEV 1 Δ 200ml	9	7	9	25	.94
FVC Δ 12%	12	6	11	29	.38
FVC Δ 200ml	21	16	18	55	.84

$p<0.05$

Sample characteristics of the 13 subjects who did not complete the study for reasons listed previously were compared with subjects who were included in the final analysis. Sample characteristics of the 13 subjects who were not included in the final analysis were not significantly different from those who did complete the study except for age. Those who did not complete the study had a lower mean age than those who completed the study (Table 5).

Table 5: Comparison of Sample With Non-Completers

	Sample	Non-completers	*p*
Gender M/F	45/57	8/5	.24
Age	66±8	59±10	.001*
FEV1 (liters)	1.09±.33	1.16±.42	.48
FEV1 % predicted	45±14	41±16	.32
FVC (liters)	2.6±.60	3.0±1.1	.052
FVC % predicted	77±15	74±17	.57
FEV1/FVC %	42±11.6	40±9	.49

* $p<0.05$

Comparisons of selected baseline measures among the three groups were performed using one-way analysis of variance. As displayed in table six, there were no significant differences in baseline characteristics among the three groups except for SEMSOB, SEADS's confidence subscale, SF-36's role limitation related to physical function question, SOB severity, and SOB interference (Table 6).

Scheffe post hoc tests showed that self-efficacy for managing SOB was significantly higher in the TRG group than the HWC group at baseline. This difference was evident in two out of three instruments that measured self-efficacy for managing SOB (SEMSOB and SEADS's confidence subscale). The third instrument CSES did not show a difference among the three groups. For role-limitation related to physical activity, the EXP group reported significantly less role-limitation than the TRG group at baseline. The EXP group also reported significantly lower SOB severity than both the TRG and the HWC group. However, the degree to which SOB interfered with normal activities did not differ among the three groups at baseline (Table 7). Spirometry was performed at baseline and post-treatment. Lung function as measured by spirometry did not change significantly from baseline to post-treatment among the three groups (Table 8).

Table 6: Baseline Measures (n=102)

	HWC	EXP	TRG	Total	*p*
<u>Measures of Self-Efficacy</u>					
Walking (SEWALK)	7.2±2.6	7.3±2.4	6.9±2.5	7.2±2.5	.81
Total Score (CSES)	3.0±.69	3.3±.70	3.1±.92	3.1±.78	.27
Physical Exertion (CSES)	2.4±.89	2.7±.79	2.7±1.1	2.6±.94	.36
Emotional Arousal (CSES)	3.3±.74	3.6±.86	3.4±1.0	3.4±.88	.38
Weather Environment (CSES) (n=100)	2.7±.75	2.9±.88	2.8±1.0	2.8±.88	.67
Behavioral Risk (CSES)	3.0±.87	3.3±.86	3.1±1.1	3.2±.93	.37
Negative Affect (CSES)	3.1±.79	3.5±.85	3.2±.92	3.3±.86	.16
SEMSOB	4.4±2.5	5.7±2.6	6.1±2.7	5.4±2.7	.02*
Confidence (SEADS) (n=100)	6.8±2.0	7.2±1.5	7.9±1.6	7.3±1.8	.03*
Strategies (SEADS) (n=101)	15.3±4.4	14.9±3.9	16.6±4.3	15.6±4.2	.22
<u>Mastery</u>					
Mastery (CRQ)	18.4±5.2	19.9±4.6	17.9±4.9	18.7±4.9	.24
<u>Physical Performance</u>					
6MW Distance (feet)	1399±346	1438±260	1334±304	1390±307	.38
<u>Physical Function</u>					
Physical Functioning (SF-36)	33.1±18.1	40±17	31.3±17.2	34.7±17.7	.11
Role-Limitation (SF-36)	26±34	40±37	18±32	28±35	.04*
<u>Measures of SOB</u>					
SOB Severity (SF-36)	4.4±.8	3.8±.7	4.4±.9	4.2±.9	.002*
SOB Interference (SF-36) (n=100)	3.1±1.1	2.6±1.0	3.2±1.2	3.0±1.1	.04*
Dyspnea (CRQ)	16.0±5.4	17.4±4.2	15.8±4.9	16.4±4.9	.38
SOB (6MW) (n=99)	3.8±1.8	4.0±1.9	4.7±2.6	4.2±2.2	.25

* $p<0.05$

Table 7. Scheffe Post Hoc Tests

	HWC/EXP	HWC/TRG	EXP/TRG
SEMSOB	.102	.023*	.845
SEADS (Confidence)	.613	.035*	.300
Role-Limitation	.240	.672	.043*
SOB Severity	.008*	.992	.006*
SOB Interference	.088	.992	.069

* $p<0.05$

Table 8: Spirometry Values Baseline and Post-Treatment

	HWC	EXP	TRG	Total	*p*
FEV1 (liters)					
- Baseline	1.06±.38	1.17±.31	1.03±.30	1.09±.33	
- Post-Treatment	1.07±.41	1.18±.31	1.07±.34	1.10±.36	.84
FEV1 % predicted					
- Baseline	44±19	49±13	44±10	45±14	
- Post-Treatment	44±20	51±16	45±12	47±17	.81
FVC (liters)					
- Baseline	2.7±.43	2.7±.68	2.4±.61	2.6±.60	
- Post-Treatment	2.8±.72	2.8±.69	2.5±.62	2.7±.68	.73
FVC % predicted					
- Baseline	77±16	81±16	73±13	77±15	
- Post-Treatment	79±19	81±14	76±17	79±17	.72
FEV1/FVC %					
- Baseline	40±14	43±9	44±11	42±11.6	
- Post-Treatment	39±13	44±12	43±12	42±12	.60

Primary Aim of Study

Treatment Effects

Self-Efficacy for Walking

Research question #1: Are there differences among the three strength of Exercise treatments in the change in self-efficacy for walking between baseline and post-treatment (2 months)?

Hypotheses for question #1: All three groups will improve their self-efficacy for walking. The TRG group will have significantly more improvement than

EXP group followed by HWC group.

Self-efficacy for walking at home was measured with the SEWALK. Subjects indicated from zero to ten their confidence for walking each of the distances listed (Appendix C). Zero represented not at all confident and ten represented total confidence. Subject's self-efficacy for home walking was determined by the mean of confidence levels reported for each distance. There was a significant change over time for the total sample ($p < .0005$). The group-by-time interaction among the three groups ($p = 0.76$), however, was not significant (Table 9). To determine whether any of the groups had a significant improvement over time in self-efficacy for walking, a test of simple effects (baseline and post-treatment) was performed for each of the three groups. All groups showed significant improvement in self-efficacy for walking from baseline to post-treatment (Table 9) (Figure 10).

Table 9. Treatment Effect: Self-Efficacy for Walking

		Mean±SD	Time	Group X Time	Simple Effects	
HWC	Baseline	*7.2± 2.6*				
	Post	*7.9 ± 2.1*			F = 5.4	*p* =.02*
EXP	Baseline	7.3 ± *2.4*				
	Post	*8.1 ± 2.0*			F = 5.9	*p* =.017*
TRG	Baseline	*6.9 ± 2.5*				
	Post	7.9 ± *2.4*			F = 10.7	*p* =.002*
Total	Baseline	7.2 ± *2.5*				
	Post	*8.0 ± 2.1*	<0.0005*	0.76		

*p<.05

The hypotheses for research question number one were partially supported. All three groups improved their self-efficacy for walking. There was a trend that the TRG group improved more than the EXP group followed by the

HWC group, however this difference was not statistically significantly among the three groups.

Relationship Between Self-Efficacy for Walking, Physical Performance and Reported Physical Functioning

Research question # 2: What is the relationship between self-efficacy for walking, performance of physical activities, and reported physical functioning at baseline, post-treatment (2 months), and change measured from baseline to post- treatment?

Hypotheses for question # 2: Self-efficacy for walking will be significantly related to performance of physical activities and reported physical functioning at baseline, post-treatment (2 months), and change measured from baseline to post-treatment.

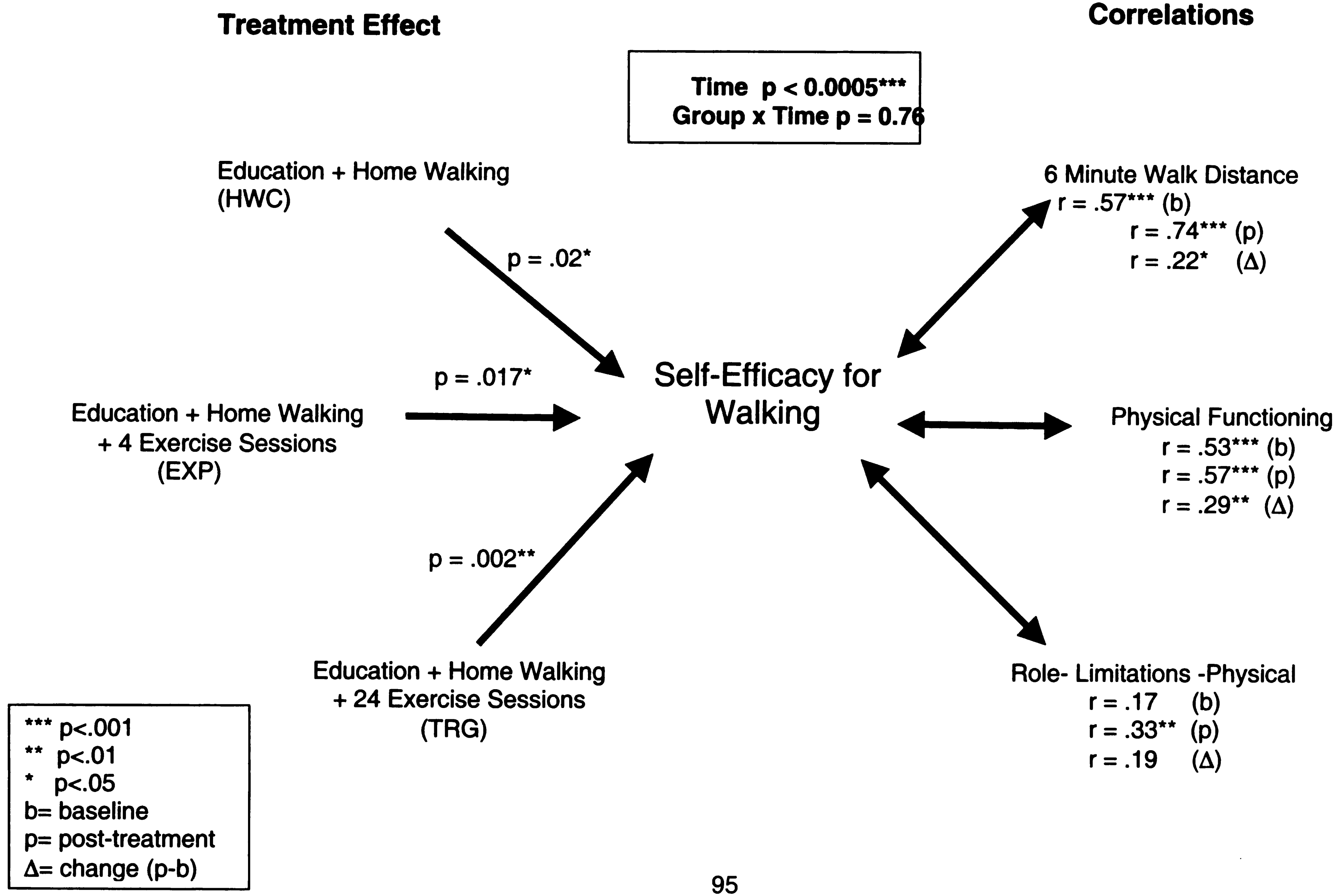
Self-efficacy for walking at baseline, post-treatment, and change between baseline and post-treatment were correlated with a measure of physical performance (the six-minute walk distance [6MW]) and measures of physical functioning (reported physical functioning [SF-36], and reported role limitation related to physical functioning [SF-36]. Self-efficacy for walking was significantly related to the six-minute walk distance at baseline ($r = 0.57$) ($p < 0.0005$), post-treatment ($r = 0.74$) ($p < 0.0005$), and the change measured between baseline and post-treatment ($r = 0.22$) ($p = 0.03$). Self-efficacy for walking was also significantly related to reported physical functioning at baseline ($r = 0.53$) ($p < 0.0005$), post-treatment ($r = 0.57$) ($p < 0.0005$), and the change measured between baseline and post-treatment ($r = 0.29$) ($p = 0.003$). Self-efficacy for walking was significantly related to perceived role limitation post-treatment (r = 0.33) (p = 0.001). However, it was not significantly related to perceived role limitation at baseline (r = 0.17) or to the change between baseline and post-treatment (r = 0.19) (Table 10) (Figure 10).

Table 10. Correlations: Self-Efficacy for Walking

	Self-efficacy for Walking								
	Baseline			Post-treatment			Change		
	Mean± SD	*r*	*p*	Mean± SD	*r*	*p*	Mean± SD	*r*	*p*
SEWALK	7.2± 2.5			8.0± 2.1					
6 MW (feet)	1390± 307	0.57	<.0005*	1431± 316	0.74	<.0005*	42± 152	.22	.03*
Physical Function	35±18	0.53	<.0005*	42±19	0.57	<.0005*	7±14	0.29	.003*
Role Limitation	28±35	0.17	.085	41±38	0.33	.001*	14±38	0.19	.058

**p*<.05

Figure 10. Self-Efficacy for Walking



Hypotheses for research question number two were mostly supported. Self-efficacy for walking was significantly related to the 6MW distance and reported physical functioning at baseline, post-treatment, and change measured between baseline and post-treatment and reported role-limitation due to physical functioning at post-treatment. However, self-efficacy for walking was not significantly related to role-limitation due to physical functioning at baseline or to the measured change between baseline and post-treatment.

Self-Efficacy for Managing Shortness of Breath

Research Question #3: Are there differences among the three strengths of exercise treatments in the change in self-efficacy for managing SOB between baseline and post-treatment (2 months).

Hypotheses for question #3: All three groups will improve their self-efficacy for managing SOB. The TRG group will have significantly greater improvement followed by the EXP group and then the HWC group.

Subjects' self-efficacy for managing SOB was measured with three instruments: The COPD Self-Efficacy Scale (CSES), the Stanford Self-Efficacy for Managing Shortness of Breath question (SEMSOB), and the Self-Efficacy and Dyspnea Strategies Scale (SEADS). The CSES measures patients' confidence in managing or avoiding dyspnea in various situations. The CSES has five subscales and a total score. The SEMSOB is a single question that measures patients' overall confidence in keeping SOB from interfering with what they want to do. The SEADS has two subscales. The strategies subscale measures the number of dyspnea management strategies used by patients to manage their dyspnea. The confidence subscale measures patients' efficacy beliefs of the effectiveness of the dyspnea management strategies.

Results of COPD Self-Efficacy Scale (CSES)

There was no significant change over time for the total score of the CSES or a significant difference among the three treatment groups. Also, none of the five subscales of CSES (physical exertion, emotional arousal, weather and environment, negative affect, and behavioral risks) demonstrated a significant main effect-of-time or a significant group-by-time interaction among the three treatment groups. Tests of simple effects were performed for each of the three groups to discern if any group had a significant improvement over time. There was no significant change between baseline and post-treatment for any group in the total and subscale scores of the CSES (Table 11) (Figure 11).

Table 11. Treatment Effect: Self-Efficacy for Managing SOB, CSES Total Score

		Mean±SD	Time	Group X Time	Simple Effect	
HWC	Baseline	2.97 ± .69				
	Post	2.98 ± .63			F = .006	*p* =.94
EXP	Baseline	3.28 ± .70				
	Post	3.26 ± .81			F = .023	*p* =.88
TRG	Baseline	3.10 ± .92				
	Post	3.22 ± .85			F = 1.410	*p* =.24
Total	Baseline	3.11 ± .78				
	Post	3.15 ± .77	0.525	0.602		

*p<.05

Results of Stanford Self-Efficacy for Managing SOB Question (SEMSOB)

Self-efficacy for managing SOB as measured by SEMSOB showed a significant change over time for the entire sample (p <0.0005). There were no statistically significant differences among the three treatment groups in the change over time (p <0.53). Tests of simple effects tests showed that TRG and HWC groups had a significant improvement over time. The EXP group also had an improvement in self-efficacy for managing SOB, however the improvement was not statistically significant (Table 12) (Figure 12).

Table 12. Treatment Effect: Self-Efficacy for Managing SOB, SEMSOB

		Mean±SD	Time	Time X Group	Simple Effects	
HWC	Baseline	4.4 ± 2.5				
	Post	5.7 ± 2.2			F = 13.1	*p* =.0005*
EXP	Baseline	5.7 ± 2.6				
	Post	6.5 ± 2.5			F = 3.7	*p* =.058
TRG	Baseline	6.1 ± 2.7				
	Post	7.0 ± 2.4			F = 5.8	*p* =.018*
Total	Baseline	5.4 ± 2.7				
	Post	6.4 ± 2.4	<.0005	0.53		

*$p<.05$

<u>Results of Self-Efficacy and Dyspnea Strategies Scale (SEADS)</u>

<u>SEADS Strategies Subscale.</u> Self-efficacy for managing SOB as measured by the SEADS strategies subscale showed a significant change over time for the entire sample (p =0.002). There were no statistically significant differences among the three treatment groups in the change over time (p =0.66). Tests of simple effects tests showed that HWC was the only group that had a significant increase in the use of strategies over time. The EXP and TRG groups also used more strategies over time, however the increase was not statistically significant (Table 13) (Figure 13).

Table 13. Treatment Effect: Self-Efficacy for Managing SOB, SEADS Strategies

		Mean±SD	Time	Time X Group	Simple Effects	
HWC	Baseline	15.3 ± 4.4				
	Post	16.5 ± 4.1			F = 6.4	*p* =.013*
EXP	Baseline	14.9 ± 3.9				
	Post	15.5 ± 3.9			F = 1.3	*p* =.260
TRG	Baseline	16.4 ± 4.2				
	Post	17.4 ± 4.1			F = 3.5	*p* =.063
Total	Baseline	15.6 ± 4.2				
	Post	16.5 ± 4.0	.002*	.66		

*p<.05

<u>SEADS Confidence Subscale.</u> Self-efficacy for managing SOB as measured by the SEADS confidence subscale showed a significant change over time for the entire sample (p <0.0005). There were no statistically significant differences among the three treatment groups in the change over time (p =0.65). Tests of simple effects tests showed that the HWC and EXP groups had a significant improvement over time. The TRG groups also improved over time, however the increase was not statistically significant (Table 14) (Figure 13).

Table 14. Treatment Effect: Self-Efficacy for Managing SOB, SEADS Confidence

		Mean±SD	Time	Time X Group	Simple Effects	
HWC	Baseline	6.8 ± 2.0				
	Post	7.5 ± 1.7			F = 8.2	*p* =.005*
EXP	Baseline	7.2 ± 1.5				
	Post	7.9 ± 1.3			F = 8.2	*p* =.005
TRG	Baseline	7.9 ± 1.8				
	Post	8.3 ± 1.6			F = 2.9	*p* =.092
Total	Baseline	7.3 ± 1.8				
	Post	7.9 ± 1.6	<.0005	0.53		

*p<.05

Hypotheses for research question number three were only minimally supported. Subjects in all three groups showed an improvement in their self-efficacy for keeping shortness of breath from interfering with what they wanted to do (SEMSOB). However the amount of improvement was significant only in the HWC and the TRG groups. Subjects in all three groups increased the number of dyspnea strategies they used (SEADS strategies sub-scale). However, the HWC group was the only group with a significant increase in the number of strategies used. In addition, subjects in all three groups had higher efficacy beliefs in the effectiveness of the strategies they used (SEADS confidence sub-scale). However, only the HWC and EXP groups significantly increased their efficacy beliefs of the strategies they used. Subjects did not show any improvement in their self-efficacy for managing or avoiding dyspnea in various situations (CSES total and sub-scale scores).

Relationship Between Self-Efficacy for Managing SOB, Dyspnea, and Mastery

Research Question #4: What is the relationship between self-efficacy for managing SOB and measures of dyspnea and mastery for baseline, post-treatment (2 months), and change from baseline to post-treatment?

Hypotheses for question #4: Self-efficacy for managing SOB will be significantly related to measures of dyspnea and mastery for baseline, post-treatment, and change measured from baseline to post-treatment.

The CSES and SEMSOB were correlated with measures of mastery and dyspnea. Mastery was measured with the mastery subscale of the CRQ (CRQ-M). Measures of dyspnea included the dyspnea subscale of the CRQ (CRQ-D), reported amount of shortness of breath at the end of the six-minute walk on the Borg scale (6MW SOB) and modified questions from the SF-36 that measured perceived shortness of breath (SOB severity) and the degree of interference SOB had on subjects' work both inside and outside of the home (SOB interference).

Results of COPD Self-Efficacy Scale (CSES)

The CSES was significantly related to mastery (CRQ-M) at baseline ($r = 0.53$) ($p < 0.0005$) , and post-treatment ($r = 0.56$) ($p < 0.0005$). However, correlation between CSES and CRQ-M of the change from baseline to post-treatment was not significant ($r = 0.18$). A small but significant negative correlation was found between self-efficacy for managing or avoiding dyspnea (CSES) and level of SOB severity at baseline ($r = -0.23$) ($p = 0.019$). However, significant correlations were not found for CSES and level of SOB at post-treatment ($r = -0.18$), and the change between baseline and post-treatment ($r = - 0.05$).

CSES also had a small negative correlation with SOB interference at baseline ($r = -0.27$) ($p = 0.006$). However, CSES was not significantly correlated with SOB interference at post-treatment ($r = -0.14$) and the change between baseline and post-treatment ($r = -0.03$). The CSES was not significantly related to SOB at the end of the six-minute walk at baseline ($r = 0.04$), post-treatment ($r = 0.07$) and the change between baseline and post-treatment ($r = 0.19$). A small but significant correlation was found between the CSES and the CRQ dyspnea subscale at post-treatment ($r = 0.22$) ($p = 0.02$), however the CSES was not significantly related to the CRQ dyspnea subscale at baseline (r = 0.18) and the change between baseline and post-treatment (r = 0.15) (Table 15) (Figure 11).

Table 15. Relationship Between Self-Efficacy for Managing SOB, Mastery and Measures of Dyspnea: COPD Self-Efficacy Scale (CSES)

	Baseline			Post-treatment			Change		
	Mean± SD	*r*	*p*	Mean± SD	*r*	*p*	Mean± SD	*r*	*p*
CRQ-Mastery	18.7± 4.9	0.53	<.0005*	21.4± 4.7	0.56	<.0005*	2.7± 4.4	.18	.07
SOB Severity	4.2± 0.9	-0.23	.019*	3.7± 0.8	-.18	.07	-0.5± 0.8	-.05	.63
SOB Interference	3.0± 1.1	-.27	.006*	2.5± 0.9	-0.14	.16	-0.5± 0.9	0.03	.74
6 MW SOB	4.2± 2.2	.035	.726	3.5± 1.8	.073	.47	.63± 1.8	.19	.06
CRQ-Dyspnea	16.4± 4.9	0.18	.064	19.8± 5.3	.224	.02*	3.4± 4.6	.15	.14

*p<.05

Results of Stanford Self-Efficacy for Managing SOB Question (SEMSOB)

The SEMSOB was significantly related to the CRQ-M at baseline (r = 0.50) (p < 0.0005), post-treatment (r = 0.63) (p < 0.0005) and the change from baseline to post-treatment (r = 0.37) (p < 0.0005). A small but significant negative correlation was present between SEMSOB and SOB severity (r = -0.25) (p = 0.01) at baseline and at post-treatment (r = -0.30) (p = 0.002). There was no significant relationship between SEMSOB and SOB severity for the change from baseline to post-treatment (r = - 0.03). SEMSOB also had a moderate negative correlation with SOB interference (r = -0.32) (p = 0.001) at baseline and at post-treatment ($r = -0.35$) ($p < 0.0005$). However, a significant correlation was not present between SEMSOB and SOB interference for the change between baseline to post-treatment ($r = -0.05$). The SEMSOB was not significantly related to shortness of breath at the end of the six-minute walk at baseline ($r = -0.16$), post-treatment ($r = -0.14$) and the change between baseline and post-treatment ($r = -0.02$).

There was a moderate and significant relationship between the SEMSOB and the CRQ-Dyspnea subscale at baseline ($r = 0.34$) ($p = 0.001$) and post-treatment ($r = 0.39$) ($p < 0.005$). However there was no significant relationship between SEMSOB and CRQ-D for the change between baseline and post-treatment ($r = 0.13$) (Table 16) (Figure 12).

Hypotheses for research question number four were partially supported. Self-Efficacy for managing SOB had a significant moderate correlation with mastery at baseline and post-treatment. The SEMSOB also had a significant and moderate correlation with mastery for the change between baseline and post-treatment. The SEMSOB had a significant low to moderate correlation with all measures of dyspnea except dyspnea reported at the end of the 6MW at baseline and post-treatment. The CSES had a low significant correlation with SOB severity and SOB interference at baseline and with CRQ-D at post-treatment. However the SEMSOB and the CSES were not significantly related to measures of dyspnea for the change between baseline and post-treatment.

Table 16. Relationship Between Self-Efficacy for Managing SOB, Mastery and Measures of Dyspnea: Self-Efficacy for Managing SOB Question (SEMSOB)

	Baseline			Post-treatment			Change		
	Mean± SD	*r*	*p*	Mean± SD	*r*	*p*	Mean± SD	*r*	*p*
CRQ-Mastery	18.7± 4.9	0.50	<.0005*	21.4± 4.7	0.63	<.0005*	2.7± 4.4	.37	<.0005*
SOB Severity	4.2± 0.9	-0.25	.01*	3.7± 0.8	-0.30	.002*	-0.5± 0.8	0.03	.98
SOB Interference	3.0± 1.1	-0.32	.001*	2.5± 0.9	-0.35	<.0005*	-0.5± 0.9	0.05	.63
6 MW SOB	4.2± 2.2	-.16	.11	3.5± 1.8	-.14	.17	.63± 1.8	-.02	.82
CRQ-Dyspnea	16.4± 4.9	0.34	.001*	19.8± 5.3	.39	<.005*	3.4± 4.6	.13	.21

$p<.05$*

Figure 11. Self-Efficacy for Managing SOB (CSES)

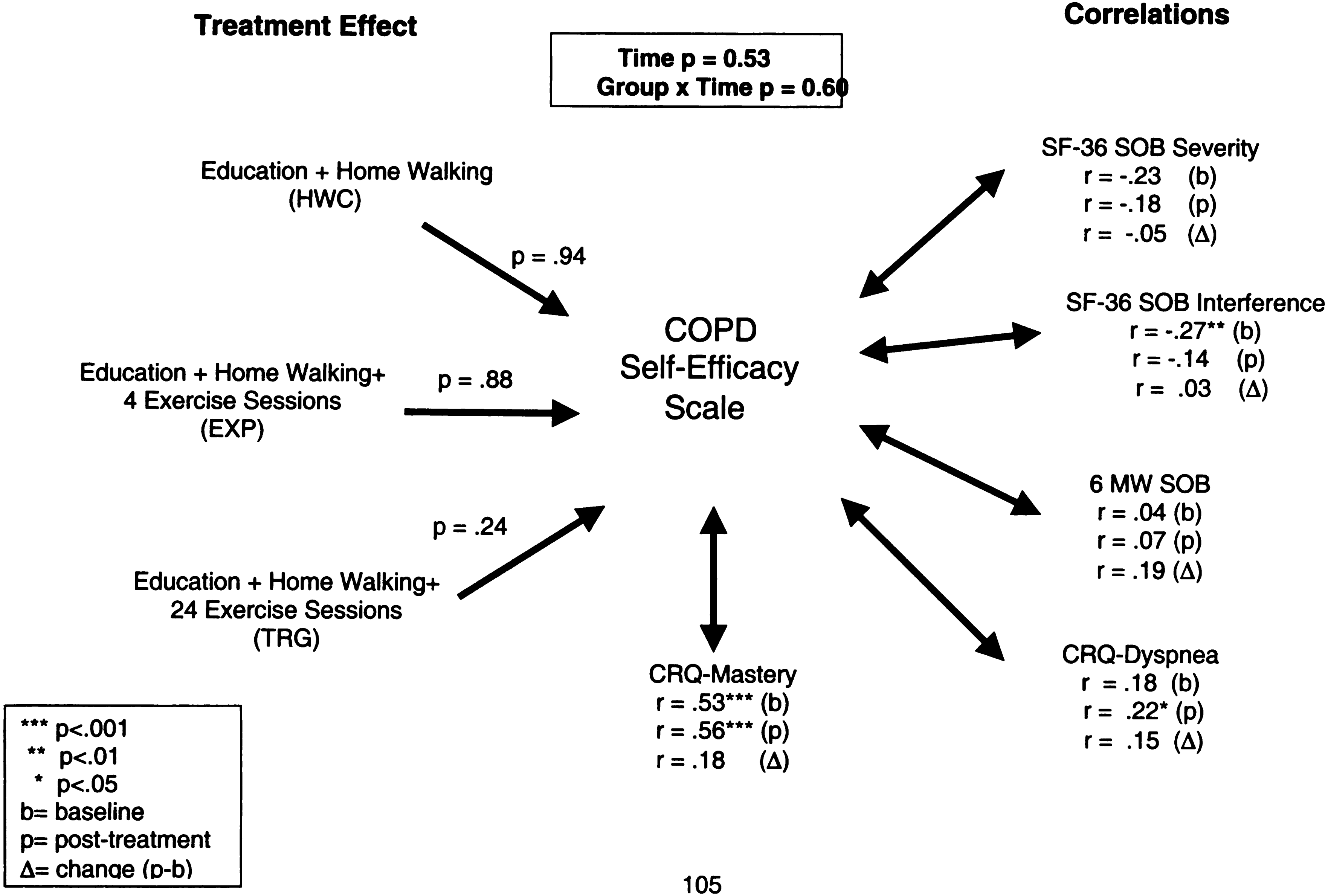


Figure 12. Self-Efficacy for Managing SOB (SEMSOB)

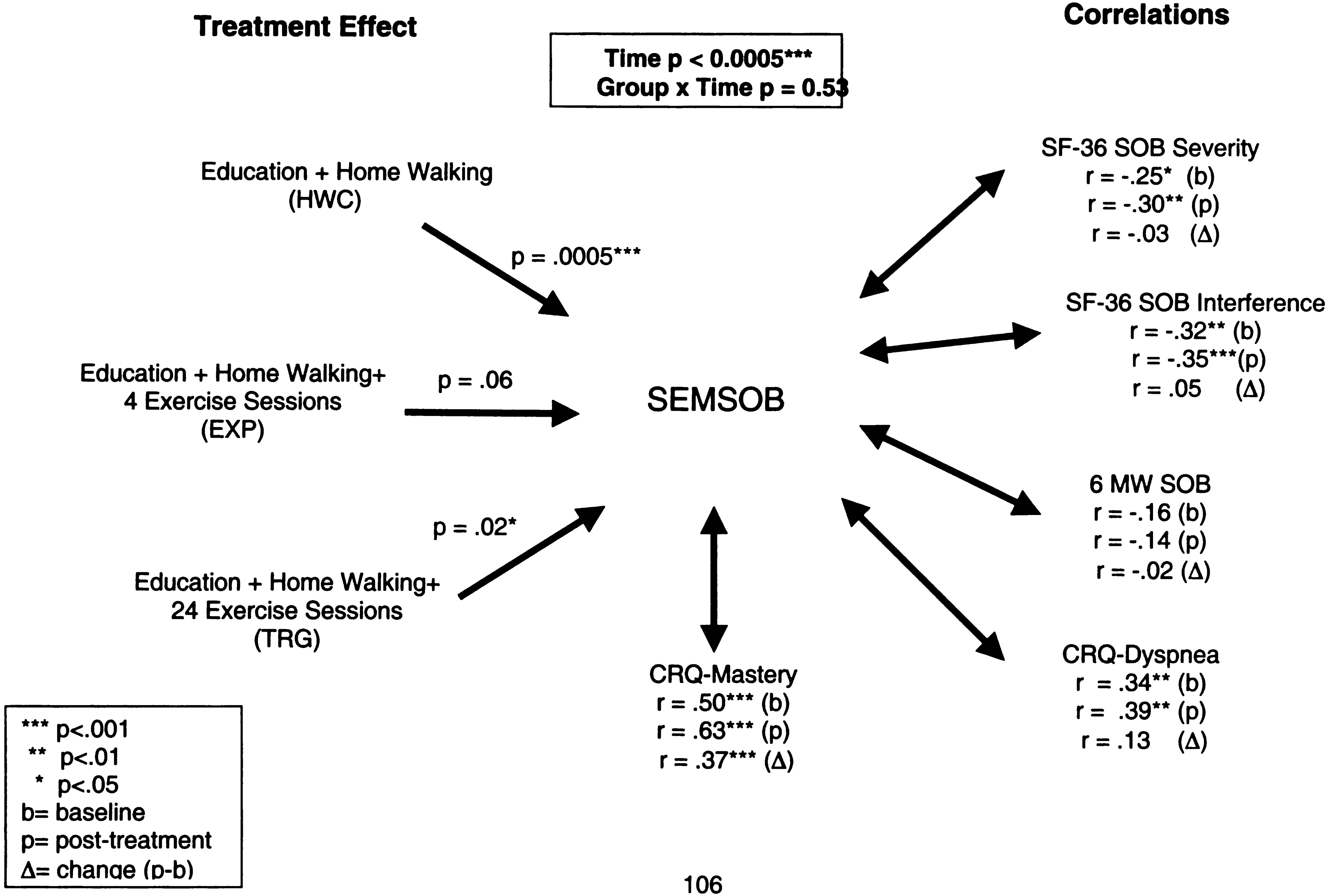
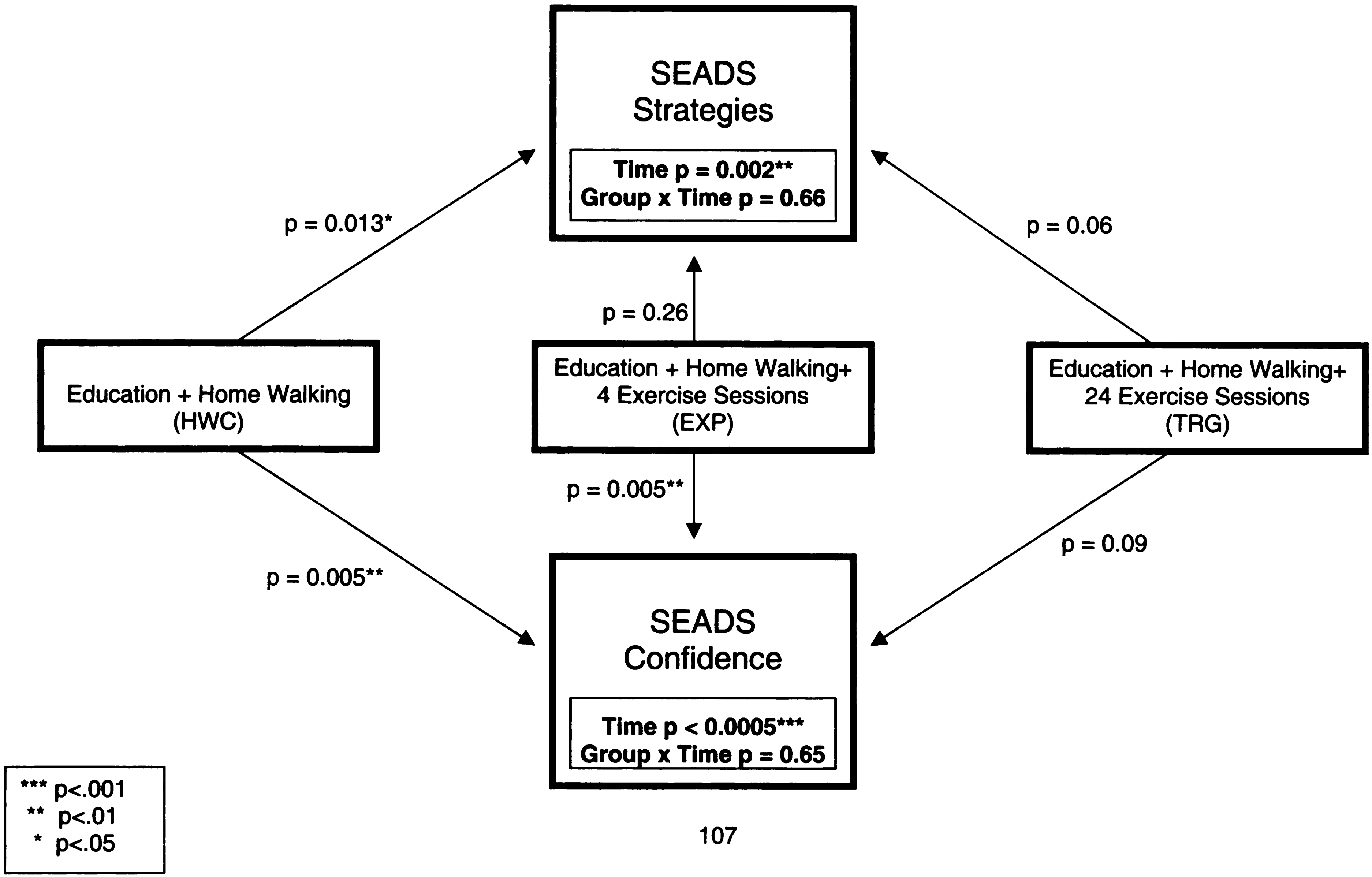


Figure 13. Self-Efficacy for Managing SOB (SEADS)



Secondary Aim

Instrument Development (SEADS)

The Self-Efficacy and Dyspnea Strategies (SEADS) scale has two components: Dyspnea management strategies (strategies) used by subjects and self-efficacy (confidence) related to the effectiveness of the strategies. Validity of the SEADS scale was determined by examining convergence and divergence with other measures of self-efficacy. Construct validity was further examined by determining the relationship between the SEADS scale and measures of dyspnea, physical performance and physical functioning. Convergence was tested with other measures of self-efficacy for managing SOB (CSES, SEMSOB) and the related concept of mastery (CRQ-M). Divergence was tested with self-efficacy for walking (SEWALK). Construct validity was also tested with measures of dyspnea (Perceived SOB Severity [SF-36], Perceived SOB Interference [SF-36], dyspnea at the end of the 6MW [6MW SOB], and perceived dyspnea [CRQ-D]) and physical performance and physical function (6MW distance, Reported Physical Function [SF-36], and Reported Role-Limitation related to physical function [SF-36]).

Convergence Testing (CSES)

Research Question #5: What is the relationship between the SEADS Scale and the CSES Scale at baseline and post-treatment?

Hypotheses for question #5: SEADS will be significantly related to CSES at baseline and post-treatment and the confidence subscale of SEADS will have a stronger relationship than the strategies subscale with CSES.

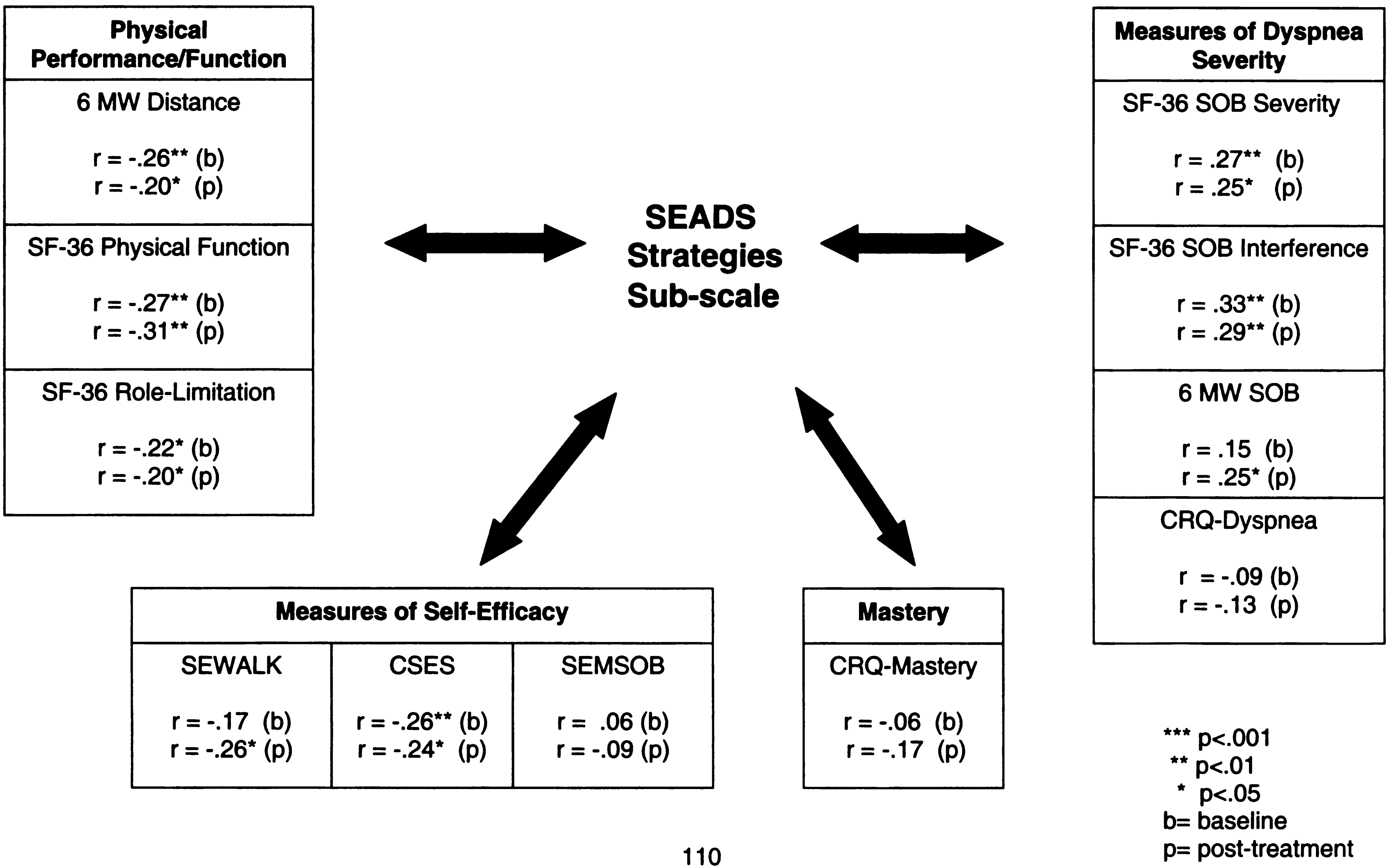
Strategies subscale. At baseline, the strategies subscale of the SEADS had a small but significant relationship to the CSES total score (r = -.26) and subscale scores of intense emotional arousal (r = -.29), weather and environment (r = -.25), behavioral risk factors (r = -.27), and negative affect (r = -.23). The strategies subscale was not significantly related to the CSES subscale score of physical exertion (r = -.07). At post-treatment, the strategies subscale also had a small but significant relationship to the CSES total score (r = -.24) and subscale scores of intense emotional arousal (r = -.22), weather and environment (r = -.26), behavioral risk factors (r = -.20), and negative affect (r = -.22). Again, the strategies subscale was not significantly related to the CSES subscale score of physical exertion (r = -.15) (Table 17) (Figure 14).

Table 17. Correlation: SEADS Strategies Subscale with CSES

	Baseline			Post-treatment		
	Mean ± SD	r	p	Mean ± SD	r	p
SEADS Strategies	15.6±4.3			16.5±4.1		
CSES						
Physical Activity	2.6±.94	-.07	.49	2.7±.84	-.15	.14
Emotional Arousal	3.4±.88	-.29	.003*	3.4±.85	-.22	.03*
Weather Environment	2.8±.88	-.25	.01*	2.9±.79	-.26	.008*
Behavioral Risk	3.2±.93	-.27	.006*	3.1±.89	-.20	.04*
Negative Affect	3.3±.86	-.23	.02*	3.3±.88	-.22	.03*
Total Score	3.1±.78	-.26	.007*	3.2±.77	-.24	.01*

*p<.05

Figure 14. SEADS Strategies Sub-scale Correlations



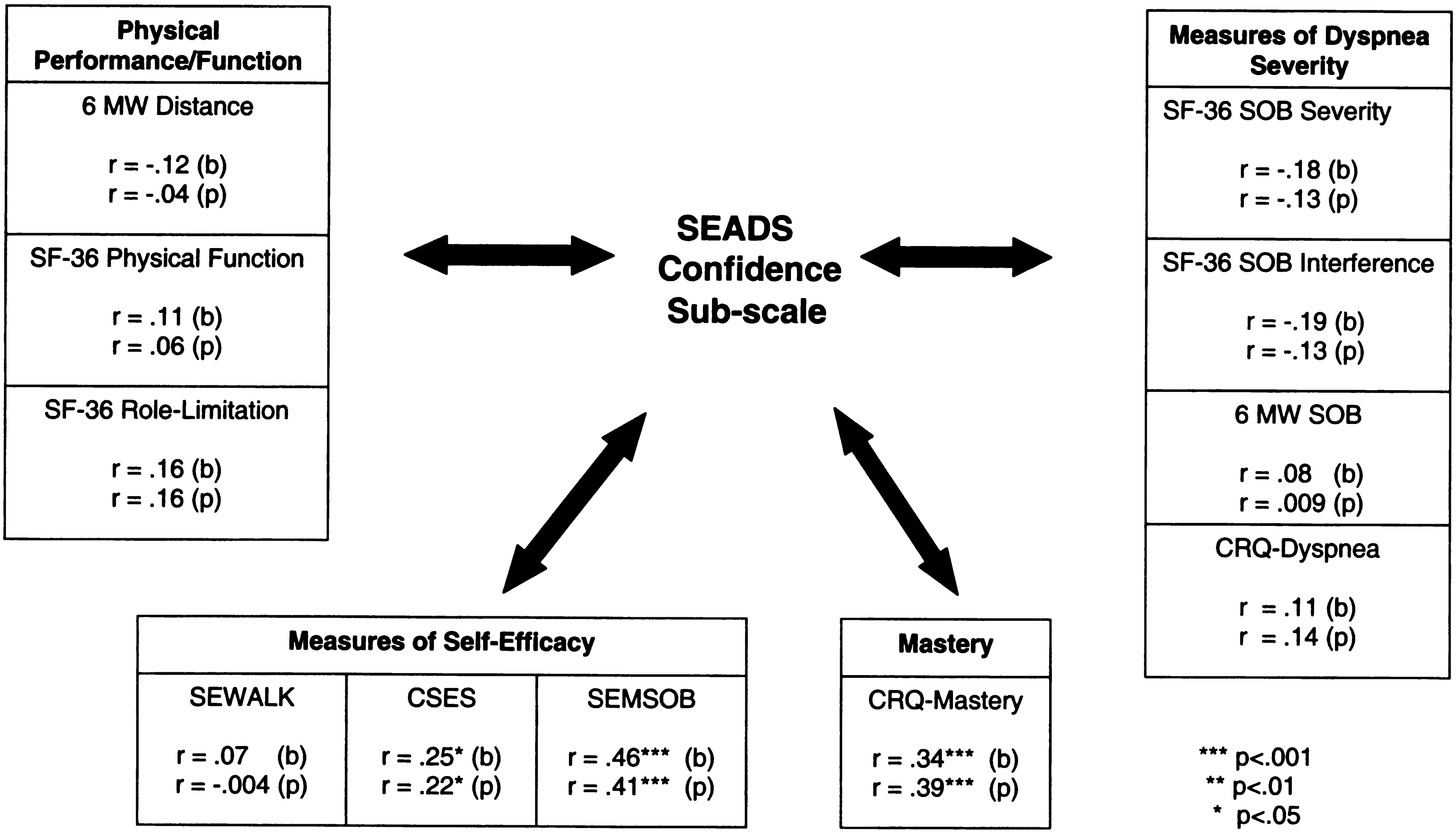
<u>Confidence subscale</u>. At baseline, the confidence subscale of the SEADS had a small but significant relationship to the CSES total score (r = .25) and subscale scores of physical exertion (r = .38) and weather and environment (r = .28). However, the confidence subscale was not significantly related to the CSES subscale scores of intense emotional arousal (r= .18), behavioral risk factors (r = .14), and negative affect (r = .17). At post-treatment, the confidence subscale had a small but significant relationship to the CSES total score (r = .22) and to subscale scores of physical exertion (r = .27) and weather and environment (r = .20). The confidence subscale was not significantly related to the CSES subscale scores of intense emotional arousal (r = .17), behavioral risk factors (r = .19), and negative affect (r = .17) (Table 18) (Figure 15).

Table 18. Correlation: SEADS Confidence Subscale with CSES

	Baseline			Post-treatment		
	Mean ± SD	*r*	*p*	Mean ± SD	*r*	*p*
SEADS Confidence	7.3±1.8			7.9±1.6		
<u>CSES</u>						
Physical Activity	2.6±.94	.38	<.0005*	2.7±.84	.27	.005*
Emotional Arousal	3.4±.88	.18	.07	3.4±.85	.17	.08
Weather Environment	2.8±.88	.28	.005*	2.9±.79	.20	.05*
Behavioral Risk	3.2±.93	.14	.15	3.1±.89	.19	.07
Negative Affect	3.3±.86	.17	.09	3.3±.88	.17	.10
Total Score	3.1±.78	.25	.01*	3.2±.77	.22	.03*

*p<.05

Figure 15. SEADS Confidence Sub-scale Correlations



*** p<.001
** p<.01
* p<.05
b= baseline
p= post-treatment

Hypotheses for research question number five were partially supported. The SEADS had small and significant correlations with the CSES at baseline and post-treatment. The SEADS strategies subscale had significant small and negative correlations with the CSES total score and all the subscale scores at baseline and post-treatment, except for the subscale of physical activity. The SEADS confidence subscale had significant small and positive correlations with the CSES total score and the subscales of physical activity and weather and environment at baseline and post-treatment. The SEADS confidence subscale did not have a significant correlation with the CSES subscales of intense emotional arousal, behavior risk, and negative affect. The SEADS confidence subscale did not have a stronger relationship than the strategies subscale with the CSES and the SEADS confidence subscale had fewer significant correlations with the subscales of the CSES than the strategies subscale.

Convergence Testing (SEMSOB)

Research Question #6: What is the relationship between the SEADS Scale and the SEMSOB Questionnaire at baseline and post-treatment?

Hypotheses for question #6: SEADS will be significantly related to SEMSOB at baseline and post-treatment and the confidence subscale of SEADS will have a stronger relationship than the strategies subscale with SEMSOB.

The strategies subscale of the SEADS was not significantly related to the SEMSOB ($r = .06$) at baseline or post-treatment ($r = -.09$). The confidence subscale of the SEADS had a moderate and significant relationship to the

SEMSOB at baseline (r = .46) and post-treatment (r = .41)(Table 19) (Figures14 and 15).

Table 19. Correlation: SEADS with SEMSOB

	Baseline			Post-treatment		
	Mean ± SD	r	p	Mean ± SD	r	p
SEMSOB	5.4±2.7			6.4±2.4		
SEADS Strategies	15.6±4.3	.06	.54	16.5±4.1	-.09	.39
SEADS Confidence	7.3±1.8	.46	<. 0005*	7.9±1.5	.41	<. 0005*

*p<.05

Hypotheses for research question number six were mostly supported. The SEADS confidence subscale had a significant moderate correlation with the SEMSOB at baseline and post-treatment. However, the SEADS strategies subscale was not significantly related to the SEMSOB at baseline or post-treatment. The confidence subscale of SEADS had a stronger relationship than the strategies subscale with SEMSOB.

Research Question #7: What is the relationship between the SEADS Scale and Mastery (CRQ-M) at baseline and post-treatment?

Hypotheses for question #7: SEADS will be significantly related to mastery at baseline and post-treatment and the confidence subscale of SEADS will have a stronger relationship than the strategies subscale with mastery.

The strategies subscale of the SEADS was not significantly related to mastery (r = -.06) at baseline or post-treatment (r = -.17). The confidence subscale of the SEADS had a moderate and significant relationship to mastery at baseline (r = .34) and post-treatment (r = .39) (Table 20) (Figures14 and 15).

Table 20. Correlation: SEADS with Mastery

	Baseline			Post-treatment		
	Mean ± SD	r	p	Mean ± SD	r	p
CRQ-Mastery	18.7±4.9			21.4±4.7		
SEADS Strategies	15.6±4.3	-.06	.56	16.5±4.1	-.17	.09
SEADS Confidence	7.3±1.8	.34	<. 0005*	7.9±1.5	.39	<. 0005*

*p<.05

Hypotheses for research question number seven were mostly supported. The SEADS confidence subscale had a significant moderate correlation with the CRQ-M subscale at baseline and post-treatment. However, the SEADS strategies subscale was not significantly related to the CRQ-M subscale at baseline or post-treatment. The confidence subscale of SEADS had a stronger relationship than the strategies subscale with the CRQ-M subscale.

Divergence Testing (SEWALK)

Research Question # 8: What is the relationship between the SEADS Scale and the SEWALK Scale at baseline and post-treatment?

Hypotheses for question #8: SEADS will not be significantly related to SEWALK At baseline and post-treatment.

The strategies subscale of the SEADS was not significantly related to SEWALK at baseline (r = -.167). However, the strategies subscale of the SEADS had a small significant negative relationship with SEWALK post-treatment (r = -.26). The confidence subscale of the SEADS was not significantly related to SEWALK at baseline (r = .07) or post-treatment (r = -.004) (Table 21) (Figures14 and 15).

Table 21. Correlation: SEADS with SEWALK

	Baseline			Post-treatment		
	Mean ± SD	r	p	Mean ± SD	r	p
SEWALK	7.2±2.5			8.0±2.1		
SEADS Strategies	15.6±4.3	-.17	.09	16.5±4.1	-.26	.01*
SEADS Confidence	7.3±1.8	.07	.51	7.9±1.5	-.004	.97

*$p<.05$

Hypotheses for research question number eight were mostly supported. The SEADS confidence subscale did not have a significant correlation with SEWALK at baseline or post-treatment. The SEADS strategies subscale did not have a significant correlation with SEWALK at baseline. However the SEADS strategies subscale had a small and significant correlation with SEWALK at post-treatment.

Construct validity was further tested with measures of dyspnea (perceived SOB severity [SF-36], perceived SOB interference [SF-36], dyspnea reported at the end of the six-minute walk [6MW SOB], and perceived dyspnea [CRQ-D]) and measures of physical performance and physical function (6MW distance, reported physical function [SF-36], and reported role-limitation related to physical function [SF-36]).

Measures of Dyspnea (Perceived SOB Severity [SF-36])

Research Question #9: What is the relationship between the SEADS Scale and Perceived SOB Severity at baseline and post-treatment?

Hypotheses for research question #9: SEADS will be significantly related to Perceived SOB Severity [SF-36] at baseline and post-treatment.

The SEADS scale was correlated with Perceived SOB Severity at baseline and post-treatment. The strategies subscale had a small significant relationship with SOB Severity I (r = .27) at baseline and post-treatment (r = .25). The confidence subscale was not significantly related to the SOB Severity at baseline (r = -.18) or post-treatment (r = -.13)(Table 22) (Figures 14 and 15).

Table 22. Correlation: SEADS with SOB Severity (SF-36)

	Baseline			Post-treatment		
	Mean ± SD	r	p	Mean ± SD	r	p
SOB Severity	4.2±.87			3.7±.80		
SEADS Strategies	15.6±4.3	.27	.005*	16.5±4.1	.25	.01*
SEADS Confidence	7.3±1.8	-.18	.07	7.9±1.5	-.13	.18

*p<.05

Hypotheses for research question number nine were partially supported. The SEADS strategies subscale had a small significant correlation with SOB Severity at baseline and post-treatment. However, the SEADS confidence subscale did not have a significant correlation with SOB Severity at baseline or post-treatment.

Measures of Dyspnea (SOB Interference)

Research Question # 10: What is the relationship between the SEADS Scale and SOB interference at baseline and post-treatment?

Hypotheses for research question #10: SEADS will be significantly related to SOB interference at baseline and post-treatment.

The SEADS scale was correlated with the degree to which SOB interfered with normal work at baseline and post-treatment. The strategies subscale had a small to moderate significant relationship with SOB interference (r = .33) at baseline and post-treatment (r = .29). The confidence subscale was not significantly related to SOB interference at baseline (r = -.19) or post-treatment (r = -.13)(Table 23) (Figures 14 and 15).

Table 23. Correlation: SEADS with SOB interference (SF-36)

	Baseline			Post-treatment		
	Mean ± SD	r	p	Mean ± SD	r	p
SOB Interference	3.0±1.1			2.5±.95		
SEADS Strategies	15.6±4.3	.33	.001*	16.5±4.1	.29	.003*
SEADS Confidence	7.3±1.8	-.19	.07	7.9±1.5	-.13	.21

*p<.05

Hypotheses for research question number ten were partially supported. The SEADS strategies subscale had a small to moderate significant correlation with SOB Interference at baseline and post-treatment. However, the SEADS confidence subscale did not have a significant correlation with SOB Interference at baseline or post-treatment.

Measures of Dyspnea (6MW SOB)

Research Question # 11: What is the relationship between the SEADS Scale and reported SOB at the end of the six-minute walk at baseline and post-treatment?

Hypotheses for research question #11: SEADS will not be significantly related to 6MW SOB at baseline and post-treatment.

The strategies subscale of the SEADS was not significantly related to 6MW SOB at baseline (r = .15). However, the strategies subscale of the SEADS had a small significant relationship with 6MW SOB at two months (r = .25). The confidence subscale of the SEADS was not significantly related to 6MW SOB at baseline (r = .08) or at two months (r = .009) (Table 24) (Figures 14 and 15).

Table 24. Correlation: SEADS with 6MW SOB

	Baseline			Post-treatment		
	Mean ± SD	r	p	Mean ± SD	r	p
6MW SOB	4.2±2.2			3.5±1.8		
SEADS Strategies	15.6±4.3	.15	.13	16.5±4.1	.25	.01*
SEADS Confidence	7.3±1.8	.08	.46	7.9±1.5	.009	.93

*p<.05

Hypotheses for research question number eleven were mostly supported. The SEADS confidence subscale did not have a significant correlation with 6MW SOB at baseline or post-treatment. The SEADS strategies subscale did not have a significant correlation with 6MW SOB at baseline, however it had a small and significant correlation with 6MW SOB post-treatment.

Measures of Dyspnea (CRQ-Dyspnea)

Research Question # 12: What is the relationship between the SEADS Scale And the CRQ-D at baseline and post-treatment?

Hypotheses for research question #12: SEADS will be significantly related to CRQ-D at baseline and post-treatment.

The strategies subscale of the SEADS was not significantly related to CRQ-D at baseline (r = -.09) or post-treatment (r = -.13). The confidence subscale of the SEADS was not significantly related to CRQ-D at baseline (r = .11) or post-treatment (r = .14) (Table 25) (Figures 14 and 15).

Table 25. Correlation: SEADS with CRQ-Dyspnea

	Baseline			Post-treatment		
	Mean ± SD	r	p	Mean ± SD	r	p
CRQ-Dyspnea	16.4±4.9			19.8±5.3		
SEADS Strategies	15.6±4.3	-.09	.36	16.5±4.1	-.13	.17
SEADS Confidence	7.3±1.8	.11	.28	7.9±1.5	.14	.17

*p<.05

Hypotheses for research question number twelve were not supported. The SEADS strategies subscale and the SEADS confidence subscale did not have a significant correlation with CRQ-Dyspnea at baseline and post-treatment.

Measure of Physical Performance (6MW Distance)

Research Question # 13: What is the relationship between the SEADS scale and the 6MW distance at baseline and post-treatment?

Hypotheses for research question #13: SEADS will be significantly related to the six-minute walk distance at baseline and post-treatment.

The SEADS scale was correlated with the 6MW distance in feet at baseline and post-treatment. The strategies subscale had a small significant negative relationship with 6MW (r = -.26) at baseline and post-treatment (r = -.20). The confidence subscale was not significantly related to 6MW at baseline (r = -.12) or post-treatment (r = -.04) (Table 26) (Figures 14 and 15).

Table 26. Correlation: SEADS with Six-Minute Walk Distance

	Baseline			Post-treatment		
	Mean ± SD	r	p	Mean ± SD	r	p
6MW Distance	1390±307			1431±316		
SEADS Strategies	15.6±4.3	-.26	.008*	16.5±4.1	-.20	.05*
SEADS Confidence	7.3±1.8	-.12	.22	7.9±1.5	-.04	.73

*p<.05

Hypotheses for research question number thirteen were partially supported. The SEADS strategies subscale had a small significant negative correlation with the 6MW distance at baseline and post-treatment. However, the SEADS confidence subscale did not have a significant correlation with the 6MW distance at baseline or post-treatment.

Measures of Physical Function (Reported Physical Function [SF-36])

Research Question # 14: What is the relationship between the SEADS scale and reported physical function at baseline and post-treatment?

Hypotheses for research question #14: SEADS will be significantly related to reported physical function at baseline and post-treatment.

The SEADS scale was correlated with reported physical function (SF-36) at baseline and post-treatment. The strategies subscale had a small to moderate significant negative relationship with physical function (r = -.27) at baseline and post-treatment (r = -.31). The confidence subscale was not significantly related to physical function at baseline (r =.11) or post-treatment (r =.06) (Table 27) (Figures 14 and 15).

Table 27. Correlation: SEADS with Reported Physical Function (SF-36)

	Baseline			Post-treatment		
	Mean ± SD	r	p	Mean ± SD	r	p
Physical Function	34.7±17.7			41.5±18.7		
SEADS Strategies	15.6±4.3	-.27	.006*	16.5±4.1	-.31	.001*
SEADS Confidence	7.3±1.8	.11	.27	7.9±1.5	.06	.59

*p<.05

Hypotheses for research question number fourteen were partially supported. The SEADS strategies subscale had a small to moderate significant correlation with reported physical function at baseline and post-treatment. However, the SEADS confidence subscale did not have a significant correlation with reported physical function at baseline or post-treatment.

<u>Measures of Physical Function (Reported Role-Limitation Related to Physical Function [SF-36])</u>

Research Question #15: What is the relationship between the SEADS scale and role limitation related to physical function at baseline and post-treatment?

Hypotheses for research question #15: SEADS will be significantly related to Role limitation related to physical function at baseline and post-treatment.

The SEADS scale was correlated with role limitation related to physical function at baseline and post-treatment. The strategies subscale had a small significant negative relationship with role limitation related to physical function (r = -.22) at baseline and post-treatment (r = -.20). The confidence subscale was not significantly related to role limitation related to physical function at baseline (r =.16) or post-treatment (r =.16) (Table 28) (Figures 14 and 15).

Table 28. Correlation: SEADS with Reported Role Limitation Related to Physical Function (SF-36)

	Baseline			Post-treatment		
	Mean ± SD	r	p	Mean ± SD	r	p
Role Limitation	27.7±35.0			41.2±37.5		
SEADS Strategies	15.6±4.3	-.22	.02*	16.5±4.1	-.20	.04*
SEADS Confidence	7.3±1.8	.16	.12	7.9±1.5	.16	.11

*p<.05

Hypotheses for research question number fifteen were partially supported. The SEADS strategies subscale had a small to moderate significant negative correlation with reported role-limitation related to physical function at baseline and post-treatment. However, the SEADS confidence subscale did not have a significant correlation with reported role-limitation related to physical function at baseline or post-treatment.

CHAPTER FIVE: DISCUSSION

Major findings of this study were that both self-efficacy for walking and for managing SOB improved in all three groups and the amount of improvement were not significantly different among the groups. In addition, patients who used more dyspnea management strategies had lower self-efficacy for walking, walked a shorter distance in six-minutes, perceived more dyspnea and reported greater physical limitation. Changes in lung function from baseline to post-treatment was not significant for the total sample and among the three groups, thus changes in lung function did not contribute to the results of the study.

Primary Aim: Treatment Effects

Hypothesis 1

The first hypothesis stated that after treatment all three groups would improve their self-efficacy for walking and the TRG group would improve the most, followed by the EXP group and then HWC group. This hypothesis was partially supported. The sample as a whole improved their self-efficacy for walking after treatment. There were no significant differences among the three groups in the degree of improvement in self-efficacy for walking over time. However, there was a trend that the TRG improved more than the EXP, followed by the HWC group. The findings supported the self-efficacy theory in that walking interventions contributed to improvement in self-efficacy for walking. However, it was not clear whether greater number of mastery experiences and opportunities for gathering other efficacy building information in the treadmill sessions contributed to greater improvement in self-efficacy for walking in a "dose response fashion". This finding seemed to suggest that self-efficacy for walking could be further enhanced by increasing the number of treadmill-walking sessions.

These findings differ from a previous report where appreciable improvements in self-efficacy for walking were not evident until the ninth treadmill session (Gormley et al., 1993). This variation in the number of sessions required to achieve greater efficacy for walking is not clear. In the study by Gormley and colleagues, the subjects either advanced their training on their own or set proximal goals with the nurse coach each day. They were not given a defined long-term goal. In this study the long-term training goal (one stage below the maximum level that was achieved during exercise stress tests) was clearly defined for the "treatment coach" and all the subjects at the beginning of the treatment. Proximal or short-term goals were set with the "treatment coach" at each session based on subjects' performance in previous sessions. It is possible that by combining proximal and long-term training goals with the knowledge of their performance, a greater training intensity was created in the current study which was more effective in enhancing self-efficacy for walking (Bandura & Cervone, 1983).

Hypothesis 2

The second hypothesis stated that self-efficacy for walking would be significantly related to performance of physical activities and reported physical functioning at baseline, post-treatment, and change from baseline to post-treatment. Both six-minute walk distance and reported physical functioning were significantly related to self-efficacy for walking at all times. However, reported role limitation due to physical functioning was significantly related to self-efficacy for walking only at post-treatment and not at baseline or the change measured from baseline to post-treatment. This finding suggests that role limitation due to physical functioning is not necessarily a result of low self-efficacy for walking and may be influenced by other factors. Patients' initial perception of their role limitation related to their physical functioning appeared to be a distinctly different construct from their actual ability to walk and reported physical function.

The strength of the relationship increased after treatment for all three measures of physical function. Experience increased the correlation between efficacy and actual performance, consistent with the self-efficacy theory (Bandura, 1977; Bandura, 1997). The six-minute walk distance showed the strongest relationship with self-efficacy for walking, followed by physical functioning, then role limitation related to physical functioning. This finding indicates actual performance is related to self-efficacy for walking. The distance walked in six minutes is the most direct performance measure for self-efficacy for walking. However, role limitations related to physical functioning had a minimal correlation with subjects' self-efficacy for walking. Interventions designed to improve self-efficacy for walking or physical performance may have a limited effect on a subject's perception of his ability to fulfill their roles. Role fulfillments related to physical function likely require other abilities that have little resemblance to the ability to walk or the ability to perform physical activities.

Hypothesis 3

The third hypothesis stated that all three groups would improve their self-efficacy for managing SOB, and the TRG group would improve the most, followed by the EXP group and then HWC group. Subjects' self-efficacy for managing SOB was measured with the Stanford Self-Efficacy for Managing Shortness of Breath Question (SEMSOB), the COPD Self-Efficacy Scale (CSES), and the Self-Efficacy and Dyspnea Strategies Scale (SEADS).

The SEMSOB was a one-item instrument that measured patients' self-efficacy for managing SOB in terms of whether they felt confident in keeping SOB from interfering with what they wanted to do (Appendix B). The sample, as a whole, showed significant improvement in SEMSOB after treatment. There was no significant difference in the degree of improvement over time among the three groups. Further analysis showed that the HWC and the TRG groups improved significantly after treatment. Although the EXP group also had a higher mean score post-treatment, the measured change did not reach statistical significance. Self-efficacy for managing SOB as measured by the SEMSOB was sensitive to change and demonstrated that education about dyspnea management strategies was effective in increasing patients' self-efficacy for managing SOB. Patients who received either 4 or 24 treadmill exercise sessions did not show a significantly greater improvement over those who received education and a home walking prescription only. Having additional opportunities to practice dyspnea management strategies during exercise sessions appeared to have had limited therapeutic effect in improving self-efficacy for managing dyspnea. This finding suggests that educating patients about dyspnea management strategies and prescribing a home walking regimen were important interventions independent of supervised exercise.

The HWC group had the lowest initial self-efficacy (4.4) and showed the most improvement among the three groups (F=13.1). This finding demonstrated the importance of identifying patients with low self-efficacy for managing dyspnea since they might benefit the most from treatment. Patients with higher initial levels of self-efficacy, such as those in the EXP (5.7) and TRG (6.1) groups, might also benefit from treatment though their improvement might be at a lower rate (F=3.7 and 5.8, respectively) due to a ceiling effect (Table 12).

The SEADS is a new instrument tested in this study. The SEADS had two subscales. The strategies subscale measured the number of dyspnea management strategies patients used, and the confidence subscale measured patients' belief of the effectiveness of the strategies they use (Appendix D). The sample as a whole showed a small and significant increase in the number of strategies used after treatment. There was no significant difference in the amount of increase over time across the three groups. Further analysis showed that the HWC was the only group that significantly increased the number of strategies they used after treatment. The significance of the increase in the number of strategies used by the HWC group was further explored as a part of the secondary aim of the study.

The sample as a whole also showed a significant increase in their belief of the effectiveness of the strategies they use. However, there was no significant difference in the amount of increase over time across the three groups. Further analysis showed that the HWC and the EXP groups increased their efficacy beliefs significantly after treatment. Findings showed that the SEADS scale was sensitive to change after treatment and that education combined with a home-walking program improved patients' efficacy beliefs for the dyspnea strategies they use. However, the change in the number of strategies used and patients' efficacy beliefs of the strategies they use were minimal after education and treadmill exercise treatments.

The CSES measured patients' self-efficacy in managing or avoiding dyspnea in various situations. Subjects in this study did not improve their self-efficacy in managing or avoiding dyspnea in various situations as measured by the CSES. No improvements were evident in the total score or any of the subscale scores of the CSES.

This finding was unexpected. Each subject in the study received four one-on-one education sessions totaling three hours. These education sessions included both standardized and individualized instruction on dyspnea management strategies. Previous studies have shown that educating patients about dyspnea management strategies increased their self-efficacy for managing or avoiding dyspnea as measured by the CSES at one month and six months (Scherer & Shimmel, 1996; Scherer & Schmieder, 1996; Zimmerman, Brown & Bowman, 1996; Scherer, Schmieder & Shimmel, 1998). However only one study compared another group with the pulmonary rehabilitation group (Scherer, Schmieder & Shimmel, 1998) and none of these studies were randomized, had a control group, or focused on dyspnea management.

The current study is the only randomized clinical trial investigating self-efficacy for managing SOB. Although the CSES has demonstrated sensitivity to change after education and exercise treatment in uncontrolled studies, it has not been tested in controlled studies. The question stem in the CSES items included two distinct actions (manage or avoid dyspnea) for each situation listed. Answers provided by patients did not allow for differentiation between those who felt confident in managing dyspnea under various situations and those that were confident they could avoid dyspnea by avoiding certain situations or activities. A possible explanation for the lack of improvement in CSES after treatment in this study might be an increase in subjects' participation in activities or situations that were previously avoided as a result of dyspnea. The CSES would not be able to reflect such an improvement had it occurred.

Self-efficacy theory states that situations do not determine the level of self-efficacy. Self-efficacy beliefs influence perceived difficulty of achieving success in various situations. Performance requirements associated with various situations is built upon perceived self-efficacy. Since various situations may represent different levels of difficulty and is not uniform across individuals, it would be necessary to first measure patient's self-efficacy for managing SOB, then present patients with situations that represent different levels of difficulty or challenge to understand the situational influence (Bandura, 1997).

Hypothesis 4

The fourth hypothesis stated that self-efficacy for managing shortness of breath would relate significantly to measures of dyspnea and mastery for baseline, post-treatment, and change from baseline to post-treatment. To test this hypothesis, the CSES and SEMSOB were correlated with mastery (CRQ-Mastery) and measures of dyspnea that included SOB severity (SF-36), the degree of interference dyspnea had on subject's work both inside and outside of the home (SF-36 SOB interference), SOB at the end of the 6MW, and dyspnea sub-scales of the CRQ (CRQ-D). Only one prior study included SOB severity as an outcome measure in investigating the effect of self-efficacy on managing SOB. Dyspnea of patients walking to the research site from the parking lot was used as the measure of SOB severity and found to be unchanged after a six-week education program (Zimmerman, Brown & Bowman, 1996). Methodological problems of this study made it difficult to interpret the results. Therefore it is not clear from this study whether an improvement in self-efficacy in managing SOB (belief) was related to a decrease in SOB severity (symptom status).

Findings of this study showed that the amount of SOB reported after exercise was not related to patients' confidence level for managing their SOB. Self-efficacy for managing SOB was significantly related to patients' sense of mastery or control over their illness, their self-reported dyspnea severity and the degree to which they perceive SOB interfered with their lives. Higher confidences for managing SOB was related to greater perceived control of the illness, lower self-reported dyspnea severity, and less SOB interference. Patients' confidence for managing SOB had the strongest relationship with mastery or their perceived control over their illness.

Findings of this study suggest that SOB reported after exercise (6MW) might not be the most sensitive or appropriate measure to determine the effect of improved self-efficacy for managing SOB. Other measures of dyspnea, such as patients' perceived SOB severity, the degree to which subjects perceive SOB interfered with their lives and their sense of mastery for dealing with the illness appeared to be conceptually more appropriate and sensitive outcome measures of changes in self-efficacy for managing SOB.

Secondary Aim: Instrument Development (SEADS)

Hypotheses 5-15

Hypotheses five through fifteen stated that the SEADS scale would demonstrate evidence of construct validity. The SEADS scale was related to: other measures of self-efficacy for managing SOB (CSES and SEMSOB); mastery (CRQ-M); a measure of self-efficacy for walking (SEWALK); measures of dyspnea (SOB severity, SOB interference [SF-36], 6MW SOB, and CRQ-Dyspnea); and measures of physical performance (6MW distance), physical functioning (SF-36), and role limitation related to physical functioning (SF-36).

SEADS' Strategies Subscale

Convergence. The SEADS' strategies subscale had a significant, moderate, and negative relationship with the CSES' total score and all subscale scores except physical activity ($r = -.07$ to $-.29$, $p = .14$ to $.008$). Subjects who reported using more dyspnea management strategies had lower confidence in managing their SOB in various situations as measured by the CSES. SEADS' strategies subscale did not demonstrate convergence with the SEMSOB as had been hypothesized. The number of strategies subjects used was not related to how confident they were in keeping shortness of breath from interfering with what they wanted to do. The cause of inconsistent findings between the two measures of self-efficacy for managing SOB, CSES and SEMSOB was unclear. The findings suggest that although both the CSES and SEMSOB proposed to measure self-efficacy for dyspnea management, managing or avoiding dyspnea in various situations (CSES) might be conceptually quite different from confidence in keeping dyspnea from interfering with what one wants to do (SEMSOB).

Mastery. SEADS' strategies subscale was not significantly related to mastery as measured by the CRQ-M. The number of strategies used by patients was not significantly related to a sense of control over their disease and its effects (Guyatt et.al., 1987). This finding was unexpected. Although the relationship between the number of strategies used by patients and their sense of mastery over their illness was statistically insignificant, the directionality of the relationship was negative. The higher the number of strategies used by patients, the lower the sense of mastery. An increase in the number of strategies was thought to represent a positive finding in that patients would have an increased repertoire of strategies they could use for managing their dyspnea and would lead to a greater sense of control over the illness. This finding suggests that patients who feel less in control of their illness might have used more strategies to manage their illness.

Divergence. As hypothesized, SEADS' strategies subscale discriminated between self-efficacy for managing SOB and self-efficacy for walking and did not demonstrate a relationship to SEWALK at baseline; however, it did demonstrate a significant negative relationship with SEWALK post-treatment, indicating that subjects who used more dyspnea management strategies after treatment had a lower level of self-efficacy for walking. This finding was unexpected. No previous study has examined the relationship between the number of strategies used to manage dyspnea and self-efficacy for walking. Those subjects who were less confident used more strategies and those who used more strategies had less confidence in walking.

Dyspnea. SEADS' strategies subscale demonstrated a moderate correlation with SF-36's SOB severity and SOB interference. Subjects who used more dyspnea management strategies had a higher level of dyspnea severity and also perceived SOB as having greater interference in their life. This finding was unexpected and suggested that the number of strategies subjects used reflected the severity of patients' dyspnea and the greater difficulty they had in managing their dyspnea. Having to use a variety of strategies to manage their dyspnea also created more interference in patients' daily life. SEADS' strategies subscale did not demonstrated a correlation, however with 6MW SOB or CRQ-Dyspnea.

The cause for the inconsistency in the findings among the four different measures of dyspnea severity is unclear. A possible explanation might be the specificity of 6MW SOB and CRQ-D. Shortness of breath reported after the six-minute walk measured dyspnea severity at one point in time for one particular activity, walking. The CRQ-D measured dyspnea severity by eliciting five activities that caused SOB for each individual. These methods of measurement might not be sensitive indicator of subjects' overall dyspnea severity. Since SF-36's SOB severity and SOB interference questions included a timeframe of four weeks and did not isolate a particular activity, responses might have provided a more useful representation of patient's perception of their overall dyspnea severity.

Physical Performance. SEADS' strategies subscale demonstrated a negative correlation with the 6MW distance. Subjects who used more strategies walked a shorter distance in six minutes and those who walked less used more dyspnea management strategies. This finding showed that an increase in the use of strategies reflected more limitation to physical performance. Subjects who experienced greater limitations in physical performance might have required the use of more strategies to manage their SOB.

Physical Function. SEADS' strategies subscale demonstrated a moderate negative correlation with physical function and role limitation related to physical function. SEADS' strategies subscale had a significantly negative relationship with measures of physical function. Subjects who had greater limitations due to their physical function, and perceived greater role limitations related to their physical function used more dyspnea management strategies.

Findings related to the SEADS' strategies subscale are consistent and provided evidence of construct validity. In general, subjects with lower self-efficacy for walking walked a shorter distance in six minutes, had higher dyspnea severity, perceived SOB as having greater interference in their lives, reported lower physical function, perceived greater role limitation related to their physical function, and used more strategies for managing dyspnea.

SEADS' Confidence Subscale

Convergence. SEADS' confidence subscale demonstrated moderate degree of convergence with CSES' total score and subscale scores of physical activity and weather and environment providing evidence of concurrent validity with a known tool; however, a significant relationship was not found for subscales of emotional arousal, behavior risk, and negative affect. The reason for the lack of a consistent relationship in the subscales of the CSES was unclear. Again, this finding might reflect the dual stem that existed in each of the questions in the CSES. Potentially, situations related to physical activity and weather and environment might be more avoidable than they are manageable. However, it was not possible to determine with which stem, manage or avoid dyspnea, subjects chose to identify their self-efficacy for managing dyspnea.

Subjects who had higher efficacy beliefs in their dyspnea management strategies seemed to have greater confidence in managing or avoiding their dyspnea in situations involving physical activity or influence of weather and environment as measured by the CSES. As hypothesized, SEADS' confidence subscale demonstrated a moderate degree of convergence with the SEMSOB. The degree of confidence subjects had in the strategies they used had a significant positive relationship to their confidence in keeping shortness of breath from interfering with what they wanted to do providing evidence of construct validity of the SEADS' confidence subscale.

Mastery. As hypothesized, SEADS' confidence subscale demonstrated a significant correlation with CRQ-M. Subjects who had more confidence in the effectiveness of the dyspnea management strategies they used perceived greater control over their disease and its effects.

Divergence. As hypothesized, SEADS' confidence subscale did not demonstrate a relationship to SEWALK at baseline or post-treatment, thus discriminating between self-efficacy for managing SOB and self-efficacy for walking. A strong efficacy belief in the dyspnea management strategies was not generalized to greater confidence for walking. This finding is supported by the self-efficacy theory, which proposes that self-efficacy does not transfer across different domains of functioning.

Dyspnea. SEADS' confidence subscale was not significantly related to measures of dyspnea. Greater confidence in the effectiveness of the dyspnea management strategies was not related to less dyspnea severity as measured by the SF-36's SOB severity, SOB interference, 6MW SOB, or CRQ-Dyspnea. This finding was unexpected and suggests that efficacy beliefs in dyspnea management strategies might not be sensitive to variations in dyspnea severity.

<u>Physical Performance.</u> SEADS' confidence subscale did not demonstrate a significant correlation with physical performance as measured by the 6MW distance. This finding demonstrated that belief in the effectiveness of the dyspnea management strategies does not influence the distance walked in six-minutes.

<u>Physical Function.</u> SEADS' confidence subscale did not demonstrate a significant correlation with physical function, and role limitation related to physical function. This finding suggests that subjects' efficacy beliefs in the dyspnea management strategies they used did not influence their perception of their physical function and their role related to physical function.

Findings related to the SEADS' confidence subscale provided evidence of construct validity for the SEADS scale through convergence and divergence testing with other measures of self-efficacy and the related concept of mastery. However, the lack of a significant relationship between SEADS' confidence subscale and measures of dyspnea severity and physical performance and physical activity was not anticipated. The two subscales of the SEADS instrument appeared to provide unique and useful information. Higher number of strategies used by patients was related to greater dyspnea severity and worse physical performance and function. Whereas, higher confidence in the effectiveness of the strategies used by patients was related to a greater sense of control over the disease and its effects and greater confidence in managing SOB.

Significance of Findings

Ability to manage symptoms and maintain physical functioning has been identified as two of the most important area of functioning for dyspneic patients with COPD. The outcome of symptom management has primarily been studied through education interventions about dyspnea management strategies, and physical function has primarily been studied by means of various modes of exercise training. Since self-efficacy has been identified as an important predictor of behavior (Allen, 1996; Bandura et.al., 1996; Bandura et.al., 1998; Conn, 1997; Jourden, Bandura, & Banfield, 1991, Matsui, 1991; Waldersee, 1994; and Wiedenfeld et.al., 1990), understanding self-efficacy as related to dyspnea management and physical function would yield valuable information for developing effective treatment options and enhance adherence to treatment. This would result in improved dyspnea management and physical function in this patient population.

Self-Efficacy Related to Managing SOB

Previous studies in patient with COPD found that educating patients about a variety of topics, including dyspnea management, increased patients' self-efficacy for managing dyspnea and, in some instances, decreased patients' perception of dyspnea severity. However, the majority of these were uncontrolled studies (Scherer & Shimmel, 1996; Scherer & Schmieder, 1996; Zimmerman, Brown & Bowman, 1996; Scherer& Schmieder, 1997; Scherer, Schmieder & Shimmel, 1998). The dyspnea management strategies taught to patients were usually not clearly described within the context of a rehabilitation education program and no investigator has previously studied patients' efficacy beliefs about the dyspnea management strategies they used.

The study reported herein is the only randomized controlled study, which investigated the effect of educating patients with COPD about dyspnea management strategies on self-efficacy for managing dyspnea. The results of this study showed that self-efficacy for managing dyspnea improved after an education treatment as have been found in previous studies. In this study, the SEMSOB and the SEADS were sensitive to this improvement and the CSES was not.

The use of three instruments to measure self-efficacy for managing dyspnea allowed comparison of the findings among the instruments. Prior uncontrolled studies measured self-efficacy for managing dyspnea with the CSES and demonstrated improvement after treatment (Scherer & Shimmel, 1996; Scherer & Schmieder, 1996; Zimmerman, Brown & Bowman, 1996; Scherer& Schmieder, 1997; Scherer, Schmieder & Shimmel, 1998). However, the findings of this study show that although the CSES had a moderate correlation with SEMSOB ($r = 0.23$ to 0.51), the CSES might not be sensitive in detecting changes in self-efficacy for managing SOB after an education intervention in randomized controlled studies.

The inclusion of two distinct concepts in the CSES, the ability to manage and the ability to avoid dyspnea, within each question might have contributed to the lack of sensitivity of the CSES. The CSES is currently the most common tool used to measure self-efficacy for managing SOB. Findings of this study suggest that further delineation and validation of the CSES using randomized controlled designs is required.

Coached treadmill exercise sessions intended to provide additional enactive mastery experiences did not significantly increase the improvement in self-efficacy for managing SOB. The treadmill sessions were conducted based on the principle of desensitization and guided mastery (Carrieri-Kohlman, Douglas, Gormley & Stulbarg, 1993) where patients were exposed to graduated levels of dyspnea while being supervised and actively guided through the exercise sessions by a “coach”. Despite significant improvements in their ability to walk on the treadmill, patients apparently did not attribute their success in walking on the treadmill to their ability to exercise better control over their dyspnea.

According to the self-efficacy theory, individuals with strong doubts about their abilities might not attribute their success to their own ability and thus would not demonstrate enhanced self-efficacy even when they have mastered the skill and received positive feedback about their accomplishments (Bandura, 1997). It is likely that dyspneic patients with COPD have strong doubts about their ability to manage SOB and might have attributed their success during the exercise sessions to other factors, such as being in a hospital environment or having a healthcare provider present rather than to their own capabilities.

Another important finding of this study is the relationship between the number of strategies used by patients and their self-efficacy for walking, dyspnea severity, and physical function. Subjects who used more strategies for managing dyspnea had lower self-efficacy for walking, walked a shorter distance in six minutes, had higher dyspnea severity, perceived SOB as having greater interference in their lives, reported lower physical function, and perceived greater role limitation related to their physical function. Confidence in the effectiveness of the dyspnea management strategies was related a sense of control over the illness and higher self-efficacy for managing SOB.

Prior studies related to dyspnea management strategies have primarily been descriptive, listing strategies that patients reported using. Little was known about the significance of the number of strategies patients use to manage their dyspnea or their efficacy beliefs about the strategies. This is the only study that describes the relationship between the number of strategies used by patients and their self-efficacy for walking, dyspnea severity, and physical function. The number of strategies patients use and their efficacy beliefs in the strategies they use lend insight to their self-efficacy for walking, their sense of control over their illness, the severity of their dyspnea, and the degree to which their physical performance and physical function is affected. The SEADS scale demonstrated evidence of construct validity and the two subscales of the SEADS each provided unique and important information regarding dyspnea management strategies.

Self-Efficacy Related to Physical Function

Studies have shown that lower extremity exercise increases patients' exercise performance and decreases dyspnea. However, since investigators used programs that varied widely in mode, length, duration, intensity, outcome of interest, and theoretical underpinning, it is difficult to draw conclusions about the most effective intervention or the mechanism of improvement. A few studies investigated self-efficacy related to physical function and focused on self-efficacy for walking, demonstrating that exercise interventions increased patients' self-efficacy for walking and increased patients' walking performance. However, no investigator has studied the effects of different strengths of exercise training on self-efficacy for walking or determined the relationship between self-efficacy for walking and other measures of physical function in addition to walking performance.

This is the only controlled study, which investigated the effect of different strengths of education and exercise treatments on self-efficacy for walking. Results from the larger randomized clinical trial showed that subjects who received twenty-four treadmill exercise sessions walked a longer distance in six-minutes after treatment. However, findings of this study showed that education and home walking was as effective in improving self-efficacy for walking as four or twenty-four treadmill exercise sessions in patients with COPD. This finding lends insight into the effectiveness of education and home walking in improving self-efficacy for walking in the patient with COPD. Although twenty-four structured treadmill exercise sessions appeared to improve patient's walking performance, its addition did not further enhancing patient's self-efficacy for walking.

This is also the first study to investigate other measures of physical functioning in addition to walking performance. Although walking is a form of physical function that is both important and easy to measure, walking represents only a small component of the domain of physical activities or physical functioning. The ability to walk a longer distance does not necessarily mean that patients will perceive less limitation in their physical function in their daily lives. Therefore, it is important to measure different types of functioning separately and to understand the relationship among walking, physical function, and role-limitation related to physical function in the patient with COPD.

This is the first study to examine the relationship between self-efficacy for walking and measures of physical function other than walking performance, such as physical function and role-limitation related to physical function. Self-efficacy for walking was related to patients' perceived physical function, however, it had limited benefit on patients' perceptions of their role limitations related to their physical function. Improving patients' self-efficacy for walking might enhance their physical function, however it will have limited usefulness in improving their perception of their role-limitation related to physical function. Results of this study suggest that the concept of role-limitation related to physical function is not well understood. Further exploration is needed to develop interventions for reducing patients' perceptions of their role-limitation related to their physical function.

For the dyspneic patient with COPD, symptom management and physical function are of the utmost importance. Various treatments have been implemented to improve the level of dyspnea and increase physical function, such as education programs about dyspnea management strategies and exercise programs to increase activity tolerance. The methods and effectiveness of each treatment have shown considerable variation. The rationale for the mechanisms of success or failure of each treatment modality demonstrated even greater inconsistency. This inconsistency in both methodology and findings contributes to varied interpretation of findings and the proliferation of non-theory-based interventions. The very early work on respiratory mechanics has not allowed clear understanding of the mechanisms of dyspnea and the targeting of treatments to dyspnea has been minimal. Medical therapies such as bronchodilators and oxygen have a physiological base and have shown to decrease dyspnea. However, cognitive behavioral therapies have been less targeted (Stulbarg, Belman & Ries, 1998).

The validity and usefulness of the self-efficacy theory has been substantiated in numerous studies involving diverse areas of human functioning such as learning, skill development, decision-making, health promotion, biological responsiveness, affectivity, and addiction (Bandura, 1997). Self-efficacy has shown to be an important predictor of behavior in patients with chronic diseases such as those with cardiovascular disease and arthritis (Ewart et. al., 1983; Gortner & Jenkins, 1990; Lorig et.al., 1989). Despite strong evidence supporting the utility of self-efficacy theory, research related to self-efficacy as a moderating factor of behavior in the COPD population has been scant.

As a result of the limited number of self-efficacy-related studies with patients with COPD, the strength of each of the four sources of efficacy building information has not been clearly established for patients with COPD. Based on a substantial amount of research in other domains of functioning and in other patient populations, enactive mastery experience was hypothesized to be the most influential in enhancing subjects' efficacy beliefs in dyspnea management and walking. Therefore, it was believed that treadmill exercise sessions would provide subjects the opportunity to practice dyspnea management strategies and experience success with walking.

Limitations

This study design was not able to test whether interventions that were provided without the presence of a healthcare worker, in a different setting, using exercise modes other than a treadmill, or in a group format, would enhance their effectiveness or the ability to demonstrate differential effects among the three groups. Subjects might have felt less confident walking without the presence of a healthcare provider or in a hospital setting. The presence of healthcare workers and the hospital environment might have contributed to the sense of security for subjects. Some subjects said they felt more comfortable exerting themselves in the hospital than at home since they knew someone was in attendance to render assistance if necessary.

For patients with COPD who might be very doubtful of their abilities to walk and manage their SOB, success attained in the presence of a healthcare worker might not have been attributed by patients to an improvement in their capabilities. Walking on the treadmill might have been construed by some subjects as requiring different capabilities from walking at home or on the street and thus were not able to transfer the mastery experiences they gained from walking on the treadmill in the hospital to walking at home or on the street. A home-based program might be more effective and better at promoting adherence to exercise interventions than hospital-based programs (Strijbos et. al, 1996). This study utilized a one-on-one intervention to maximize 'guided mastery' by providing individualized coaching to patients. The limitations of individual training sessions include the lack of opportunity to learn through vicarious experiences or peer modeling.

Another limitation of this study was that the scores of several baseline measures were significantly different among the three groups. These included the SEMSOB, the SEADS confidence subscale, role-limitation related to physical function, SOB severity, and SOB interference. Since the repeated measures analyses used subjects as their own controls, the differences in baseline scores among the three groups do not affect interpretation of the results. However, it would have been preferential to stratify the sample by self-efficacy to ensure equal distribution of scores among the three groups at baseline.

The use of several instruments that have not been extensively tested for validity and reliability in the COPD patient population was another limitation of the study. This was mainly a product of the small number of studies that have investigated self-efficacy-related issues in the COPD population and highlights the need for more research in this area.

Implications for Clinical Practice

Nurses are frequently involved in educating patients about symptom management and implementing exercise programs to improve COPD patients' physical function. Self-efficacy has been shown to be an important predictor of behavior and it is important to address the effectiveness of an intervention in improving self-efficacy as well as improving performance. An increase in self-efficacy could also lead to improved adherence to the intervention thus providing long-term benefits, whether the intervention is the use of a strategy to manage dyspnea or a walking program. This study provided new insight into the amount of education and exercise training necessary to improve patients' self-efficacy. This study also identified the type of instrument to use for measuring self-efficacy and several relevant outcome measures.

Educating patients about dyspnea management strategies improves patients' self-efficacy for managing their dyspnea. Patients' self-efficacy for managing their dyspnea is related to their sense of control over their illness, their SOB severity, and the degree to which they feel SOB interferes with their daily life. Therefore, it is important for the clinician to educate patients about dyspnea management strategies in a manner that will serve to enhance patients' self-efficacy for managing their dyspnea and to document changes in self-efficacy and related outcome measures.

Encouraging patients to walk and prescribing a home walking regimen alone is as effective in improving patients' self-efficacy for walking as providing patients with a home walking prescription and 4 or 24 supervised exercise sessions. Patients' self-efficacy for walking is related to their physical performance and physical function. Implementation of a home walking program alone without supervised exercise has beneficial effects for patients with COPD.

The absence of significant augmentation in subjects' self-efficacy for walking despite additional supervised exercise sessions would suggest there is a need to examine, explore, and develop exercise programs that will maximize subjects' self-efficacy for walking.

This study also examined the strategies commonly taught to patients by clinicians to manage their dyspnea. The use of numerous strategies by patients can provide information as to the degree of difficulty patients experience managing their dyspnea. The numbers of strategies patients use is related to their physical performance, physical function, and their SOB severity. Therefore, it is important for clinicians to assess strategies that patients use to manage their dyspnea. Patients' efficacy beliefs of the management strategies they use are related to their self-efficacy for managing dyspnea and their sense of control over their illness. Knowing patients' efficacy beliefs of the management strategies they use will help the nurse determine which strategies will likely be more effective for a particular patient.

Implications for Research

This is the first controlled study that examined the effect of education and exercise on both self-efficacy for managing SOB and self-efficacy for physical functioning. Findings of this study have import in expanding the self-efficacy theory in patients with COPD and suggest that more studies are needed to better understand and delineate concepts of dyspnea management and physical function. Physical function is an important domain of functioning for patients with COPD. Future studies need to examine more than the sub-domain of walking, consider other forms of physical function, and how physical function affects subjects' perceptions of their role-limitations. A sound theoretical base would be necessary for the development and refinement of interventions to enhance subjects' self-efficacy related to physical function. More studies are needed to clarify the most powerful source of efficacy building information in patients with COPD. Future studies also need to address the role of attribution in patients with COPD so that successful experiences would be attributed to inherent ability and serve to improve self-efficacy.

Symptom management can be viewed as a broad domain of functioning that includes various sub-domains. Future studies in this area need to integrate the concept that symptom management is not simply a decrease in the reported perception of symptom severity, but rather a balance between symptom severity and the influence of symptom on patients' daily lives. Other outcomes related to improved symptom management also need to be considered, such as sense of control or mastery and the degree to which dyspnea interferes with patients' lives or prevents them from doing what they want to do. For example, positive changes in symptom management may include a decrease in symptom perception or an increase in mastery, leading to improvements in quality of life. A patient who has acquired a greater sense of mastery may be more confident in engaging in various activities in or outside the home, as another who reports the same level of dyspnea, leading to an improvement in quality of life. On the other hand, a patient who avoids life-enhancing activities to minimize dyspnea may experience decreased overall symptom severity but may experience a decreased quality of life. Measures of self-efficacy for dyspnea management need to preserve conceptual clarity so that an avoidance of life enhancing but dyspnea producing activities would indicate a negative rather than a positive effect. More controlled studies related to self-efficacy for dyspnea management are needed.

The findings of this study support the notion that self-efficacy is an important concept in patients with COPD. To improve treatment effectiveness for patients with COPD, additional studies are needed. Although enactive mastery experiences have been found to be the most powerful source of efficacy information, this finding needs to be confirmed in the COPD population. In this study, knowledge and home walking were as strong as additional structured exercise in improving self-efficacy. Other sources of efficacy information, such as negative physiological feedback including anxiety, dyspnea, fatigue and pain, may play a significant role in negating the effect of enactive mastery experiences in this population. It is possible that dyspneic patients with COPD might demonstrate varied responses to enactive mastery experiences as a result of significant negative physiological feedback from dyspnea. This also requires further study.

Since self-efficacy has not been well studied in patients with COPD, measures of various domains of functioning requires continued development and validation. These measures must be grounded in self-efficacy theory and be domain-specific with a focus on conceptual clarity, precision, and sensitivity to change. In addition, future studies need to examine the effect of the presence of a healthcare worker, setting variations, or training methods on subjects' self-efficacy. Attention to subjects' processing of performance success or failure is vital to understanding the internal attribution process of patients with COPD. Assessment of self-efficacy and attribution in addition to actual performance is necessary to understand how efficacy information is processed.

The symptom of dyspnea is influenced by a person's perception, evaluation, and response to a myriad of physiological, psychological and social factors. Therefore, successful dyspnea management must not be narrowly construed as a reduction in the perception of dyspnea severity. More studies on self-efficacy for managing dyspnea and self-efficacy for physical functions are needed to further our understanding of the role of self-efficacy in patients with COPD, so that effective interventions can be developed to improve patient outcomes.

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Appendix A

THE COPD SELF-EFFICACY SCALE (CSES)

Read each numbered item below, and determine how confident you are that you could manage breathing difficulty or avoid breathing difficulty in that situation. Use the following scale as a basis for your answers:

(a) = Very confident, (b) = Pretty confident, (c) = Somewhat confident
(d) = Not very confident, (e) = Not at all confident

1. When I become too tired.
2. When there is humidity in the air.
3. When I go into cold weather from a warm place.
4. When I experience emotional stress or become upset.
5. When I go up stairs too fast.
6. When I try to deny that I have respiratory difficulties.
7. When I am around cigarette smoke.
8. When I become angry.
9. When I exercise or physically exert myself.
10. When I feel distressed about my life.
11. When I feel sexually inadequate or impotent.
12. When I am frustrated.
13. When I lift heavy objects.
14. When I begin to feel that someone is out to get me.
15. When I yell or scream.
16. When I am lying in bed.
17. During very hot or very cold weather.
18. When I laugh a lot.
19. When I do not follow a proper diet.
20. When I feel helpless.
21. When I drink alcoholic beverages.
22. When I get an infection (throat, sinus, colds, the flu, etc).
23. When I feel detached from everyone and everything.
24. When I experience anxiety.
25. When I am around pollution.
26. When I overeat.
27. When I feel down or depressed.
28. When I breathe improperly.
29. When I exercise in a room that is poorly ventilated.
30. When I am afraid.
31. When I experience the loss of a valued object or a loved one.
32. When there are problems in the home.
33. When I feel incompetent.
34. When I hurry or rush around

Appendix B

Stanford's Self-Efficacy for Managing Shortness of Breath Question (SEMSOB)

How confident are you that you can keep your shortness of breath from interfering with what you want to do?

0	1	2	3	4	5	6	7	8	9	10
Not at all Confident										Totally Confident

Appendix C

Self-Efficacy for Walking Questionnaire (SEWALK)

INSTRUCTIONS: In the group of questions that follow, you will be asked to think about how far you think you can walk. You will be asked to rate how confident you are right now of your ability to walk different distances. You may use numbers to rate your confidence with 0 meaning not at all confident and 10 meaning totally confident. You may select any number from 0 to 10. There are no right or wrong answers; it is your opinion that is important.

	NOT AT ALL CONFIDENT										TOTALLY CONFIDENT
1) From your bed to the bathroom	0	1	2	3	4	5	6	7	8	9	10
2) Around inside your home	0	1	2	3	4	5	6	7	8	9	10
3) ½ block	0	1	2	3	4	5	6	7	8	9	10
4) 1 block	0	1	2	3	4	5	6	7	8	9	10
5) 2 blocks	0	1	2	3	4	5	6	7	8	9	10
6) 4 blocks	0	1	2	3	4	5	6	7	8	9	10
7) 6 blocks	0	1	2	3	4	5	6	7	8	9	10
8) 8 blocks	0	1	2	3	4	5	6	7	8	9	10
9) 1 mile	0	1	2	3	4	5	6	7	8	9	10
10) 2 miles	0	1	2	3	4	5	6	7	8	9	10

Appendix D

Self-Efficacy and Dyspnea Strategies Scale (SEADS)

Circle **yes** for the strategies listed below that you use to manage your shortness of breath. Then ***pick a number*** from zero to ten to indicate how confident you are that the strategy is effective. If you don't use the strategy, just circle **no**.

Activities	**Do you use this to manage your shortness of breath?**		**Not at all Totally Confident Confident** 0	1	2	3	4	5	6	7	8	9	10
1. I change position	YES	NO	0	1	2	3	4	5	6	7	8	9	10
2. I stop doing whatever I am doing	YES	NO	0	1	2	3	4	5	6	7	8	9	10
3. I keep still/rest	YES	NO	0	1	2	3	4	5	6	7	8	9	10
4. I stay quiet	YES	NO	0	1	2	3	4	5	6	7	8	9	10
5. I move slowly	YES	NO	0	1	2	3	4	5	6	7	8	9	10
6. I decrease activity	YES	NO	0	1	2	3	4	5	6	7	8	9	10
7. I avoid exercise	YES	NO	0	1	2	3	4	5	6	7	8	9	10
8. I exercise, such as walking	YES	NO	0	1	2	3	4	5	6	7	8	9	10
9. I use other transportation	YES	NO	0	1	2	3	4	5	6	7	8	9	10
10. I plan activities in advance	YES	NO	0	1	2	3	4	5	6	7	8	9	10
11. I rely on others to help me with routine activities	YES	NO	0	1	2	3	4	5	6	7	8	9	10
12. I do pursed-lips breathing	YES	NO	0	1	2	3	4	5	6	7	8	9	10
13. I use abdominal/ diaphragmatic breathing	YES	NO	0	1	2	3	4	5	6	7	8	9	10
14. I use fans	YES	NO	0	1	2	3	4	5	6	7	8	9	10
15. I call the doctor/nurse	YES	NO	0	1	2	3	4	5	6	7	8	9	10
16. I get some fresh air (without pollution)	YES	NO	0	1	2	3	4	5	6	7	8	9	10
17. I avoid irritants such as smoke	YES	NO	0	1	2	3	4	5	6	7	8	9	10
18. I use oxygen	YES	NO	0	1	2	3	4	5	6	7	8	9	10

Appendix D

Self-Efficacy and Dyspnea Strategies Scale (SEADS)

Circle **yes** for the strategies listed below that you use to manage your shortness of breath. Then ***pick a number*** from zero to ten to indicate how confident you are that the strategy is effective. If you don't use the strategy, just circle **no**.

Activities	**Do you use this to manage your shortness of breath?**		**Not at all** **Totally** **Confident** **Confident** 0	1	2	3	4	5	6	7	8	9	10
19. I take medication: bronchodilators	YES	NO	0	1	2	3	4	5	6	7	8	9	10
20. I take medication: prednisone	YES	NO	0	1	2	3	4	5	6	7	8	9	10
21. I take medication: valium, xanax	YES	NO	0	1	2	3	4	5	6	7	8	9	10
22. I take medication: antidepressant	YES	NO	0	1	2	3	4	5	6	7	8	9	10
23. I drink alcohol	YES	NO	0	1	2	3	4	5	6	7	8	9	10
24. I smoke cigarettes	YES	NO	0	1	2	3	4	5	6	7	8	9	10
25. I use relaxation techniques	YES	NO	0	1	2	3	4	5	6	7	8	9	10
26. I calm myself down	YES	NO	0	1	2	3	4	5	6	7	8	9	10
27. I forget it, I try not to think about it	YES	NO	0	1	2	3	4	5	6	7	8	9	10
28. I do something to think about it less, such as: Watch TV/Read	YES	NO	0	1	2	3	4	5	6	7	8	9	10
29. I pray	YES	NO	0	1	2	3	4	5	6	7	8	9	10
30. I meditate	YES	NO	0	1	2	3	4	5	6	7	8	9	10
31. I socialize and participate in leisure activities with others	YES	NO	0	1	2	3	4	5	6	7	8	9	10
32. I get support from friends and family	YES	NO	0	1	2	3	4	5	6	7	8	9	10
33. I do leisure activities by myself	YES	NO	0	1	2	3	4	5	6	7	8	9	10
34. I try to be alone	YES	NO	0	1	2	3	4	5	6	7	8	9	10
35. I use home remedies such as:													
______________________________			0	1	2	3	4	5	6	7	8	9	10
______________________________			0	1	2	3	4	5	6	7	8	9	10

Appendix E

SF-36 Questionnaire

INSTRUCTIONS: This survey asks for your views about your health. This information will help keep track of how you feel and how well your are able to do your usual activities.

Answer each question by marking the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can.

Physical Functioning

The following items are about activities you might do during a typical day. Does **your health now limit you** in these activities? If so, how much?

(Circle one number on each line)

	Yes, Limited a Lot	Yes, Limited a Little	No, Not Limited at All
a. **Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports	1	2	3
b. **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
c. Lifting or carrying groceries	1	2	3
d. Climbing **several** flights of stairs	1	2	3
e. Climbing **one** flight of stairs	1	2	3
f. Bending, kneeling, or stooping	1	2	3
g. Walking **more than a mile**	1	2	3
h. Walking **several blocks**	1	2	3
i. Walking **one block**	1	2	3
j. Bathing or dressing yourself	1	2	3

Appendix E

SF-36 Questionnaire

Role-Limitation Related to Physical Functioning

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?

	(Circle one number on each line) Yes	No
a. Cut down the **amount of time** you spent or work or other activities	1	2
b. **Accomplished less** than you would like	1	2
c. Were limited in the **kind** of work or other activities	1	2
d. Had **difficulty** performing the work or other activities (for example, it took extra effort)	1	2

Shortness of Breath Severity

How much **shortness of breath** have you had during the **past 4 weeks**?

(Circle one number)

None	1
Very mild	2
Mild	3
Moderate	4
Severe	5
Very severe	6

Shortness of Breath Interference

During the **past 4 weeks,** how much did **shortness of breath** interfere with your normal work (including both work outside the home and housework)?

(Circle one number)

None	1
Very mild	2
Mild	3
Moderate	4
Severe	5
Very severe	6

Appendix F

Chronic Respiratory Questionnaire (CRQ)

CRQ-Dyspnea

This questionnaire is designed to find out how you have been feeling during the last 2 weeks. You will be asked about how short of breath you have been, how tired you have been feeling and how your mood has been.

1) I would like for you to think of the activities that you have done during the last 2 weeks that have made you feel short of breath. These should be activities which you do frequently and which are important in your day-to-day life. Please list as many activities as you can that you have done during the last 2 weeks that have made you feel short of breath.

2) I will now read a list of activities, which make some people with lung problems feel short of breath. I will pause after each item long enough for you to tell me if you have felt short of breath doing that activity during the last 2 weeks. If you haven't done the activity during the last 2 weeks, just answer "NO". The activities are:

1. BEING ANGRY OR UPSET
2. HAVING A BATH OR SHOWER
3. BENDING
4. CARRYING, SUCH AS CARRYING GROCERIES
5. DRESSING
6. EATING
7. GOING FOR A WALK
8. DOING YOUR HOUSEWORK
9. HURRYING
10. MAKING A BED
11. MOPPING OR SCRUBBING THE FLOOR
12. MOVING FURNITURE
13. PLAYING WITH CHILDREN OR GRANDCHILDREN
14. PLAYING SPORTS
15. REACHING OVER YOU HEAD
16. RUNNING, SUCH AS FOR A BUS
17. SHOPPING
18. WHILE TRYING TO SLEEP
19. TALKING
20. VACUUMING
21. WALKING AROUND YOUR OWN HOME
22. WALKING UPHILL
23. WALKING UPSTAIRS
24. WALKING WITH OTHERS ON LEVEL GROUOND
25. PREPARING MEALS

Appendix F

Chronic Respiratory Questionnaire (CRQ)

CRQ-Dyspnea

3a) Of the items which you have listed, which is the most important to you in your day-to day life? I will read through the items, and when I am finished, I would like you to tell me which is the most important.

3b) Of the remaining items, which is the most important to you in your day-to day life? I will read through the items, and when I am finished, I would like you to tell me which is the most important.

3c) Of the remaining items, which is the most important to you in your day-to day life?

3d) Of the remaining items, which is the most important to you in your day-to day life?

3e) Of the remaining items, which is the most important to you in your day-to day life?

4) I would now like you to describe how much shortness of breath you have had during the last 2 weeks while doing the five most important activities you have selected.

a-e) Please indicate how much shortness of breath you have had during the last 2 weeks while [INTERVIEWER: INSERT ACTIVITY LIST IN 3a-3e] by choosing one of the following options from the card in front of you:

1 EXTREMELY SHORT OF BREATH
2 VERY SHORT OF BREATH
3 QUITE A BIT SHORT OF BREATH
4 MODERATE SHORT OF BREATH
5 SOME SHORT OF BREATH
6 A LITTLE SHORT OF BREATH
7 NOT AT ALL SHORT OF BREATH

Appendix F

Chronic Respiratory Questionnaire (CRQ)

CRQ-Mastery

1) How often during the past 2 weeks did you have a feeling of fear or panic when you had difficulty getting your breath? Please indicate how often you had a feeling of fear or panic when you had difficulty getting your breath by choosing one of the following options from the card in front of you.

   1. ALL OF THE TIME
   2. MOST OF THE TIME
   3. A GOOD BIT OF THE TIME
   4. SOME OF THE TIME
   5. A LITTLE OF THE TIME
   6. HARDLY ANY OF THE TIME
   7. NONE OF THE TIME

2) In the last 2 weeks, how much of the time did you feel very confident and sure that you could deal with your illness? Please indicate how much of the time you felt very confident and sure that you could deal with your illness by choosing one of the following options from the card in front of you.

   1. NONE OF THE TIME
   2. A LITTLE OF THE TIME
   3. SOME OF THE TIME
   4. A GOOD BIT OF THE TIME
   5. MOST OF THE TIME
   6. ALMOST ALL OF THE TIME
   7. ALL OF THE TIME

3) How often during the past 2 weeks did you feel you had complete control of your breathing problems? Please how often you felt you had complete control of your breathing problems by choosing one of the following options from the card in front of you.

   1. NONE OF THE TIME
   2. A LITTLE OF THE TIME
   3. SOME OF THE TIME
   4. A GOOD BIT OF THE TIME
   5. MOST OF THE TIME
   6. ALMOST ALL OF THE TIME
   7. ALL OF THE TIME

Appendix F

Chronic Respiratory Questionnaire (CRQ)

CRQ-Mastery

4) How often during the past 2 weeks did you feel upset or scared when you had difficulty getting your breath? Please how often during the past 2 weeks you felt upset or scared when you had difficulty getting your breath by choosing one of the following options from the card in front of you.

1. ALL OF THE TIME
2. MOST OF THE TIME
3. A GOOD BIT OF THE TIME
4. SOME OF THE TIME
5. A LITTLE OF THE TIME
6. HARDLY ANY OF THE TIME
7. NONE OF THE TIME