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Effects of a pulmonary rehabilitation program on dyspnea, self care, and pulmonary function of patients with chronic obstructive pulmonary disease.

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EFFECTS OF A PULMONARY REHABILITATION PROGRAM ON DYSPNEA, SELF-CARE, AND PULMONARY FUNCTION OF PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

by

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A DISSERTATION

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ABSTRACT OF DISSERTATION
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Title Effects of a Pulmonary Rehabilitation Program on Dyspnea, Self-Care, and Pulmonary Function of Patients with Chronic Obstructive Pulmonary Disease

Chronic obstructive pulmonary disease (COPD) is a leading cause of disability and death in the United States. The goal of pulmonary rehabilitation is to restore the patient to the optimum level of functioning within the limitations imposed by the disease. Patients who complete multidisciplinary pulmonary rehabilitation programs frequently report positive outcomes, but published research has provided only limited support of the effectiveness of pulmonary rehabilitation.

The purpose of this study was to ascertain the effects of a pulmonary rehabilitation program (PRP) on dyspnea, self-care, and pulmonary function of patients with COPD. Orem's Self-Care Theoretical Framework was used to guide the study.

A quasi-experimental nonequivalent control group design was used with 15 patients in the treatment group and 11 patients in the control group. Treatment group patients completed a 12-week, 36-session multidisciplinary PRP.

Data collection for demographic variables and the dependent variables of dyspnea and self-care was done through home visits.

Pulmonary function results were obtained from medical records. Dyspnea was measured with two visual analog scales (VASs) and two Modified Borg Scales. Self-care was measured with the Self-Care Questionnaire developed for this study. Pulmonary function was measured by the forced vital capacity (FVC), forced expiratory flow in the first second (FEV_1), forced mid-expiratory flow ($FEF_{25\%-75\%}$), and the maximal voluntary ventilation (MVV).

No statistically significant differences between groups post-PRP were found in dyspnea, self-care, and pulmonary function. The difference between groups in self-care approached significance. The validity and reliability of the Self-Care Questionnaire were supported by the findings of this study. The rigor of the statistical procedures used to test the hypotheses, the small sample size, and the mild severity of disease characteristic of this study sample contributed to the outcomes of the study. Although dyspnea, self-care, and pulmonary function were not significantly affected by the PRP, patients who completed the program reported increased activity tolerance with less dyspnea.

Recommendations for future study included repeating this study with a larger sample, further instrument development, studies of the effectiveness of pulmonary rehabilitation programs using other variables, and studies of effective strategies to use in teaching the chronically ill.

Abstract Approved by: Committee Chairman _____

Program Director _____

Date _____ Dean of Graduate School _____

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CHAPTER I

Introduction

Pulmonary rehabilitation has been described as a new frontier in the care of patients with chronic obstructive pulmonary disease (COPD). Thomas Petty, a physician who has authored many articles as well as texts on pulmonary care, has stated: "All evidence points to the fact that rehabilitation techniques forestall both morbidity and mortality. There is more to life than just surviving, however . . . Pulmonary rehabilitation probably does more to improve quality of life than anything else . . . (1984, p. xiii).

In published research evaluating the effectiveness of pulmonary rehabilitation programs, the most frequently studied variable is pulmonary function. Most of these studies have failed to demonstrate significant changes in pulmonary function following rehabilitation programs. Some authors, however, do report conflicting results (Kochansky, Hendrix, & Markel, 1986; Sinclair & Ingram, 1980). Others question the appropriateness of pulmonary function as a measurement of effectiveness of such programs because of the progressive and irreversible pattern of chronic obstructive pulmonary disease (MacDonnell, 1981).

Dyspnea is the predominant symptom of COPD that alters the quality of life for many individuals. The severity of dyspnea may range from slight shortness of breath with moderate exertion to severe shortness of breath with the slightest physical activity, such as reaching for a glass of water (Esperson, 1988). A primary focus of pulmonary

rehabilitation is reducing the disability caused by dyspnea, thereby improving the quality of life (DeVito, 1985). Patients frequently use the subjective measure of changes in level of dyspnea to support the effectiveness of rehabilitation programs (Petty & Nett, 1981).

Education directed toward the development of self-care skills is a major component of most pulmonary rehabilitation programs (MacDonnell, 1981). Evaluation of the effectiveness of education is frequently cited in the literature to support the effectiveness of programs (Howland et al., 1986); however, post-program assessments of education usually relate to knowledge gained, not necessarily to changes in self-care actions. There is little documentation in research literature as to specific types and frequencies of self-care actions performed by patients during or subsequent to a rehabilitation program; however, these actions are considered to be the means by which the patient gains control over the disease (Ries, 1987).

The lack of published research to support numerous positive comments made by patients of the effectiveness of pulmonary rehabilitation programs led to the proposal of this study. The investigator sought to ascertain the effects of a specific pulmonary rehabilitation program on dyspnea, self-care, and pulmonary function of patients with chronic obstructive pulmonary disease.

The Problem

Impact

The impact of COPD on the individual and on society is phenomenal. In the United States the disease ranks as the fifth leading cause of death with a mortality rate that has almost tripled in the last 30 years (Bullock & Rosendahl, 1988). Lambert and Lambert (1985) reported the death rate as 30,000 per year. COPD is second only to heart disease as

the leading cause of disability among American workers receiving Social Security disability payments. COPD is also a major contributor to work time lost (Lambert & Lambert).

Symptoms

Chronic obstructive pulmonary disease is a clinical syndrome characterized by airway obstruction and/or loss of elastic recoil. Other acronyms include COLD (chronic obstructive lung disease), COAD (chronic obstructive airways disease), and CAL (chronic airway limitation (Woolcock, 1984). COPD is sometimes used as a specific diagnostic label but most often refers collectively to chronic bronchitis, emphysema, and asthma (Higgins, 1984). These diseases commonly coexist, and COPD almost always involves an interaction between at least two of the three disorders (Niewoehner, 1983). Distinguishing which of the three diseases is the primary pathologic process is often difficult because of common etiologies and symptoms. The predominant symptoms include dyspnea, cough, wheezing, and fatigue (DeVito & Kleven, 1987; Lewis & Collier, 1986; Petty, 1986).

Dyspnea, one of the most frightening of all bodily symptoms, is the problem that most often leads the person with COPD to seek health care. Brooks and Brawner (1981) opened an article with the following anonymous quote made by a patient:

> I was gasping for air, but there was none to breathe, I felt my life pass before me. I was drowning in a sea of air. If I must die, please let me take that last breath; I cannot rob my soul from it (p. 32).

Quality of life has less meaning when a "good" day is described as being able to walk to the dining room table to join the rest of the family for a meal. Quality of life becomes of primary concern as the patient increasingly feels powerless in preventing progression of the

disease. Inadequate coping mechanisms and a sense of powerlessness result in maladaptive behaviors that create a vicious cycle of increased shortness of breath, decreased activity level, and progressive weakness that only causes more dyspnea (Petty, Hudson, & Neff, 1973).

Dyspnea, or shortness of breath, results from the specific and collective pathophysiological processes that occur with chronic bronchitis, emphysema, and asthma. In chronic bronchitis, changes in the bronchial mucosa cause excessive secretion and accumulation of mucus and bronchial inflammation with edema (Bullock & Rosendahl, 1988). Obstruction to airflow results in dyspnea. In emphysema, there is enlargement and destruction of air spaces distal to the terminal bronchioles resulting in destruction of alveolar walls and the pulmonary capillary bed. Intact overdistended alveoli trap air causing the normally passive process of exhalation to become a very active process, greatly increasing the work of breathing and causing marked dyspnea (Porth, 1986). Asthma is characterized by increased reactivity of the trachea and bronchi to various stimuli resulting in airway narrowing due to a combination of bronchospasm, mucosal swelling, and increased secretions. Work of breathing, particularly for inhalation, is greatly increased and dyspnea results from closed or narrowed airways (Branscomb, 1984; Farzan, 1978).

Chronic obstructive pulmonary disease, for most patients, has an insidious onset and is progressively debilitating (Shekleton, 1987). Often the disease is well advanced when a diagnosis is made. Treatment will not reverse the pathophysiological changes in the lungs; however, treatment may slow the progression of the disease (Petty & Nett, 1981).

Diagnosis

Petty (1986) reported that 25 million Americans have some degree of chronic airway obstruction with varying degrees of physiological

impairment. The most specific diagnostic test used to assist in differentiating obstructive lung disease from other causes of impaired lung function is pulmonary function testing, specifically the measurement of forced expiratory volumes known as spirometry (Gardner & Crapo, 1983; Petty, 1986). Some authors diagnose obstructive lung disease solely on the basis of spirometry results. Petty (1986) described an obstructive defect as being present when the FEV_1 is decreased and the forced vital capacity is less than 70% to 80% of predicted. In obstructive disease, the ratio of forced expiratory volume in the first second to the forced vital capacity is less than 70% (Carroll, 1986).

Episodic exacerbations of the pathologic processes involved may alter spirometry findings. Between periods of exacerbations, lung tissues do not return to normal or to the previous state, and pulmonary damage is a slow progressive process (Bullock & Rosendahl, 1988).

Rehabilitation

Care of patients with COPD must address educational needs. Studies show that health education can increase the patient's understanding of the disease and teach self-care skills useful in coping with airway obstruction (Ashikaga, Vacek, & Lewis, 1980). However, Howland and colleagues (1986) concluded that education programs for COPD patients are unlikely to improve the patient's health status unless the programs are part of comprehensive rehabilitation that includes physical conditioning.

Rehabilitation has been defined as the process by which disabled individuals are provided opportunities to develop self-care skills necessary to return to the highest possible level of independent functioning (Branscomb & Weems, 1986; Knust & Quarn, 1983). Comprehensive pulmonary rehabilitation programs, in which nurses play a vital role, utilize a multidisciplinary approach to achieve this goal (Moser, Bokinsky, Savage,

Archibald, & Hansen, 1980). Early assessment of educational, physical, and psychological needs is important in designing a comprehensive plan for rehabilitation specific to the individual (Harris, 1985). Nurses participate in the development of this plan, assist patients in the identification of options, and implement nursing actions to assist the patient in the development of self-care skills to maximize independence (Knust & Quarn).

In pulmonary rehabilitation, as in other areas of nursing practice, much of what nurses do has been derived empirically without adequately controlled testing and is based on personal professional practice experience as well as on the practice experience of others (Lagerson, 1979). The effectiveness of most therapeutic elements of pulmonary rehabilitation has not been established (MacDonnell, 1981). Little research has been done related to self-care activities of patients with COPD. Although most nursing texts or articles dealing with the care of patients with COPD address educational needs, few published studies identify specific self-care activities and the effects of educational programs on self-care actions.

Pulmonary rehabilitation programs are said to reduce numbers of rehospitalizations, reduce overall costs of care, and improve the quality of life (Callahan, 1985; Dudley, Glaser, Jorgenson, & Logan, 1980; Fishman & Petty, 1971; MacDonnell, 1981; Moser et al., 1980; Ries, 1987; Toevs, Kaplan, & Atkins, 1984). The problem lies in the fact that research does not clearly support the effectiveness of pulmonary rehabilitation programs. Thus, funding for such programs will continue to be limited, restricting access to patients who could benefit from them.

Even when programs are locally available, many physicians will not refer patients due to program costs and the lack of documented effectiveness (Callahan, 1985).

Purpose

The purpose of this study was to ascertain the effects of a specific pulmonary rehabilitation program on dyspnea, self-care, and pulmonary function of patients with chronic obstructive pulmonary disease.

Significance of Study

Nurses participate in providing comprehensive health care to patients with COPD. Comprehensive care addresses principles of rehabilitation, whether the care is given through an established pulmonary rehabilitation program or in a general acute or primary care setting.

The American Nurses' Association (1980) defines nursing as "the diagnosis and treatment of human responses to actual or potential health problems" (p. 9). These human responses are the phenomena of concern to nurses. Dyspnea is clearly a human response to a "perceived inability to breathe normally" (Moser, 1977, p. 220) and is an appropriate focus for nursing research. In a broad sense, self-care is a human response to a health problem, and pulmonary function is a physiologic measurement of the human response to the disease process. Thus, self-care and pulmonary function are phenomena of concern to nurses and are appropriate foci for nursing research.

In patients with COPD, inadequate coping mechanisms and a sense of powerlessness result in other human responses of maladaptive behaviors Pulmonary rehabilitation programs are described as effective in breaking the cycle of increased dyspnea caused by maladaptive responses (Fishman & Petty, 1971). However, the lack of published research

documenting significant improvement in objective parameters following pulmonary rehabilitation programs retards the development of such programs.

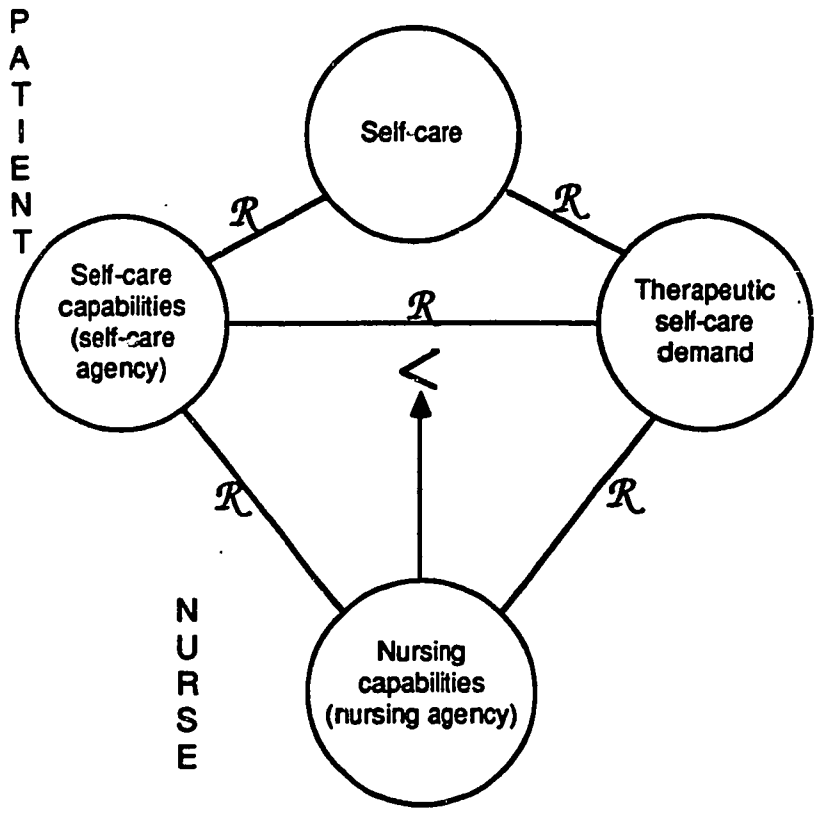
Pulmonary rehabilitation is described as a new frontier in the care of patients with lung disease (O'Ryan & Burns, 1984). This new frontier needs to be explored and studied through formal research to evaluate the effectiveness of the goals of pulmonary rehabilitation. The goals are to maximize independent functioning in activities of daily living, to increase activity tolerance and efficient energy expenditure through exercise and physical training, and to educate patients regarding the disease process, medications, and therapeutic techniques (Harris, 1985).

Theoretical Framework

Dorothea Orem has developed a theoretical framework of self-care which serves adequately as a basis for rehabilitation nursing practice (Knust & Quarn, 1983; Orem, 1985a; Porter & Shamian, 1983). The theoretical framework consists of three constructs; the Theory of Self-Care, the Theory of Self-Care Deficits, and the Theory of Nursing Systems. Orem's theoretical framework was used to guide this study and is illustrated in Figure 1.

Orem (1971, 1980, 1985a, 1985b) defines self-care as "the practice of activities that individuals personally initiate and perform on their own behalf in maintaining life, health, and well-being" (Orem, 1985b, p. 84). Self-care requisites are described as "the purposes to be attained through the kinds of actions termed self-care" (Orem, 1985b, p. 85). Three types of self-care requisites are identified:

1. Universal self-care requisites which are common to all human beings;



R = relationship

< = deficit relationship, current or projected

Figure 1. Orem's Conceptual Framework for Nursing

Note. From Nursing: Concepts of practice (3rd ed.) (p. 32) by Dorothea Orem, 1985, New York: McGraw-Hill. Copyright 1985 by McGraw-Hill. Reprinted by permission. (See Appendix A for related correspondence).

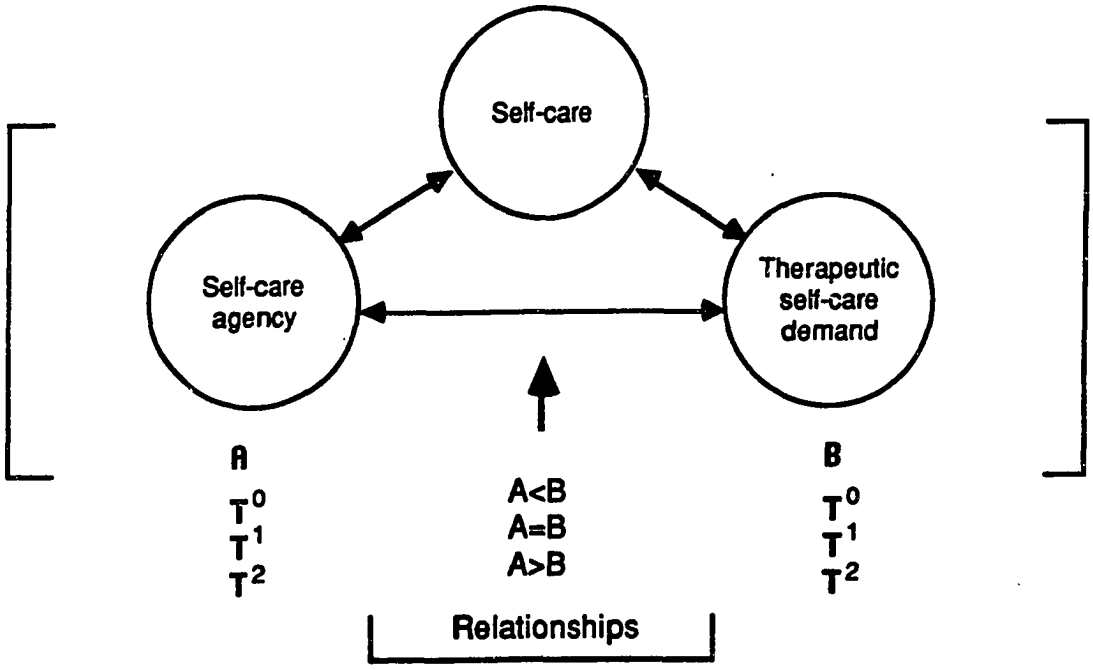
2. Developmental self-care requisites associated with human developmental processes and with conditions and events occurring during various stages of the life cycle; and

3. Health deviation self-care requisites which result from genetic and constitutional defects, human structural and functional deviations, and medical and diagnostic and treatment measures (Orem, 1985b, p. 90).

The self-care requisites determine the therapeutic self-care demand which Orem (1985b) defines as "the totality of self-care actions to be performed for some duration in order to meet known self-care requisites" (p. 88). In determining the therapeutic self-care demand of a patient with COPD, the universal self-care requisite of maintenance of a sufficient intake of air may assume primary importance. In other less acute periods, forced early retirement may lead to a greater therapeutic self-care demand as it reflects a developmental self-care requisite. The day-by-day living with the disease creates health deviation self-care requisites. A patient's total therapeutic self-care demand varies according to the self-care requisites which exist at a given point in time.

Therapeutic self-care care demand establishes areas in which self-care is needed. Self-care agency refers to the power or ability to engage in self-care. The specifications for self-care agency, as well as the specific self-care activities, are determined by the therapeutic self-care demand (Nursing Development Conference Group, 1979). Self-care activities of patients with COPD generally fall within the types of activities included in breathing retraining, energy conservation, exercise reconditioning, and lifestyle changes.

Orem (1985a) uses the relationship between self-care agency and therapeutic self-care demands to determine when nursing care is needed. Figure 2 illustrates this relationship. When the patient's self-care



T = Time

Figure 2. Adequacy Values of Self-Care Agency as Related to Therapeutic Self-Care Demand May Vary Over Time

Note. From Nursing: Concepts of practice (3rd ed.) (p. 106) by Dorothea Orem, 1985, New York: McGraw-Hill. Copyright 1985 by McGraw-Hill. Reprinted by permission. (See Appendix A for related correspondence).

demand exceeds self-care agency, a self-care deficit results. According to Orem's Theory of Self-Care Deficits, a need for nursing exists only when a self-care deficit is present or can be projected. If the therapeutic self-care demand is less than self-care agency, a self-care deficit does not exist, and nursing is not needed. However, if the therapeutic self-care demand is greater than the self-care agency, a self-care deficit does exist, and nursing is needed.

Orem (1985b) stated that the Theory of Self-Care Deficits serves as the core of her general comprehensive theory of nursing. The third theory included in Orem's framework is the Theory of Nursing Systems which is illustrated in Figure 3 and provides the basis for nursing agency to therapeutically meet self-care requisites of the individual in the presence of a deficit relationship. Three nursing systems are identified: (a) wholly compensatory nursing system, (b) partly compensatory nursing system, and (c) supportive-educative nursing system.

Patients who need wholly compensatory nursing care include: (a) those who are unresponsive to stimuli and unaware of their environment, (b) those who are alert and able to make decisions regarding self-care but are unable to initiate self-care actions due to physical limitations, and (c) those who are alert and physically able to perform self-care actions but lack the ability to make rational and reasonable judgements about their care. These patients need a nurse to perform self-care actions for them.

Patients who need partly compensatory nursing care are those who are able to perform some self-care actions but need the nurse to: carry out other self-care actions, to guide and direct self-care actions performed by the patient, to provide physical assistance with self-care actions, to provide psychological support, to control or regulate the

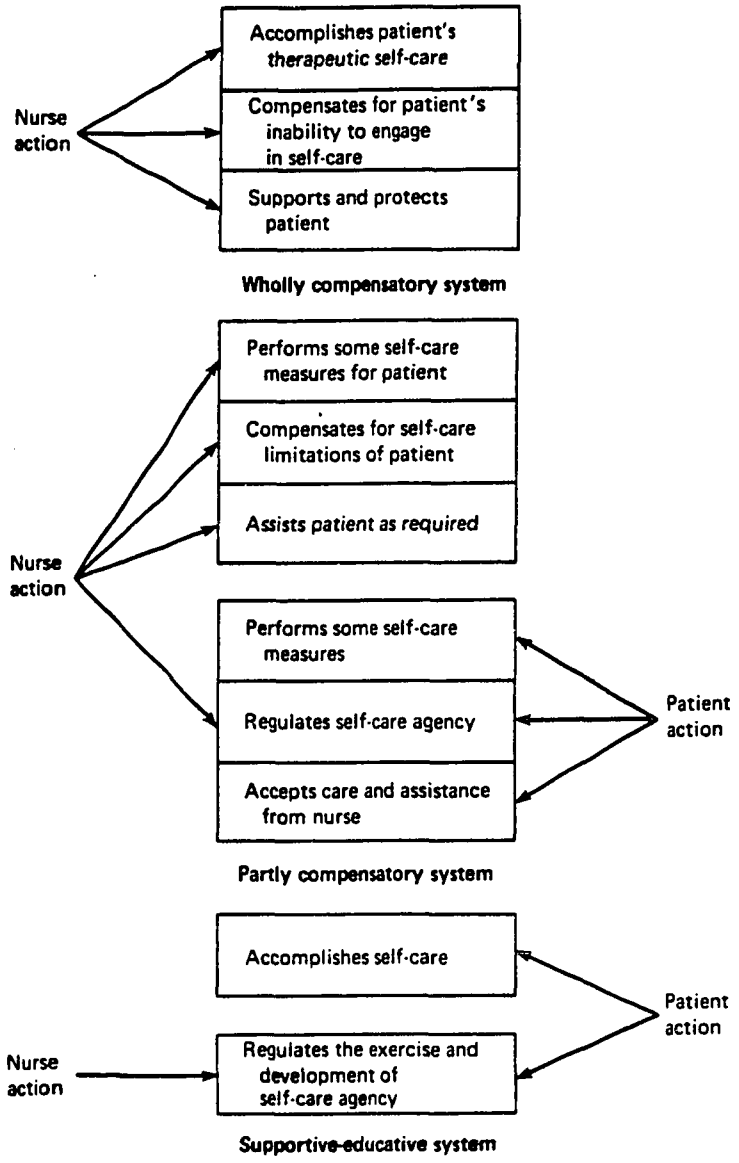


Figure 3. Basic Nursing Systems

Note. From Nursing: Concepts of practice (3rd ed.) (p. 153) by Dorothea Orem, 1985, New York: McGraw-Hill. Copyright 1985 by McGraw-Hill. Reprinted by permission. (See Appendix A for related correspondence).

environment, or to teach knowledge and skills necessary for continuous and effective self-care. In the partly compensatory nursing system, responsibility for self-care is shared by the patient and the nurse.

Patients in the supportive-educative nursing system are those who need periodic guidance or who are able and can learn to perform self-care actions but cannot do so without assistance. The nurse provides guidance and support, provides a suitable learning environment, and teaches self-care knowledge and skills.

Orem's theoretical framework of self-care is an appropriate basis for rehabilitation nursing and was used to guide this study. Nurses caring for patients in a rehabilitative setting are viewed as functioning within the supportive-educative nursing system described by Orem (1985a). The role of the nurse, as described and addressed in this study, is presented as the role functions and responsibilities of a nurse practicing within the supportive-educative nursing system. Orem's three categories of self-care requisites (universal, developmental, and health deviation) were used to generate a list of self-care behaviors specific to patients with COPD. The list of self-care behaviors was used to develop the Self-Care Questionnaire instrument tested in this study. Although the self-care theoretical framework is complex, its applicability to rehabilitation nursing renders the framework a practical basis for guiding this study.

Hypotheses

For statistical purposes, the six hypotheses were stated in null form:

1. There is no significant difference in dyspnea between control and treatment groups post-pulmonary rehabilitation program (post-PRP)

as measured by the Usual Dyspnea Visual Analog Scale (VAS), Worst Dyspnea VAS, Usual Dyspnea Modified Borg Scale, and Worst Dyspnea Modified Borg Scale.

2. There is no significant difference in self-care between control and treatment groups post-PRP as measured by the summative score on the Self-Care Questionnaire.

3. There is no significant difference in pulmonary function between control and treatment groups post-PRP as measured by the FVC, (forced vital capacity), FEV_1 (forced expiratory flow in the first second), $FEF_{25\%-75\%}$ (mean forced expiratory flow during the middle half of the forced vital capacity), and MVV (maximal voluntary ventilation).

4. The amount of variance in dyspnea explained by the demographic variables of age, sex, race, marital status, education background, income range, number of years since first noticed shortness of breath, pack years, and health locus of control is equal to 0.

5. The amount of variance in self-care explained by the demographic variables is equal to 0.

6. The amount of variance in pulmonary function explained by the demographic variables is equal to 0.

Definition of Terms

The following terms were defined theoretically and operationally for the purposes of this study.

Pulmonary Rehabilitation Program (PRP) - The PRP in this study was a 12-week, 36-session rehabilitation program provided by a selected facility in the southeastern United States for patients with pulmonary disorders.

Dyspnea - Dyspnea was defined as the subjective perception of difficult breathing that interfered with desired activities and lifestyle.

Operationally defined, dyspnea was the patient's scores on the Usual Dyspnea VAS (visual analog scale), Worst Dyspnea VAS, Usual Dyspnea Modified Borg Scale, and Worst Dyspnea Modified Borg Scale.

Self-Care - Self-care was defined as the process by which an individual assumes an active decision-making role in the performance of activities that allow the individual to function effectively in promoting or maintaining the individual's optimum state of health. Operationally defined, self-care was the patient's summative score on the Self-Care Questionnaire.

Pulmonary Function - Pulmonary function was the spirometry measurement obtained by standardized pulmonary function testing equipment of forced expiratory airflow volumes and maximum voluntary ventilation. The variable pulmonary function (operational) had four levels: The FVC, FEV_1, $FEF_{25\%-75\%}$, and MVV. The terms pulmonary function and spirometry are used interchangeably in this study. Although spirometry is a more specific term, pulmonary function was chosen as the name for this variable to facilitate retrieval of this study from publication indices.

FVC - The FVC or forced vital capacity is the maximum amount of air an individual can exhale after a maximal forced inhalation (Guenter & Welch, 1982). Operationally defined, FVC was the ratio of the patient's FVC to the predicted forced vital capacity of an individual of the same age, sex, and height, under standard laboratory conditions and was reported as percentage of predicted.

FEV1 - The FEV_1, or forced expiratory flow in the first second, is the volume of air exhaled during the first second of a forced vital capacity maneuver (Harper, 1981). Operationally defined, FEV_1 was the

ratio of the patient's FEV_1 to the predicted FEV_1 of an individual of the same age, sex, and height, under standard laboratory conditions and was reported as percentage of predicted.

FEF 25%-75% - The $FEF_{25\%-75\%}$ is the mean forced expiratory flow during the middle half of the FVC (Harper, 1981). Operationally defined, $FEF_{25\%-75\%}$ was the ratio of the patient's $FEF_{25\%-75\%}$ to the predicted $FEF_{25\%-75\%}$ of an individual of the same age, sex, and height, under standard laboratory conditions and was reported as percentage of predicted.

MVV - The MVV, or maximal voluntary ventilation, is the volume of air exhaled in a 60-second time period during repetitive respiratory effort (Sobol, 1983). Operationally defined, MVV was the ratio of the patient's MVV to the predicted MVV of an individual of the same age, sex, and height, under standard laboratory conditions, and was reported as percentage of predicted.

Patient - Patient was defined as an individual who was under the care of health care professionals. This definition was adapted from Orem's (1985b) definition of patient. In this study, patient was operationalized as an individual diagnosed with COPD.

Chronic Obstructive Pulmonary Disease (COPD) - COPD was defined as diseases of uncertain etiology characterized by persistent slowing of airflow during forced expiration (American College of Chest Physicians & American Thoracic Society, 1975). COPD is described as a clinical syndrome resulting from the individual and/or collective pathophysiological effects of chronic bronchitis, asthma, and emphysema (Daly, 1985).

Pack Years - Pack years was an indicator of smoking history and was treated as a demographic variable. Operationally defined, the

variable pack years was the number of packs of cigarettes smoked per day multiplied by the number of years smoked (Lewis & Collier, 1986).

Health Locus of Control (HLC) - HLC was treated as a demographic variable and defined as a psychological variable which reflects the perceived locus of control over one's health (Wallston & Wallston, 1978). Operationally defined, HLC was the three scores on the internal (IHLC), chance (CHLC), and powerful others (PHLC) subscales on the Modified Multidimensional Health Locus of Control (MHLC) scale.

Assumptions

1. Participants in the study had the motivation and energy to develop and practice self-care skills.

2. Participants in the study had the cognitive ability and disposition to develop and practice self-care skills.

3. Educational programs presented to treatment group patients did not vary in content or method of presentation.

4. Patients were able to comprehend and respond appropriately to items on the instruments used in data collection.

5. Pulmonary function measurements were obtained under appropriate testing conditions with maximal patient cooperation.

6. Differences in dyspnea, self-care, and pulmonary function were not significantly affected by the specific obstructive disease process(es) present in each patient.

Limitations

1. The study sample was one of convenience, and the investigator was unable to randomly select participants for either the control or treatment group.

2. The study sample was small diminishing the power of statistical analyses to infer real differences between treatment and control groups.

3. The treatment group involved patients from only one pulmonary rehabilitation program.

Summary

The purpose of this study was to ascertain the effects of a pulmonary rehabilitation program on dyspnea, self-care, and pulmonary function of patients with COPD. Dyspnea is the major variable by which patients evaluate the effectiveness of pulmonary rehabilitation programs. Pulmonary function has been the variable most frequently assessed by professionals in evaluating effectiveness of PRPs; however, most studies show no statistically significant changes. The effectiveness of the educational component of pulmonary rehabilitation programs has been assessed in measures of knowledge gained rather than actual behavioral change. Few studies published relate to the self-care activities of patients with COPD.

This study combined the three dependent variables of dyspnea, self-care, and pulmonary function to ascertain the effects of a PRP. The need for this study was supported by the discrepancy between published research, using objective measures, which failed to support the effectiveness of pulmonary rehabilitation programs in the presence of subjective statements and objective findings indicating improvement in the patient's condition. The variables addressed in this study were not assessed in combination in published research at the time the study was conducted.

CHAPTER II

Review of Literature

To organize the review of the volume of literature related to the variables considered in this study, the following approach was used. Studies related to the assessment of dyspnea are first presented. Self-care literature, in general, is then reviewed followed by self-care as specifically applied to COPD. Selected literature addressing pulmonary function is addressed. Finally, literature related to pulmonary rehabilitation programs is presented.

Dyspnea

Dyspnea may be experienced under a variety of circumstances. Strenuous activity leads to dyspnea in healthy persons, but in those with compromised lung function, minor activity can precipitate shortness of breath, or dyspnea may occur even at rest (DeVito & Kleven, 1987). The sensation of dyspnea is subjective in nature and includes both the perception of difficult breathing and the reaction to that sensation (Comroe, 1974). The very anxious person may complain of dyspnea on minimal exertion with minimal lung disease, while the stoic appears not to be bothered even though moderate to severe respiratory insufficiency exists. Moser (1977) reported the case study of a 64-year-old businessman who was visiting a nearby city for an important business conference. He became suddenly short of breath and lost consciousness with severely labored respirations that led to a respiratory arrest. His close business associates reported to emergency personnel that he had been in

"vigorous" health without physical complaint. The tentative diagnosis of a massive pulmonary embolus was made and appropriate treatment initiated. When family members arrived, they reported he had been under the care of a physician, and they had noticed increasing shortness of breath with exertion, but he refused to discuss it with them. His family reported he had progressively structured his life so that the dyspnea would not be apparent, especially to his business associates. Further diagnostic tests revealed severe respiratory failure superimposed on marked COPD. An autopsy showed extensive pulmonary emphysema and pneumonia. No emboli were found.

At the other end of the spectrum is the patient who came to the emergency room complaining of severe shortness of breath, chest pain, tingling around the mouth, and dizziness. Arterial blood gases indicated respiratory alkalosis consistent with hyperventilation. Further assessment data included a statement by a family member that the patient had received a phone call concerning the death of a close relative shortly before the onset of dyspnea. Treatment of this patient included breathing into a paper bag. The patient was discharged and sent home.

Both situations represent patients with dyspnea. The dyspnea was just as real to the patient with hyperventilation as it was to the patient in acute respiratory failure. Studies have repeatedly shown that physiological measures of lung function such as lung volumes, expiratory flow rates, oxygen consumption, and arterial blood gases have shown minimal correlation with report of dyspnea (Janson-Bjerklie, Carrieri, & Hudes, 1986). Dyspnea is a subjective experience and is difficult for another person to quantify. Attempts to assess dyspnea must include subjective measures.

Early investigators conducted studies using exercise testing to measure exertion dyspnea based on the idea that dyspnea is the result of increased work of breathing. Hugh-Jones (1952) used an exercise test to measure respiratory work with a breathlessness scale on which patients were asked to identify their perception of their breathlessness. The investigator reported general agreement between the physiologic measure, termed dyspnea index, and the patient's perception of dyspnea.

The breathlessness scale used in Hugh-Jones' (1952) study was the earliest reported clinical scale and had been in use for several years to establish clinical grades of breathlessness (Fletcher, 1952). The Fletcher scale ranged from grade 1: "Is the patient's breath as good as that of other men of his own age and build at work, on walking and climbing hills and stairs"? (p. 577) to grade 5: "Is the patient breathless on talking or undressing, or unable to leave his house because of breathlessness?" (p. 577). The standardized respiratory disease questionnaire published by the American Thoracic Society (1978) contained a scale known as the Grades of Breathlessness Scale, or GBS, which also had five levels or grades of dyspnea. Investigators who used either Fletcher's Scale or the GBS assigned a grade of dyspnea according to the level of activity necessary to produce shortness of breath. The wording of the GBS was similar to Fletcher's scale. The investigator assigned the grade of dyspnea, for data collection purposes, based on the patient's response to questions about what caused dyspnea.

Haas, Pineda, Haas, and Axen (1979) expanded the concept of dyspnea to functional capacity in evaluating patients for pulmonary rehabilitation. This scale used five functional classifications reflecting the extent to which dyspnea affects a person's way of life. The classifications ranged from full functional capacity (Class A) with

insignificant COPD symptoms, to no remaining functional capacity (Class E) indicating that the individual had dyspnea at rest, was confined to a wheelchair or bed, and was completely dependent on others to carry out activities of daily living.

A serious limitation of these scales may be that the level or grade of dyspnea was assigned by the investigators based on the patient's responses. The grade of dyspnea was not selected by the patient. Another limitation was that the levels of dyspnea were not distinct and were subject to individual interpretation.

In 1982, Burdon, Juniper, Killian, Hargreave, and Campbell used a modification of the Borg scale to assess dyspnea. The original Borg scale measured perceived exertion on a digital scale which ranged from 6 to 20. Odd numbers on the scale were labeled beginning with the number 7. The scale ranged from very, very light, the description given for number 7, through the number 19, which was labeled very, very hard (Borg, 1970). This format for a scale is known as a Cantril ladder (Engle, 1984) which is anchored at the ends by labels of extremes connected by an incremental ladder-like scale with the rungs or points between labeled incrementally from one extreme to the other. Borg (1978) and others have extensively used this scale in research related to exercise physiology. Morgan (1973) modified the original exertion scale so that it began with the number 1, instead of 6, and continued through number 20. He also added a few more rungs, or labeled numbers, in his study of perceived exertion and work intensity.

In the modification of the Borg scale by Burdon and others (1982), words describing increasing levels of breathlessness were anchored to numbers between 0 and 10. In their study, the scale was used to measure

perception of breathlessness in patients with asthma. Each subject was asked to select a number from the scale whose words most appropriately described his sensation of breathlessness at that particular time. The patient's perceived dyspnea score from the scale was found to have a .88 correlation with the patient's forced expiratory flow in the first second (FEV_1).

Harries, Booker, Rehahn, and Collins (1983) used the original Borg scale for perceived exertion and a visual analog scale (VAS) to assess breathlessness in subjects who participated in a walking test. The correlation between the two measures of dyspnea was not given; however, the distance walked did not correlate significantly with either measure of dyspnea.

Visual analog scales have been used to measure depression, mood, pain, and nausea (Aitken, 1969; Folstein & Luria, 1973; Huskisson, 1974; Ohnhaus & Adler, 1975; Pace, 1986; Scott & Huskisson, 1987; Steptoe & Holmes, 1985; Zealley & Aitken, 1969). Dyspnea has also been measured in several studies using a visual analog scale. A VAS consists of a measured line with descriptive phrases at each end (Carrieri, Janson-Bjerklie, & Jacobs, 1984).

In 1982, Stark, Gambles, and Chatterjee reported a study which opened with the statement "A new test for assessing clinical dyspnoea [sic] with greater precision has been devised" (p. 269). Patients walked on a treadmill while ventilation was measured, and dyspnea was assessed before, during, and after the exercise with a VAS. To anchor the maximum point on the VAS, the patient was instructed to compare it to an activity "which induced breathlessness of a severity which was easily recalled by the patient" (p. 270). While the patient walked on the treadmill, the VAS was repeatedly administered at 1-minute intervals

by a computer connected to a television screen suspended in front of the patient. The line measured 20 cm with the minimal end labeled not at all breathless and the maximal end labeled very breathless. The patient response was made by using finger controls. Five patients with asthma were recruited for this study. They were tested twice with a 5-day interval between tests. The relationship between dyspnea scores, as measured by the VAS and ventilation, was reported to show intra-subject reliability.

Belman, Rambhatla, Blair, and Sieck (1983) exercised seven patients with COPD on a treadmill once a day for 5 consecutive days. At the end of each minute of exercise, the speed of the treadmill was increased with the treadmill maintained at 0% grade. Also, at the end of each minute, the patient made a mark on the 10 cm VAS which ranged from not breathless to severely breathless. Physiologic measures included the expired volume per minute of mixed oxygen and carbon dioxide and heart rate. The VAS breathlessness scale was found to be a repeatable measure of dyspnea and showed less variability than the physiologic measurements.

The previous studies were published by physicians. Articles and studies addressing the phenomenon of dyspnea have also been published by nurses. Carrieri et al. (1984) proposed the use of a 10 cm VAS labeled at the extremes as no difficulty breathing and unable to breathe, in combination with a modification of the American Thoracic Society's (ATS) Grades of Breathlessness Scale (1978) in the assessment of patients with dyspnea. This was not a study, but a review of articles discussing the use of the VAS in assessing dyspnea. Their conclusions were:

> . . . visual analog scales seem to be the most appropriate for measuring acute changes and documenting patterns in the degree of dyspnea exhibited by chronically ill patients. This type of scale . . . could provide a rapid measure of efficacy of various therapeutic procedures, such as airway suctioning, chest physiotherapy, and ventilation adjustment (p. 441).

Subsequent to this article, Carrieri and Janson-Bjerklie (1986) published a study which assessed dyspnea using the original ATS Grades of Breathlessness Scale and two 100mm VASs measuring usual and worst dyspnea. Sixty-eight patients with diagnosed pulmonary disease were included in this study and were grouped by disease. The measurements of dyspnea were obtained for descriptive purposes only. The focus of the study was to identify strategies patients used to cope with dyspnea. The mean grade of breathlessness on the GBS was 3.24. The VAS scores for worst dyspnea showed no significant differences among groups, although the patients with asthma had a higher mean score. There was a significant difference among groups on usual dyspnea with the patients diagnosed with asthma reporting the lowest score.

In another article related to the same study (Janson-Bjerklie et al., 1986) more information was provided related to the measurements of dyspnea. The instructions given to the patients for the usual dyspnea VAS were to mark the line "at the point they believed corresponded to the usual dyspnea experienced" (p. 155) and the worst dyspnea VAS was to be marked "at the point indicating the worst dyspnea they had felt" (p. 155). The correlation between the usual dyspnea VAS score and the GBS score was considered to be significant (r = .40, p = .001) and was thought to provide evidence for concurrent validity of the dyspnea VASs. The usual dyspnea VAS score was subtracted from the worst dyspnea VAS score to obtain a dyspnea intensity score which was used to approximate

the variation in the intensity of the sensation of dyspnea. Asthmatic patients had the highest mean difference score and differed significantly from the other disease groups.

Because patients with asthma differed in their dyspnea experiences from persons with other obstructive pulmonary diseases, a subsequent study of predictors of dyspnea intensity only included patients with asthma (Janson-Bjerklie, Ruma, Stulbarg, & Carrieri, 1987). The sample included 31 asthmatic patients. The VAS in this study was a 100mm line anchored at the ends with the words no difficulty breathing and extreme difficulty breathing. Patients came to the laboratory 2 days. On the first day, after informed consent and demographic data were obtained, subjects rated their baseline dyspnea on the VAS. Baseline airway resistance was also measured. Bronchoconstriction and dyspnea were induced with methacholine, a cholinergic drug, administered by a hand-held nebulizer with a dose-metering device until airway resistance increased by 100% or by eight units (centimeters of water per liter per second), whichever was greater. Subjects rated their dyspnea on the VAS 30 seconds after each methacholine dose was administered. Bronchoconstriction was reversed with the administration of albuterol, a bronchodilator. The amount of airway resistance was not found to be related to the magnitude of dyspnea (r = .03, p = .86). Baseline dyspnea was considered to be related to dyspnea during induced bronchoconstriction (r = .44, p = .01). On the second day of the study, cough was induced with an ultrasonic nebulizer to examine the relationship between cough and dyspnea. Subjects rated their dyspnea on the VAS at several points during the procedure. A significant difference was found between males

and females in the intensity of dyspnea at the point when cough was induced. The mean dyspnea score for males was 36 and 13.6 for females (p = .007).

Carrieri et al. (1984), in their review of literature, clearly identified a need for research on all aspects of dyspnea to gain an understanding of this human response to a health problem. Specifically, the need for research related to the development of dyspnea, self-care behaviors, and strategies to manage dyspnea were identified as foci of study. Methods used in pulmonary rehabilitation programs which may or may not relieve dyspnea were listed and the need for research to evaluate their effectiveness was addressed.

Self-Care

Although much has been written about self-care, research related to self-care in specific patient populations is limited and does not address the basic concept of self-care. A review of articles specifically addressing self-care in COPD patients follows this general section on self-care. Thirty-six other articles were reviewed which were indexed under the heading self-care. Thirty (83%) of these articles had nurse authors. The other six articles were authored by physicians and behavioral scientists.

The most prevalent definition of self-care in nursing literature was that of Dorothea Orem (1986b). Her definition was used in 13 articles. Anna, Christensen, Hohon, Ord, and Wells (1978) tested Orem's conceptual framework with nursing home patients who had cerebrovascular accidents (CVA). The researchers' attempt to examine all the major concepts in Orem's framework proved to be a difficult task because of the abstract nature of the concepts. The CVA patients needed much encouragement to assume a more active role in their own care. However,

Anna and colleagues saw changes in attitudes during the time they worked with these patients. The researchers found that cultural differences in perception of the sick role influenced the level of participation in self-care.

Sullivan and Monroe (1986) stated that for the elderly "self-care equals health equals independence" (p. 17). For the independent elderly, health is diminished to the extent that self-care ability is absent. In two case studies, Sullivan and Monroe (1986) demonstrated how the application of self-care theory enabled elderly patients to regain the ability to provide self-care and, as a result, regain independence.

In another direct application of Orem's Self-Care Theory to the care of the elderly patient, Clark (1986) sought to identify facilitators and inhibitors to clinical application of the theory. Five factors that aided the use of the theory were identified as facilitators and included the patient's desire to be independent, the nurse-patient relationship, mutual goal setting, the nurse's knowledge base, and the self-care plan which was developed. Inhibitors, or factors that deterred use of the theory, included the large number of concepts in the theory and the lack of published case studies with care plans based on the theory. Clark included a self-care plan in the article.

Gallant and McLane (1979) applied the concept to nursing administration by using Orem's definition of self-care and Lang's Model for quality assurance to validate outcome criteria for postoperative cardiovascular patients. The researchers developed a tool to evaluate knowledge and perceived ability to perform self-care behaviors. Knowledge and perceived ability are part of Orem's self-care agency construct. Gallant and McLane concluded that the outcome criteria were congruent with self-care. In another nursing administration application, Clinton, Denyes,

Goodwin, and Koto (1977) used Orem's theoretical framework to develop criterion measures of nursing care. These authors utilized Orem's self-care requisites to develop outcome criteria for use in evaluating the effectiveness of nursing care and published the article early in the development phase of the instrument.

Zinn (1986) reported the application of many of Orem's self-care concepts in developing and implementing a self-care education program for hemodialysis patients. The author stated that as a result of this program, patients could regain some control over their lives and gain self-esteem and confidence.

Williams (1986) published an assessment tool which was being tested in a generic baccalaureate nursing program at the time of publication. The tool was based on Orem's universal, developmental, and health deviation self-care requisites and was used by students to identify self-care deficits of patients. Alterations in self-care requisites served as the basis for formulation of nursing diagnoses and planning of care using Orem's nursing systems.

Kearney and Fleischer (1979) applied Orem's definition of self-care in the development of an instrument to test what they conceptualized as "exercise of self-care agency." The instrument listed 43 self-care behaviors and was administered to healthy individuals. Kearney and Fleischer concluded that their instrument was reliable and valid. Fitzpatrick and Whall (1983), in their discussion of this study, cite a lack of clarity in the conceptualization of "exercise" as used with self-care agency.

Woods (1985) sought to identify specific self-care activities and studied self-care practices among young adult married women. A sample of 96 women kept a daily health diary for 3 weeks in which they reported

their regular health care, symptoms experienced each day, and self-care actions taken in response to symptoms. A total of 1,140 activities were reported. Woods applied Orem's definition of self-care as well as the concepts of universal and health deviation self-care requisites to identify specific self-care actions.

Gulick (1987) reported the development and refinement of an instrument to measure activities of daily living (ADL) among persons diagnosed with multiple sclerosis. Orem's self-care framework was used to guide the development of the ADL self-care scale. Universal and developmental self-care requisites were reflected in the scale. The instrument was reduced from 60 items to 15 items utilizing the statistical procedure of factor analysis. Although the need for further testing of the scale was suggested, the usefulness of the scale in assessing ADL was supported.

One purpose of Pace's (1986) study of leukemia patients receiving chemotherapy was to identify self-care actions utilized in the clinical setting to relieve nausea and vomiting. Patients were also questioned about the effectiveness of the actions. Individuals reported a variety of self-care actions which they described as effective. The request for an antiemetic medication was considered an important and effective self-care action for both nausea and vomiting. Orem's theoretical framework was used to guide the study.

In a study involving children, Kruger, Shawver, and Jones (1980) used Orem's framework to describe behavior changes of siblings in families who had a child with cystic fibrosis. Fourteen families were interviewed. Changes in sibling behavior were used synonymously with changes in self-care practices of siblings. The authors identified methods by which nurses could meet the assistance needs of these families.

Clements (1985) applied Orem's framework in dissertation research addressing the relationship between self-care activities and knowledge, age, sex, and duration of diabetes in children. An instrument was developed which identified appropriate self-care actions. Included in this report of research was a detailed discussion of how reading level and reliability of the instrument was assessed.

Based on Orem's framework, Stullenbarger (1984) used Q methodology to formulate an approach to the investigation of self-care abilities. Children were presented with a 60-item deck of cards to sort into piles along a continuum from "most like me" to "least like me." The findings suggested that children may be capable of active participation in their own health care.

Sirles (1988) studied the effects of a self-care health education program on parents' knowledge and children's medical utilization rates. Orem's framework was used to guide the study. Instruments included a self-care knowledge questionnaire given to parents in control and treatment groups. The treatment group demonstrated increased self-care knowledge scores ($p = .001$); however, no difference was found between groups in children's medical utilization rates.

Two other studies defined self-care according to Orem but specifically studied self-care agency (Denyes, 1982; Stockdale-Woolley, 1984). Five studies applied some aspect of Orem's conceptual framework but did not use Orem's self-care definition. Dickson and Lee-Villasenor (1982) did not include a definition of self-care but used Orem's conceptual framework as modified by Kinlein (1977), a nurse generalist in independent practice.

Goodwin (1979) applied Orem's conceptual framework in the development of a programmed instruction module for patients recovering from pulmonary surgery. The primary focus of this study was education for self-care.

Harper (1984) tested Orem's theoretical constructs in a study of self-medication behaviors of black, elderly, hypertensive patients. The definition used by Harper for self-care was not Orem's, but that of a behavioral scientist. Results initially supported improved knowledge of medications and self-care behaviors following an experimental program; follow-up analysis, however, revealed a diminutive effect. The experimental program combined teaching with performance testing of self-medication behaviors. Five study hypotheses were deduced from four propositions Orem made about self-care. Harper concluded the results of this study supported Orem's propositions.

Of the 30 nursing research articles related to self-care, the majority were applying some aspect of Orem's theoretical framework. Harper was the only investigator who attempted to validate Orem's basic construct of self-care. The nine remaining studies applied various definitions, if any, of self-care, and used various theoretical frameworks. Crockett (1982), using psychiatric subjects and controls, defined self-care as practices developed for coping with one's psychiatric illness and conducted a descriptive study of self-reported development of coping beliefs and practices. Crockett's study did attempt to answer the basic question so infrequently addressed in the literature of "What is self-care?" or "What constitutes self-care in a specific population?".

Michael and Sewall (1980) studied the use of the peer group in increasing self-care agency of selected adolescents. Pridham (1971) defined self-care as the self-management of day-to-day needs of a child

with diabetes in a study describing the nurses' assessment of a child's readiness for self-care instruction. Dewey's conceptualization of the education process was used as the theoretical framework. Roberts (1982) attempted to assess how the perceptions of the nurse compared to the patient's perceptions of his/her problems. Using a modification of the National Conference Group's 37 nursing diagnoses, Roberts found that patients identified self-care as a problem, while the nurses viewed non compliance as the problem.

Connelly (1987) cited Orem but used Levin's (1976) definition of self-care in an article addressing self-care in the chronically ill. A model, which was a modification and extension of the health belief model, was proposed to serve as a framework for clinical decision-making in promoting self-care actions by chronically ill patients. The need for further testing of the model was cited.

Gibson and Pulliam (1987) discussed self-care as a new method of patient care delivery. No definitions or theoretical frameworks related to self-care were given. The steps in the establishment of an in-hospital care unit based on the self-care concept was described. The unit was reported to be cost efficient while providing an atmosphere that promoted the development of self-care.

Kogan and Betrus (1984) attempted to differentiate between self-care and self-management in patients with stress disorders. Self-management is sometimes used to refer to self-care. Kogan and Betrus offered this statement to differentiate between self-care and self-care management:

> Self-care addresses the problems of bodily maintenance of health habits during recovery from episodic health deviation. Self-management training addresses those physical and psychosocial states that may be in episodic or chronic disregulation (p. 59).

In a study of diabetics, Miller, Goldstein, and Nicolaisen (1978) used self-care and self-management interchangeably. Attitudes of trainees in a rehabilitation program toward the use and value of self-management strategies were evaluated by Sawyer and Crimando (1984), rehabilitation counselors. These authors defined self-management as: ". . . the individual's ability to initiate and maintain goal directed behavior and eliminate habitual behavior patterns that interfere with life and work adjustment" (p. 27).

Medical literature contained six studies indexed under the heading of self-care. Several medical studies related to self-care involved the evaluation of a lay text on health care written by Vickery and Fries (1977). The users of the text were expected to make fewer office visits to see a physician. Berg and LoGerfo (1979) selected eight self-care algorithms included in the book and sought to determine the effects of algorithm use on the number of office visits. The study concluded that if the consumers had followed the recommended algorithms, they would have actually increased physician visits. No definition of self-care was provided in this study, and no theoretical framework was identified.

Another study involving the same lay text was conducted by Green and Moore (1980), an education psychologist and a physician, respectively, who sought to assess consumers' attitudes toward self-care. One group received the text; another group received the text and a promised reward of $50 if, at the end of 6 months, they had a decrease in the number of visits to the physician. The third group was the control and received no intervention. All three groups completed a questionnaire. No significant differences in attitudes among the groups were found. This study used Lowell Levin's (1976) definition

of self-care:

> Self-care is a process whereby a layperson can function in his own behalf in health promotion and prevention and in disease detection and treatment at the level of the primary health resource in the health care system (p. 170).

Vickery and Fries' text was also used as the basis for a study by Moore, LoGerfo, and Inui (1980) that was similar to the study by Green and Moore (1980). No significant differences in attitude were found. Self-care was not clearly defined, and no theoretical framework was identified.

Linn and Lewis (1979), whose credentials were listed as PhD and MD, respectively, developed an instrument to measure the attitudes of physicians toward self-care. Levin's (1978) definition was given but no theoretical framework was identified. Attitudes were found to be related to religious background, age, locus of control, and practice setting.

Kuriansky, Gurland, Fleiss, and Cowland (1976), who were biometricians, compared patient assessment of self-care agency to the health provider's perception of the patient's self-care agency in geriatric psychiatric patients. The perceptions of providers were found to be far more accurate. No definition of self-care was given, and no theoretical framework was identified.

Lebovitz, Ellis, and Skyler (1978), whose credentials were not cited, evaluated the effects of an educational program on self-care in diabetic children. Self-care was defined as the mechanical skills needed for everyday existence. No theoretical framework was given. A significant increase in skills was found following the educational experience.

Medical literature has not significantly contributed to the development of the concept of self-care. Many articles related to the concept of self-care were indexed in medical literature under the more traditional terms of compliance and adherence.

The most widely used theoretical framework in health science literature addressing the concept of self-care is Orem's theoretical framework which consists of the Theory of Self-Care Deficits, the Theory of Self-Care, and the Theory of Nursing Systems. Only two studies reviewed actually tested Orem's framework. Findings in Anna and colleagues' (1978) study were difficult to synthesize because of the attempt to address constructs within all three theories. Harper (1984) deductively studied and found support for four of Orem's propositions for self-care. In this review of literature pertaining to self-care, as studied in populations other than COPD patients, only five authors attempted to identify specific self-care actions within specific patient populations (Clements, 1985; Crockett, 1982; Gulick, 1987; Pace, 1986; Woods, 1985). A few authors studied self-care agency (Denyes, 1982; Kearney & Fleischer, 1979). Published instruments were limited to self-care actions for only a few specific patient populations and the Exercise of Self-Care Agency Scale developed by Kearney and Fleischer. Additional testing and application of the three theories in Orem's self-care framework are required.

Self-Care and COPD

Only five studies were found specifically addressing self-care in patients with COPD. Two were published studies of nursing research (Stockdale-Woolley, 1984; Stollenwerk, 1985), two studies were master's theses (Kramer, 1979; Nelson, 1983), and one study was medical research (Avery, March, & Brook, 1980).

Nelson (1983) conducted telephone interviews with COPD patients to identify self-care skills subsequent to attendance at a Better Breathers program provided by a local lung association. This program consisted of several educational sessions, and family members were encouraged to attend. The major focus of the study was family participation in the program as a factor in the utilization of self-care skills which were defined as:

> . . . those actions taught in an education program and utilized by the C.O.P.D. patient at home to minimize symptoms of dyspnea or anxiety that accompany C.O.P.D., to promote optimum air exchange, and to foster pulmonary hygiene (p. 12).

No association was found between family participation at the program and utilization of self-care skills. The most frequently used self-care skills were pursed-lip breathing, relaxation techniques, diaphragmatic breathing, checking pulse, effective cough, and postural drainage. Orem's self-care framework was used to guide Nelson's study.

Stollenwerk (1985) used grounded theory methodology to describe the self-care practices of a patient with emphysema. This study was part of a larger ongoing project focusing on self-care practices of adults with chronic respiratory disease in a pulmonary rehabilitation clinic. The patient who was presented in this study had completed the formal rehabilitation program in which the teaching sessions addressed exercise, breathing patterns, resistive breathing training, drugs, and adjusted lifestyle. Gordon's (1982) diagnostic categories were used as a framework to categorize self-care practices, specific client needs, and nursing strategies. The diagnostic categories most recurring in the data were health perception/health management, activity/exercise, self-perception/self-concept, role/relationship, coping/stress tolerance, and value/belief systems. The data were presented in relation to

these categories. In general, Stollenwerk found that the needs of this particular patient were related to acceptance of the illness and life-style changes which provided for goal achievement within restrictions imposed by the illness. Self-care practices described were related to these psychosocial needs. Self-care actions specific to physical symptoms were not addressed. The nurse's role was viewed as fulfilling the educative and supportive roles of Orem's nursing systems theory.

Stockdale-Woolley (1984) examined the effects of a group of education classes on self-care agency of patients with COPD. The Exercise of Self-Care Agency Scale developed by Kearney and Fleischer (1979) was used to measure self-care agency. The sample was composed of 25 patients. Factor analysis and oblique rotation were used to assess construct validity of the instrument. Reliability was tested with coefficient alpha and was reported as .92. Self-care agency scores were significantly greater after the educational sessions (p = .013). Stockdale-Woolley also used stepwise regression to determine predictor variables for self-care agency and change in self-care agency. Predictor variables considered were presence of a significant other, severity of disease which was determined using the functional capacity scale developed by Haas et al. (1979), social status as measured by the Hollingshead Four Factor Index of Social Status, and type of lung disease. The only variable to enter the equation for self-care agency was bronchitis and/or emphysema which was dummy coded as one type of lung disease (R^2 = .20, p = .025). In the prediction of change in self-care agency, none of the variables met the criterion to enter the equation. In recommendations for further study, Stockdale-Woolley suggested the examination of the effect of education on self-care agency by objective physical measurements.

Kramer (1979) conducted a study to identify self-care activities of patients with COPD. Actual self-care practices, descriptions of perceived effectiveness, and sources of self-care information were obtained by means of a structured and unstructured interview schedule. Self-care acitvities were grouped as preventive or ameliorative and then subclassified as medically prescribed, taught by health professionals, and self-initiated. In this sample of 20 patients, self-care activities were closely related to activity level and emotional and environmental factors which evoked dyspnea. Twenty-four specific self-care activities were identified with some redundancy in the preventive and ameliorative groupings as well as in the subclassifications. The majority of the self-care activities were classified as self-initiated.

Avery et al. (1980) studied self-care practices of 157 adult patients with asthma in relation to medications and physician use following a change in symptoms. Three expected self-care behaviors were identified as: (a) start medication promptly, (b) use appropriate medication, and (c) seek professional assistance for persisting symptoms. A substantial proportion of asthma patients exhibited inappropriate self-care behaviors. An educational program was not included in this study. The need for improving health behaviors through education was identified.

The literature related to self-care in COPD patients was limited. The studies which addressed self-care actions specific to the disease process and effects used open-ended statements in interview guides (Kramer, 1979; Nelson, 1983). The self-care actions identified were specific to the patients in those samples and were not inclusive of many of the methods and techniques patients are taught to enable them

to manage the disease and their lives. The need for an instrument to assess utilization of self-care skills was supported in this review of literature.

Pulmonary Function

A limited review of literature related to pulmonary function is given for the purpose of presenting standards for measurement, a more indepth description of the four measures of pulmonary function used in this study, and the changes in these measures commonly found in COPD patients. Studies addressing changes in pulmonary function measurements following rehabilitation programs are presented in the review of literature related to PRPs.

Chronic obstructive pulmonary disease is a functional disorder, and its presence and severity can be assessed with pulmonary function studies. In a complete pulmonary function study, all lung volumes and capacities are measured, either directly or indirectly, using very sophisticated, complex, and expensive equipment operated by a highly trained technician. Spirometry measures are part of a complete pulmonary function study and comprise the diagnostic tests most commonly used to diagnose obstructive airway disease (Hunsinger, Lisnerski, Maurizi, & Phillips, 1976). Spirometry is considered to be the best test of pulmonary function for screening purposes and can be performed with relatively inexpensive, more readily available equipment (Gardner & Crapo, 1983).

Payne and Gillespie (1983) estimated that more than 100 spirometric devices were on the market. Because of wide variability in specific tests the spirometric devices could perform and concern related to the accuracy and reliability of the many devices in the later 1970's, the American Thoracic Society (1979) appointed a task force to develop

standards for spirometry measurement and equipment. The standards, or recommendations as they were clearly identified, were the result of a workshop held in Snowbird, Utah in 1977. Consequently, literature addressing standards for spirometry measurement frequently cite the Snowbird Workshop. The standards were considered to be minimum recommendations for instrument specification. Recommendations were developed for every test which could be performed by the most sophisticated spirometer; however, the standards applied only to the specific tests each device could perform.

The most commonly used spirometric measurements of lung function are the forced vital capacity (FVC), the forced expiratory volume in the first second (FEV_1), the mean forced expiratory volume during the middle half of the FVC ($FEF_{25\%-75\%}$), and the maximum voluntary ventilation (MVV) (Boushey & Dawson, 1982). The standards for these tests are given in Appendix B.

Forced expiratory volumes, another term commonly used for spirometry, are the most sensitive diagnostic tests for obstructive lung diseases (Haas et al., 1979). These data often detect the existence of pulmonary impairment before the patient is aware of functional impairment.

Spirometry is a simple and non-invasive procedure which presents almost no risk to the patient. Accuracy of the results of the tests depends upon an adequate spirometer operating effectively, the patient's cooperation and performance, and correct calculation and measurement of the results (Gardner & Crapo, 1983). A nose clip is applied so that no air escapes from the patient's nostrils, and the patient breathes into a mouthpiece connected via a tube to the spirometer. The patient is instructed to take in as deep a breath as possible and then to blow all the air out of the lungs as hard and fast as possible. The

spirometer measures how much air is exhaled and how fast the patient exhales (Carroll, 1986). Mechanical spirometers produce a tracing on graph paper that plots volume in liters vertically against time in seconds horizontally (Shapiro, Harrison, & Trout, 1975) as shown in Figure 4. Measurements of volumes are calculated from the tracing. Computerized spirometers give the same information in digital printouts and produce a graphic tracing that plots flow rate against volume. The test procedure performed by the patient is referred to as a forced vital capacity maneuver. The maneuver is performed at least three times and the best effort for each volume tested is the measurement recorded. The patient's volumes are divided by predicted volumes to obtain the percentage of predicted measurement. Predicted values are norms based on age, sex, and height and are adjusted for BTPS, or body temperature and pressure under saturated conditions (Gardner & Crapo, 1983).

The pulmonary function or spirometry measurements addressed in this study were the FVC, FEV_1, $FEF_{25\%-75\%}$, and the MVV. The specific changes that occur with chronic obstructive pulmonary disease are presented in brief. Figures 4 and 5 illustrate the graphic tracing of normal FVC, FEV_1, and $FEF_{25\%-75\%}$ measurements and the changes that occur in the tracing with COPD.

FVC

The forced vital capacity is a measure of the total volume of air that can be exhaled and is an indicator of lung size. The FVC is dependent upon muscular effort and airway caliber. Other volumes and flow rates measured by spirometry usually show changes prior to a significant reduction in forced vital capacity (Pearson & Morgan, 1985). A reduction of FVC may occur with either restrictive or obstructive lung

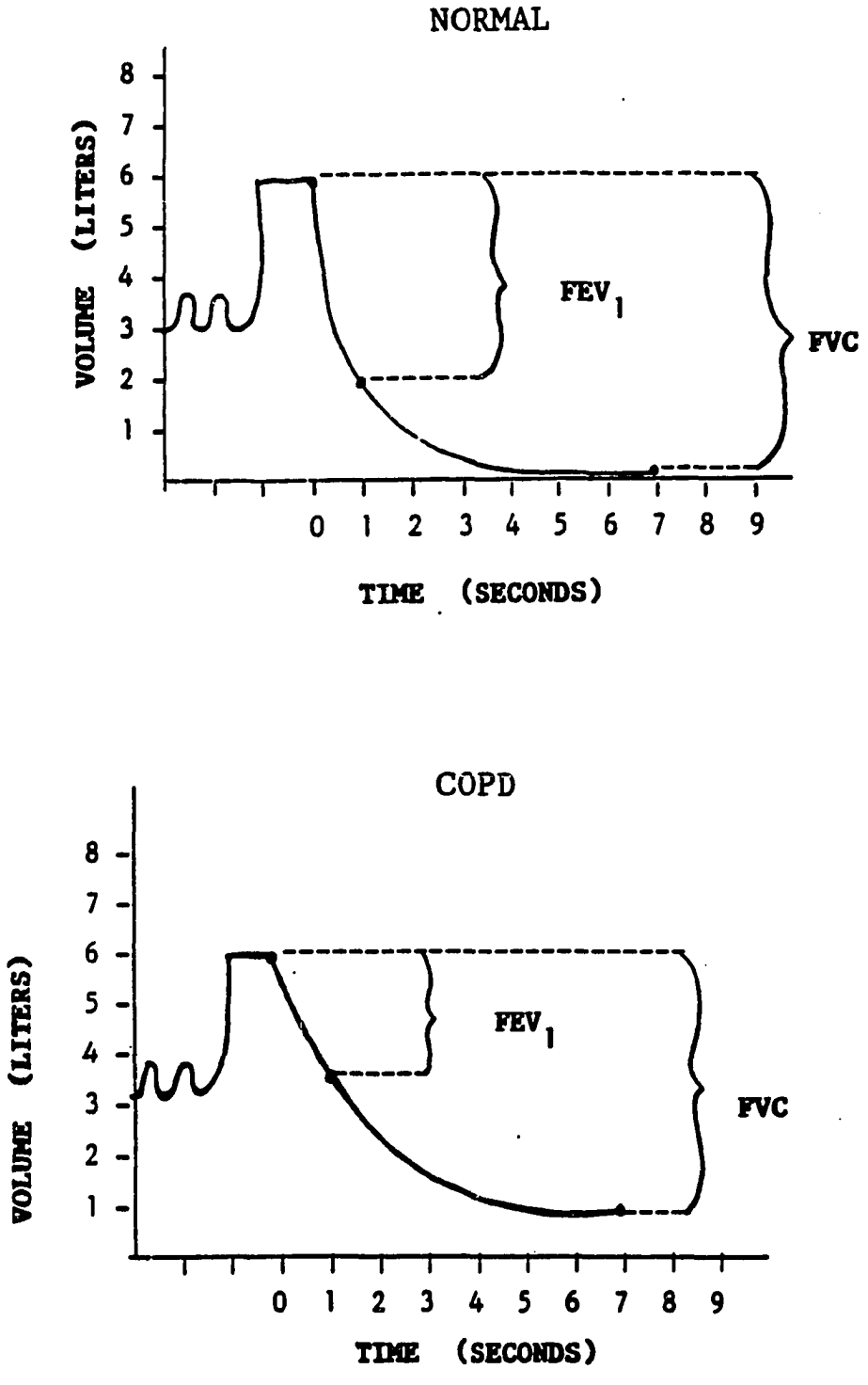


Figure 4. Normal FVC and FEV_1 Volume Curves and Changes That Occur With COPD

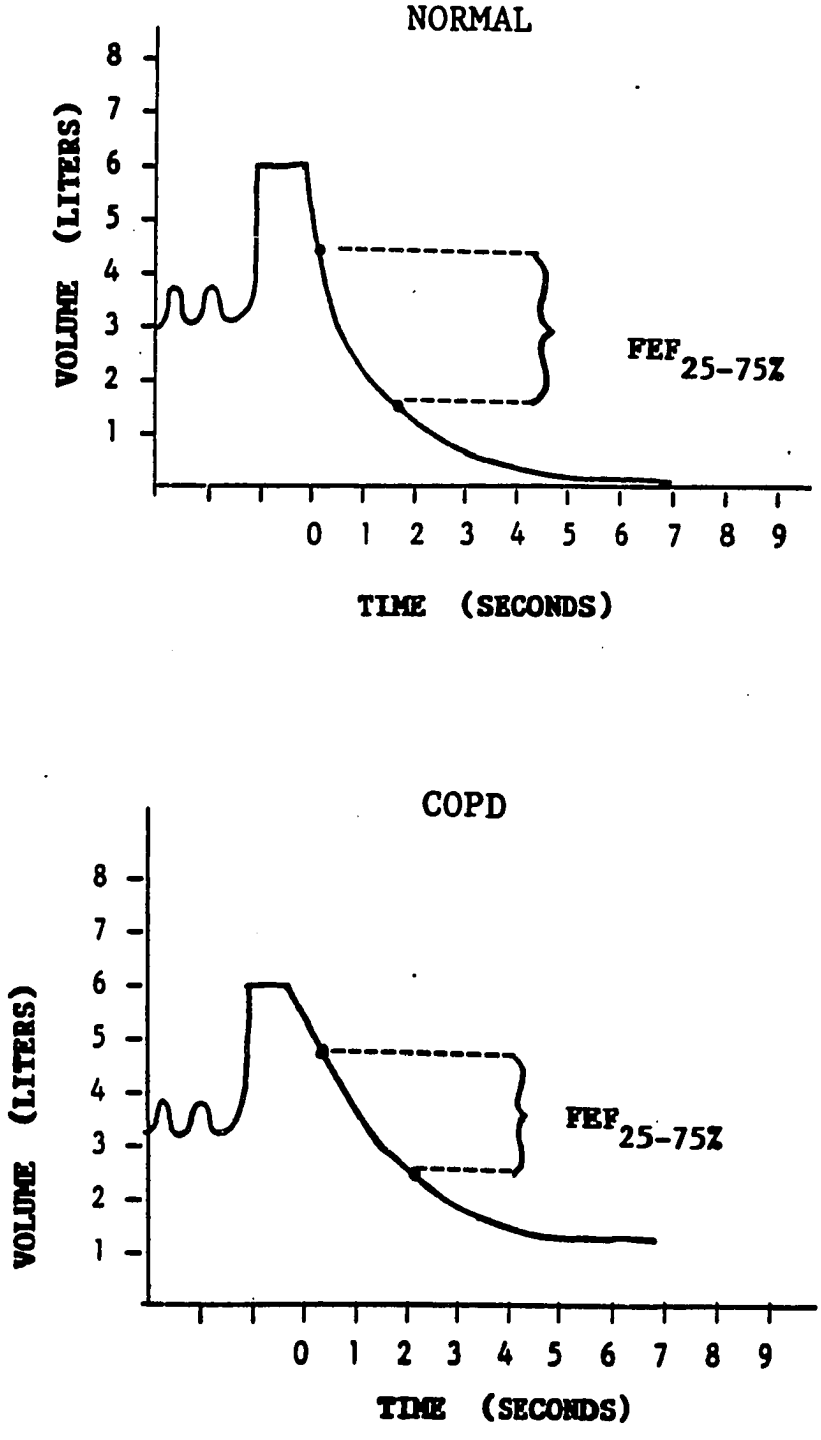


Figure 5. Normal $FEF_{25\%-75\%}$ Volume Curve and Changes That Occur With COPD

lung disease. The ratio of the FVC to the FEV_1 is most often used to differentiate between an obstructive or restrictive problem (Dawson, 1985).

FEV1

The volume of air expired over the first second of the forced vital capacity maneuver has been the most commonly used screening test for obstructive lung disease (Thompson, McFarland, Hirsch, Tucker, & Bowers, 1986). In early obstructive disease, the FEV_1 is reduced while the FVC is normal. As obstructive disease progresses, the FVC decreases (Wise & Permutt, 1985). Obstructive disease is diagnosed when the FEV_1 is reduced and the FVC is less than 70% to 80% of predicted (Petty, 1986), and the ratio of the FEV_1 to the FVC is less than 70% (Carroll, 1986). During the first .20 seconds of the forced expiration, flow rates are primarily determined by muscular effort; after the initial .20 seconds, flow rates are most influenced by airway caliber which is related to the size and patency of the airways (Pearson & Morgan, 1985).

The FEV_1 is considered to be such a reliable indicator of the degree of airway narrowing that the test is the most frequently used spirometry measure of pulmonary function in medical research. Pineda, Haas, Axen, and Haas (1984) found the FEV_1 to be the best predictor of exercise tolerance in COPD when compared to the other measures of pulmonary function. The FEV_1 has been one of the principle tests to determine eligibility for disability compensation in occupational lung disease (Morgan, Lapp, & Seaton, 1980).

The FEV_1 has also been the principal test used in assessing the reversibility of obstructive lung disease. Asthma, one of the three diseases which may be present in COPD, is characterized by acute hyperreactivity of airways resulting in bronchospasm. In many patients

bronchospasm can be treated effectively, or reversed, with bronchodilating drugs. A specific test to assess reversibility of obstructive lung disease is before and after bronchodilator spirometry testing. The FEV_1 is measured prior to and then following the administration of an inhaled bronchodilator. Significant improvement in the FEV_1 indicates that some of the airway obstruction can be treated or reversed with bronchodilators and gives a more favorable prognosis (Farzan, 1978). In some patients reversibility may not become apparent until after they have received drug therapy over a period of time.

In a 10-year follow-up study of 182 patients with severe COPD, Sahn, Nett, and Petty (1980) reported only 29 (17%) of the patients were still alive at the end of the 10-year period. The cause of death in more than half of the patients was progressive pulmonary disease. Pulmonary function studies had been done on a yearly basis. The average decrease per year in FEV_1 was much lower in the survivors than in those who died during the 10-year period ($p < .05$). The investigators concluded that the FEV_1 can be used for prognostic purposes. In patients with advanced COPD the decline in FEV_1 has been reported as 60 to 80ml per year (Feldman, 1982) which is four to five times the decline in the normal aging lung (Fowler, 1985).

Of all the pulmonary function tests, the FEV_1 has shown the strongest correlation with severity of symptoms (Burns, 1984). Carrieri et al. (1984) reported a -.71 correlation between FEV_1 and dyspnea. However, in studies involving patients who reported an improvement in dyspnea, no significant changes in FEV_1 were found (Kochansky et al., 1986). The FEV_1 has been the most commonly studied measure of lung

function in research evaluating the effectiveness of pulmonary rehabilitation programs. These studies are presented in the discussion of literature related to pulmonary rehabilitation programs.

FEF 25%-75%

The mean expiratory flow during the middle half of the forced vital capacity maneuver appears to be the most sensitive spirometry test for early detection of obstructive airway disease (Sobol, 1983). Small airways less than 2mm in diameter are generally the first to be affected by obstructive pulmonary disease (Carroll, 1986). Many patients show a decrease in the $FEF_{25\%-75\%}$ before the FEV_1 decreases. If the disease has progressed to the point that the FEV_1 is reduced on an initial spirometry test, the $FEF_{25\%-75\%}$ is considered to add little clinical significance to the impairment of pulmonary function (Sobol, 1983).

MVV

The maximum voluntary ventilation test is not part of the forced vital capacity maneuver but is measured with a spirometer using the procedure known as the MVV maneuver. The subject is instructed to breathe the maximal amount of air possible over a 15 to 20 second interval by taking rapid deep breaths (Boushey & Dawson, 1982). A graphic tracing of the MVV is shown in Figure 6. The test is fatiguing and highly dependent upon patient effort (Carrieri et al., 1984). The MVV gives an indication of the status of the respiratory muscles, airway and tissue resistance, and compliance of the lungs and thorax (Thompson et al., 1986). The MVV represents the best a patient can do over a specified time period and is useful in establishing the ventilatory limit to exercise (Payne & Gillespie, 1983). In addition to the FEV_1, the MVV was one of the principal tests initially used to determine

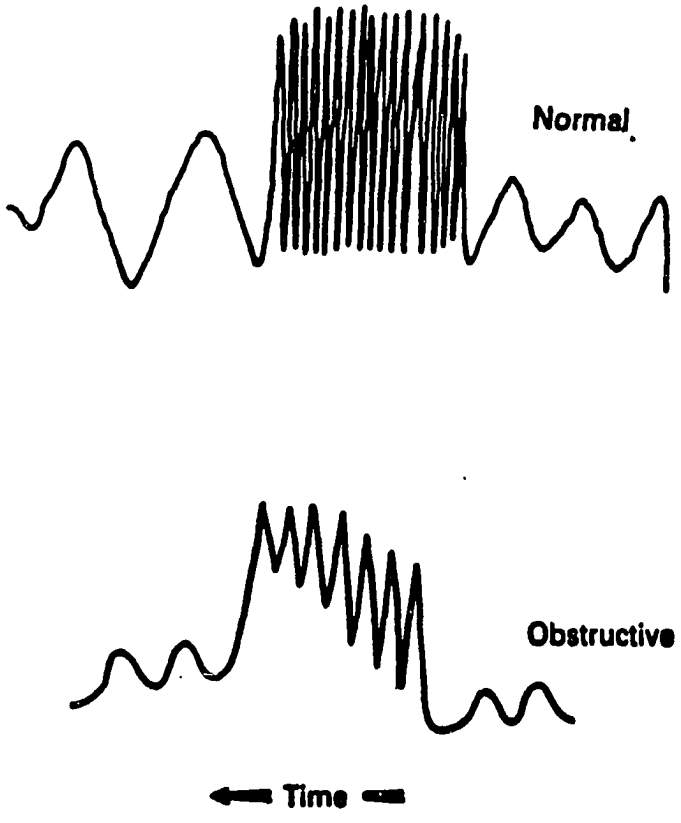


Figure 6. Normal MVV Tracing and Changes That Occur With COPD

Note. From Respiratory Care: A Guide to Clinical Practice (2nd ed.), (p. 237) edited by George Burton and John Hodgkin, 1984, J. B. Lippincott. Copyright, 1984, by J. B. Lippincott. Reprinted with permission (See Appendix C for related correspondence).

pulmonary disability for compensation purposes (Morgan, Lapp, and Seaton, 1980). In patients with COPD, the MVV Is usually reduced (Thompson et al., 1986).

The use of spirometry as a measure of lung function is widely accepted. In patients with COPD the FVC, FEV_1, $FEF_{25\%-75\%}$, and MVV are usually altered. Due to the progressive and irreversible nature of COPD, these measurements continue to decline over time (MacDonnell, 1981). The FEV_1 specifically has been used for prognostic purposes. Pulmonary function studies, specifically spirometry, provide the most objective measure of lung function, and is a variable frequently addressed in studies evaluating the effectiveness of pulmonary rehabilitation programs

Pulmonary Rehabilitation Programs

The literature addressing pulmonary rehabilitation programs is extensive. To organize this review, types of pulmonary rehabilitation programs are described, selection of patients is expanded, components of multidisciplinary programs are addressed, and then studies evaluating the effectiveness of PRPs are presented.

Types of Programs

Harris (1985) described five different types of pulmonary rehabilitation programs: private practice, community agencies, inpatient, referral medical centers, and multidisciplinary programs. Callahan (1985) cited wide variability within these types. The most readily available PRP in many locations is the program that is established as part of a physician's private practice. The program is usually staffed by a nurse or respiratory therapist employed by the physician. Instruction is usually given one-to-one or in small groups and such programs

seldom include supervised exercise. Patients are often given comprehensive exercise instructions but are expected to follow through without direct supervision.

Educational programs in the management of respiratory disease offered by community agencies are considered as a type of pulmonary rehabilitation. Very few of these agencies offer exercise programs. Many state and local chapters of the American Lung Association provide programs such as Better Breathers to teach patients how to manage the disease. Nelson (1983) reported a study which involved this type of a PRP in addressing utilization of self-care skills following the program. A variety of patient education pamphlets, books, films, and other forms of media produced by the American Lung Association are used by other pulmonary rehabilitation programs.

Inpatient pulmonary rehabilitation programs usually provide education and progressive ambulation as a form of exercise for patients who are still in the hospital following an acute illness such as pneumonia. Limited attention spans and concentration difficulties at this stage of the illness make it difficult for patients to comprehend and learn lifestyle modifications (Harris, 1985).

Large medical referral centers often incorporate pulmonary rehabtiltation programs in their institutions. Harris (1985) described the purpose of such programs as "one of total tune-up" (p. 259). The patient is referred by the primary physician to the center for a combination of medical management with rehabilitation and then referred back to the primary physician for follow-up. Many patients travel great distances to these referral centers. Actual time spent in the PRP varies, but most patients are unable to commit to a lengthy rehabilitation program. Benefits to the patient are decreased if there is no

time for exercise conditioning (Harris, 1985). Berzins (1970) described a referral center PRP which hospitalized patients for an initial period of about 2 weeks for intensive study and treatment, and then followed the patients as outpatients. This program was supported by a grant.

Most multidisciplinary outpatient pulmonary rehabilitation programs are hospital-based because of the need for access to various health care providers. The PRP may be physically located at the hospital or in a free-standing facility. Many of these programs were initially supported by grants (Brooks & Brawner, 1981). Some have been established by independent investors, such as physicians. In multidisciplinary PRPs, representation of disciplines vary but most usually have a pulmonary nurse clinician or clinical specialist, a respiratory therapist, social worker, dietician, pharmacist, occupational therapist, and physical therapist. A physician is usually present or readily available. In addition, many programs have a psychologist available, at least on a consulting basis. In many programs, the nurse or respiratory therapist acts as program coordinator and maintains contact with the patient's primary physician while the patient is involved in the program. Education and exercise are integral components of multidisciplinary programs which may range in length from 2 to 12 weeks.

Types of PRPs range from very informal, such as those based in practices of private physicians, to the very structured multidisciplinary programs. Unfortunately, due to the limited number of PRPs, patients usually are referred to the program most readily accessible, rather than the type of program that best meets their individual needs.

Selection of Patients

Criteria for patient selection vary in pulmonary rehabilitation programs. The American Thoracic Society (1981) in a published document

on pulmonary rehabilitation, stated: "Any patient with symptomatic COPD should be considered for pulmonary rehabilitation" (p. 63). Ries (1987) similarly stated that any patient with symptomatic COPD was eligible. Some programs, especially those funded by grants, had more stringent criteria such as an FEV_1 reduced below a certain level. Most authors generally agree, however, that some patients make better candidates for rehabilitation programs (O'Ryan, 1984). According to Ries (1987), patients who are ready for pulmonary rehabilitation are those who recognize they have COPD, perceive some limitation or disability caused by the disease, are motivated to learn about and improve their health, and have some pulmonary reserve. During the initial evaluation period, most patients receive a psychological as well as a physical evaluation. Psychological variables have been shown to be significantly affected by pulmonary rehabilitation programs (Dudley et al., 1980; MacDonnell, 1981). Some of the programs described in the literature do not explain the criteria by which patients are selected. Brooks and Brawner (1981) described a grant-sponsored hospital-based PRP in which the case of each patient was reviewed and, if given a favorable rehabilitation potential rating, the patient was accepted. The method of determining the rating was not described.

Shenkman (1985) attempted to identify factors which contributed to attrition rates in a pulmonary rehabilitation program. The findings reported that patients who failed to complete the program scored higher on measures of psychological variables such as helplessness, hopelessness, and alienation than those who completed the program. Non-compliant patients are considered to have limited rehabilitation potential (O'Ryan, 1984). In some programs extensive psychological testing is done prior to a determination of acceptance into a program (Dudley et al., 1980).

Severity of COPD is the determinant most physicians use in referring patients to a PRP. Most patients referred to PRPs have moderate to moderately severe disease (Ries, 1987). A PRP can be beneficial to patients with severe disease, but end-stage patients are usually not considered candidates (O'Ryan, 1984). The FEV_1 is frequently used in assessing severity of disease for rehabilitation purposes (Kimbel, Kaplan, Alkalay, & Lester, 1971). Petty (1982) listed a 50% decrease in FEV_1 or MVV as a selection criterion of patients for a PRP.

Patients are often excluded from a PRP if other disabling diseases are present, such as cancer, severe arthritis, or heart disease (American Thoracic Society, 1981). Exercise testing may be used to assess exercise tolerance (Hudson & Pierson, 1981). In programs that are multidisciplinary, extensive evaluation of the patient is done, either before a determination of acceptance or prior to beginning the PRP in programs with more liberal acceptance guidelines.

Components of Multidisciplinary PRPs

In the American Thoracic Society's (ATS) (1981) statement on pulmonary rehabilitation, the components of a multidisciplinary program were identified as physical therapy, exercise conditioning, respiratory therapy, and education. In addition, the ATS's statement specifies the following as essential services: initial medical evaluation and care planning; patient education, evaluation, and program coordination; respiratory therapy techniques; physical therapy techniques; daily performance evaluation; social service and nutritional evaluation. Multidisciplinary programs provide an integrated approach to stabilizing the disease process, improving exercise tolerance and functional capacity, and reducing complications (Ries, 1987).

Effectiveness of Pulmonary Rehabilitation

Studies which addressed specific components of pulmonary rehabilitation, such as education, exercise, and resistive breathing are first presented in this section of the review of the literature. Studies evaluating the effectiveness of specific pulmonary rehabilitation programs are then discussed.

Howland et al. (1986) used a quasi-experimental design to test the hypothesis that a purely educational intervention would improve symptoms and health status in patients with COPD. COPD patients in two matched communities were located and assessed to determine baseline health status. The patients in one community served as the control group and the patients in the other community were the treatment group. The treatment group was divided into two groups of severely impaired and mildly impaired patients. The education courses consisted of six 2-hour sessions for the severely impaired COPD patients and three 2-hour sessions for the mildly impaired patients. Control groups in the second community were advised of the findings of the baseline assessment only. In 1 year, the control and treatment groups were reassessed and data were collected from 325 and 213 patients, respectively. Results showed significant differences in health locus of control, but no differences in health outcomes. The authors concluded that COPD education programs did not independently improve disease states, functional health, mental health, or life quality of COPD patients. Recommendations from this study supported education combined with exercise training as vital components of pulmonary rehabilitation.

The study by Nelson (1983) previously described in the review of the literature related to self-care and COPD was the only study which addressed utilization of self-care skills taught in a rehabilitation

program. The focus of the study, however, was the effect of family participation on utilization of skills. The questionnaire used in this study limited responses to yes or no without indication of frequency used.

Pineda, Haas, and Axen (1986) studied the effects of exercise only on pulmonary function test parameters and exercise tolerance. A sample of 14 patients with severe COPD performed a pulmonary function test and treadmill exercise stress test before and after an individualized training program which consisted of three 20-minute sessions of treadmill exercise per week for 5 consecutive weeks. The only significant change after the exercise program was in exercise tolerance as measured by average stress test time ($p < .001$) and total external work ($p < .01$). Eleven patients initially required oxygen supplementation to exercise. Eight of these 11 patients were able to exercise without oxygen by the end of the training program.

Mungall and Hainsworth (1980) studied the effect of a graded exercise training on spirometry and other physiological measures. Grading was accomplished by gradually increasing the rate and/or elevation of the treadmill. Assessments were made during three 12-week periods which were before, during, and after a period of training and were done at intervals of every 2 weeks. The sample consisted of 10 males who participated in a training program of 11 or 12 minutes of activity a day. Every 2 weeks during the three phases of the study, the subjects were tested with a 12-minute walking test and standard pulmonary function tests. Reports showed a significant increase in distance walked ($p < .005$) and a small but significant increase in FEV_1 ($p < .05$). This was the only study reviewed which showed improvement in FEV_1, the most commonly used objective measure of lung function.

Sinclair and Ingram (1980) used a treatment group of 17 patients and a control group of 16 patients to study the effect of supervised exercise training in patients with chronic bronchitis. The exercise program was supervised once a week with daily exercises of a 12-minute walk and stair climbing. Both groups underwent the training while hospitalized. After discharge only the treatment group was supervised. Both groups were reassessed at 6 months after discharge and again at 10 or 12 months post discharge. Although there was considerable subjective improvement, no significant changes in cardiopulmonary function were found.

Resistive breathing training is considered one of the principal skills taught in pulmonary rehabilitation (Callahan, 1985). Pursed-lip breathing is an example of resistive breathing. Devices are also available to train patients in this skill. Belman, Thomas, and Lewis (1986) studied the effect of resistive breathing training on spirometry and lung volumes. Ten patients performed two 15-minute sessions of resistive breathing daily for 6 weeks following the printed instructions which came with the inspiratory resistive device. No significant changes were found. As an additional study, seven of the patients were instructed to vary the printed procedure for using the device by taking long, slow inspirations through the resistive device. Five of the seven were able to improve their performance of resistive breathing. The authors concluded that alterations in breathing patterns had a profound effect on performance, but when the device was used according to instructions, spirometry and lung volumes did not improve.

Atkins, Kaplan, Timms, Reinsch, and Lofback (1984) reported the only experimental study found in the literature evaluating pulmonary rehabilitation. Patients with COPD were randomly assigned to one of

five groups to study compliance with an exercise program. The study did not evaluate a formal PRP. Severity of disease was not controlled in the sample selection, but the exercise program for each patient was based on the maximum miles per hour the patient walked on a treadmill. Three treatment groups and two control groups were established for this study. All groups were exercised on the treadmill and given prescriptions for exercise. The treatment groups were behavior modification, cognitive modification, and combined behavior and cognitive modification groups and consisted of 15, 16, and 16 subjects, respectively. With the behavior modification group, principles aimed at developing self-control were combined with positive reinforcement methods and instruction in methods of anxiety reduction and muscle relaxation using breathing exercises. In the cognitive modification group, subjects were encouraged to replace negative self-statements, such as: "I can't take another step," with positive self-statements, such as: "I've already walked half way; I can do it!" The third treatment group received a combined approach of behavior and cognitive modification.

The two control groups in the study by Atkins and colleagues (1984) were no-treatment and attention groups. The 13 patients in the no-treatment group were exercise tested, given a prescription for exercise with a walking log and were encouraged to implement the exercise program. To control for the possible effect that a professional individual spending time with a patient might increase compliance alone, an attention control group of 15 subjects was also used. The experimenters spent the same amount of time with these patients but used various pen and pencil tasks to occupy the time.

All three of the treatment groups in the study by Atkins et al. (1984) showed significant increases in distance walked and in exercise

tolerance compared to the control groups. There was no significant difference between the control groups. No significant changes in physiological parameters were found in spirometry measures for any of the groups. The findings of these investigators support the work of others who conclude that exercise cannot reverse the physiological characteristics of COPD.

In another aspect of the study by Atkins and others (1984), the costs and effects of the behavioral programs were studies. Toevs et al. (1984) concluded that the behavioral program appeared relatively cost effective in comparison to other health care and medical interventions.

Zack and Palange (1985) evaluated the effects of an outpatient rehabilitation program with oxygen supplemented exercise. No components other than exercise training were identified in this evaluative study. The program was described as a 12-week program which met three times a week for 1-1/2 hours each session. Patients exercised a total of 25 minutes per session with frequent rest periods. On days when they were not scheduled to come to the program, they were instructed to exercise at home. A total of 53 patients completed the program. Zack and Palange found significant improvement in maximum workload, distance walked, and endurance time on room air after patients had completed the program. No improvement was noted in pulmonary function, which was a finding consistent with earlier studies.

Kimbel et al. (1971) evaluated the effects of an inhospital rehabilitation program that included the components of multidisciplinary programs. The authors studied level of dyspnea, exercise tolerance, and FEV_1 in patients with advanced disease. The investigators reported an improvement in dyspnea and exercise tolerance. Consistent with the findings of others, no improvement was found in the FEV_1. Follow-up

data 1 and 2 years after the program showed a significant decrease in FEV_1 consistent with changes expected in patients with advanced disease.

Mohsenifar, Horak, Brown, and Koerner (1983) attempted to identify measures of improvement in a sample of 15 patients with severe lung disease before and after a multidisciplinary pulmonary rehabilitation program with educational and exercise components. No significant changes in resting and exercise lung functions were found with the exception of a decreased heart rate and decreased blood lactate levels. The authors reported the significant findings differed from those of other investigators on these measures. Mohsenifar and colleagues also reported that patients experienced a subjective improvement in exercise endurance and general sense of well-being.

Moser et al. (1980) evaluated the physiologic and functional effects of a comprehensive inpatient PRP. This study was one of very few that described the program in depth. Patients who had been referred and selected for this program were admitted to the hospital for 2 weeks of intensive evaluation and training and then discharged with instructions to continue walking exercises. Four weeks later, the patients returned to repeat the treadmill testing. Forty-two patients participated in the study. Significant improvement was found in subjective perception of dyspnea. Significant decreases were reported in oxygen consumption during exercise, minute ventilation, heart rate, and respiratory rate.

Kochansky et al. (1986) developed a 6-week hospital-based outpatient program which placed special emphasis on the use of controlled breathing techniques and energy conserving maneuvers. The authors evaluated the effects of the program on first 30 patients using pulmonary function studies. As expected, the FEV_1 change was not significant; however, other measures which indicated air trapping did show a significant

decrease. The authors concluded that special emphasis on controlled breathing and energy conserving techniques in a PRP could reduce air trapping and improve ventilatory efficiency.

Thomas Petty, a pulmonary specialist, along with other investigators, conducted numerous longitudinal studies of pulmonary rehabilitation programs. Although the studies are dated, more recent studies examining the long-term effects of PRPs could not be found in the literature. One PRP at the University of Colorado Medical Center (UCMC) was designed as a demonstration program to evaluate methods, logistics, costs, and effectiveness. A total of 182 patients, 87% of whom were male, were enrolled in the program between 1966 and 1968 (Petty, 1982). Patients selected for the PRP had an established diagnosis of COPD; did not have complicating respiratory, cardiac, or other conditions that would alter the patient's course of prognosis; had a demonstrable level of pulmonary function as measured by the FEV_1 and MVV; verbalized a functional impairment of daily activity; and expressed a willingness to participate in an outpatient program. A physician and nurse evaluated the patients for selection. The PRP was multidisciplinary using existing hospital personnel and combined education with exercise. Initial results of program evaluation reported a majority of the patients described symptomatic improvement and improved exercise tolerance (Petty et al., 1973).

One year after completion of the program, using a pre-post research design, Fishman and Petty (1971) selected the last 36 males admitted to the program and studied objective measures of ventilation impairment (FEV_1, MVV, arterial oxygen and carbon dioxide levels, walking tolerance on a treadmill, and ability to perform work climbing stairs); severity of symptoms of airway obstruction; affective distress; dependency behavior; and psychopathology. Using *t*-tests, the only

statistically significant changes ($p < .05$) were improvements in MVV, walk tolerance, and affective distress as measured by the Multiple Affect Adjective Check List. Also, severity of symptoms demonstrated a significant change ($p < .05$) which consisted of stabilization of symptoms during the first year post program, in contrast to a pattern of deterioration during the year prior to entry into the program.

Petty (1982) reported that for the total sample of patients admitted to this program, the expected rate of pulmonary function deterioration did not occur within the first few years, but did decline over the 4-year period at a rate lower than expected. Most patients were able to perform the same amount of exercise at a lower oxygen consumption (Petty, 1982).

Hudson, Tyler, and Petty (1976) studied the number of days hospitalized per year for 4 years of 44 patients who completed the UCMC program. These patients were selected beacuse of the availability of hospital records for the year prior to entry into the PRP. Hudson and associates found a significant reduction in the number of days of hospitalization for each of the 4 years. Taking into consideration the costs involved with the PRP, the authors calculated an average net savings of $21,000 per year due to reduced hospitalizations.

Petty (1980) studied the number of days hospitalized for patients of four other pulmonary rehabilitation programs. A significant reduction in days hospitalzed was found for patients who had attended each program compared to the year prior to entry into a PRP. Petty's findings support those of Hudson et al. (1976). Analysis of costs was not reported for the other four programs.

Sahn et al. (1980) examined survival rate in a 10-year follow-up study of the rehabilitation program at UCMC. Of the 182 patients

admitted to the PRP, 64% were living at the end of the third year, 41% at the end of 5 years, and only 17% or 28 patients at the end of 10 years. The mean age on admission to the PRP was 61 years with a range of 33 to 81 years. The survival rate of healthy men, age 61, in 1968 was 69% at 10 years. One hundred and forty-three patients died, with 75% of the deaths due to progressive COPD. Other causes of death included myocardial infarction, other cardiovascular problems, suicide, and others. In comparing the yearly data of the 28 10-year survivors to the 143 non-survivors, significant differences were found in rate of decline of FEV_1, arterial oxygen and carbon dioxide levels, hematocrit, and days hospitalzed ($p < .05$). Sahn et al. concluded that a multidisciplinary pulmonary rehabilitation program for patients with COPD:

> . . . may stabilize or reverse the disease and return the individual to his highest functional capacity. The degree of success of such a program depends on the stage of the disease when the patient is first encountered (p. 314).

Summary

The purpose of this study was to ascertain the effects of a pulmonary rehabilitation program on dyspnea, self-care, and pulmonary function of patients with COPD. No studies were found in the literature addressing these variables in combination. In most of the studies reviewed, effectiveness of specific components of pulmonary rehabilitation or of total multidisciplinary programs focused on the effects of pulmonary function. With the exception of the studies reported by Mungall and Hainsworth (1980) and Kochansky et al. (1986), no significant changes were found in pulmonary function. The literature supported the selection of the FVC, FEV_1, $FEF_{25\%-75\%}$, and MVV as appropriate measures of lung function altered by chronic obstructive pulmonary disease.

The literature did not specifically address changes in dyspnea post pulmonary rehabilitation, although Fishman and Petty (1971) reported a decrease in severity of symptoms. Because dyspnea is a symptom, and thus subjective in nature, quantification of dyspnea is difficult. Carrieri et al. (1984) supported the use of visual analog scales and other measures such as the modified Borg scale. A number of studies reported increased exercise tolerance and a decrease in oxygen consumption following exercise training. These findings would be consistent with decreased levels of dyspnea, although this specific finding was not reported.

The few studies which focused on self-care in patients with COPD identified some self-care skills. Education is presumed to influence self-care skills. Studies addressing effects of education measured knowledge gained rather than behavioral change. Howland and others (1986) strongly supported a combined approach of education and exercise training in the rehabilitation of patients with COPD.

Dyspnea, self-care, and pulmonary function are human responses to the actual health problem of COPD. Nursing is defined as "the diagnosis and treatment of human responses to actual or potential health problems" (American Nurses' Association, 1980, p. 9). The evaluation of treatment, such as pulmonary rehabilitation, is therefore an appropriate focus of nursing research. The role of the nurse was alluded to but not addressed in studies concerning rehabilitation found primarily in medical literature. Functions of the nurse cited were: evaluation of the patient prior to entry into a PRP, goal setting, care planning and implementation, continuous evaluation of the patient, program coordination, and communication with the physician and other members of the multidisciplinary health team. Nurses play a vital role in pulmonary rehabilitation,

but no studies in nursing literature by nurses examine the effectiveness of pulmonary rehabilitation. Two of the medical studies reviewed listed nurses as co-authors. A nurse was the last of five authors listed in the study by Moser et al. (1980) evaluating the functional and physiologic effects of a PRP. A nurse was the second author listed in a study by Sahn et al. (1980). Shenkman (1985) was a nurse author who studied attrition rates in a PRP.

The need for this study evaluating the effectiveness of a pulmonary rehabilitation program was supported by the lack of and limited publication of studies addressing dyspnea, self-care, and pulmonary function of patients who completed a PRP. Orem's theoretical framework of self-care provided an appropriate theoretical basis to guide this study.

CHAPTER III

Methodology

The purpose of this study was to ascertain the effects of a pulmonary rehabilitation program on dyspnea, self-care, and pulmonary function of patients with COPD. The methods used to implement the study are described in this chapter.

Design

A quasi-experimental nonequivalent control group design (Campbell & Stanley, 1963) was selected for the study. The independent variable or treatment was a pulmonary rehabilitation program; and the dependent variables were dyspnea, self-care, and pulmonary function. The study design is depicted in Figure 7.

In the nonequivalent control group design, equivalency of the treatment and control groups cannot be assumed due to the inability to assign subjects (Polit & Hungler, 1983). However, when pretest results are similar for the two groups, confidence is increased that any posttest differences are the result of the treatment or intervention (Campbell & Stanley).

Hypotheses

The null hypotheses for this study were:

1. There is no significant difference in dyspnea between control and treatment groups post-pulmonary rehabilitation program (post-PRP)

	T_0		T_1
Treatment Group	O_1	X	O_2
Control Group	O_1		O_2

Legend: O_1: Pre-PRP Dyspnea
Pre-PRP Self-Care
Pre-PRP Pulmonary Function

X: Pulmonary Rehabilitation Program

O_2: Post-PRP Dyspnea
Post-PRP Self-Care
Post-PRP Pulmonary Function

T_0: Entry into PRP

T_1: Post-PRP, 3 Months After Entry

Figure 7. Quasi-Experimental Nonequivalent Control Group Design for Study

as measured by the Usual Dyspnea Visual Analog Scale (VAS), Worst Dyspnea VAS, Usual Dyspnea Modified Borg Scale, and Worst Dyspnea Modified Borg Scale.

2. There is no significant difference in self-care between control and treatment groups post-PRP as measured by the summative score on the Self-Care Questionnaire.

3. There is no significant difference in pulmonary function between control and treatment groups post-PRP as measured by the FVC, FEV_1, $FEF_{25\%-75\%}$, and MVV.

4. The amount of variance in dyspnea explained by the demographic variables of age, sex, race, marital status, education background, income range, number of years since first noticed shortness of breath, pack years, and health locus of control is equal to 0.

5. The amount of variance in self-care explained by the demographic variables is equal to 0.

6. The amount of variance is pulmonary function explained by the demographic variables is equal to 0.

Pulmonary Rehabilitation Program

The PRP in this study, as defined by Harris (1985), was a multidisciplinary outpatient program for pulmonary rehabilitation. This rehabilitation center was free-standing and not owned or operated by a a hospital, but by a group of independent investors. Disciplines represented included medicine, nursing, respiratory therapy, occupational and physical therapy, nutrition, social services, and psychology. Staff from all disciplines were present onsite except for the psychologist who was available on a consultant basis and saw patients by appointment at the center.

The PRP accepted patients by physician referral only. The nurse coordinator of the pulmonary rehabilitation program received the referral and arranged an appointment for the patient to come to the center. During this appointment, services of the program were explained, the facility was toured, health history information was obtained, goals were discussed, an initial plan of care developed, and the patient was scheduled for physiological testing.

The extensive pre-program physiological testing included baseline pulmonary function studies and treadmill exercise testing during which pulmonary function, cardiac function, and arterial blood gases were monitored. A beginning exercise program was then planned with the goal of incremental advancement as the patient progressed.

The total program was 12 weeks in length, with three 1½ hour sessions per week for a total of 36 sessions. At an orientation program, prior to actually beginning the sessions, the patient received a 17-page handbook which described the program in detail, including policies and procedures. The patient had a choice of five schedules of exercise and educational sessions to attend. In this orientation program, the importance of exercise in rehabilitation was discussed. Patients were instructed to notify the staff if unable to attend any session. Continuous participation in the program was required for coverage by most insurance companies. If the patient failed to call, the staff called the patient. Consequently, most patients who began the program attended the scheduled sessions and completed the program. Van transportation was provided for patients within a 20-mile radius who needed this service.

At entry into the PRP, an individualized reconditioning exercise program was planned for each patient based on the prescribed treatment plan. As the patient increased endurance, types and amounts of exercise

were increased. The facility had a large gym with many types of exercise equipment and an indoor track. Most patients performed six forms of exercise to strengthen large muscle groups including walking on a treadmill and around the indoor track, turning an armcrank, arm movement of the handbars of an exercise bicycle, climbing steps, and the rowing motion on the rowing machine. At each session, patients exercised for the specified length of time following their individualized plans. At least two staff members supervised each session and would signal the patient to change from one activity to another. The patient's heart rate and blood pressure were monitored. Patients wore a cardiac telemetry monitor so that cardiac rate and rhythm could be observed on the oscilloscope as they exercised. A physician was present on the premises. Appropriate actions were taken if dysrhythmias or other complications developed. Emergency equipment was located in the gym and was readily available if needed. The patient's physician was informed of any significant problems. Following the exercise session, patients were allowed a cool-down period and then attended a 15- to 30-minute educational session related to some aspect of self-care. A list of the sessions and content descriptions is provided in Appendix D.

At or near the end of the 12-week PRP, the patients repeat the same physiological testing done prior to beginning the program. Many patients elect to attend the post-PRP supervised, non-cardiac monitored exercise sessions provided by the PRP. If not, a home program is planned and discussed with the patient so that the patient can continue to exercise. The cost of the post-PRP supervised program is usually not covered by insurance. Patients pay a set fee per month to participate.

The pulmonary rehabilitation program used in this study met the criteria identified in the literature as to services that should be

provided by a multidisciplinary PRP (American Thoracic Society, 1981; Haas et al., 1979; Hudson, 1984; Petty, 1980; Yee, Hodgkin, Zorn, & McLean, 1984). Many pulmonary rehabilitation programs provide the educational component but lack the capability of providing the exercise component and other services offered by the PRP in this study.

Sample Selection

Pre- and post-PRP data were collected from 15 patients in the treatment group and 11 patients in the control group. The treatment group was composed of patients diagnosed with COPD who had completed a 12-week multidisciplinary PRP. The control group was composed of patients with COPD whose physicians generally did not refer patients to multidisciplinary pulmonary rehabilitation programs.

The following criteria were used in the selection of patients for the study:

1. The patient had been diagnosed with COPD.

2. The patient stated that dyspnea interfered with desired activities and lifestyle.

3. The patient was willing to allow the investigator to make the home visits to collect pretest and posttest data.

4. The patient had or was willing to have pre- and post-PRP pulmonary function testing.

5. The patient's physician was a pulmonary specialist.

5. The patient's physician had given the investigator permission to invite the patient to participate in the study and was willing to provide, for control group patients, the post-PRP pulmonary function testing at no charge to the patient or investigator. Post-PRP pulmonary function testing was routinely included with other post-program testing.

No attempt was made to control for severity of disease or co-existing conditions. Many patients were excluded from participation because of the restraint of time in the pre-PRP data collection process. Most patients referred to the PRP entered the program less than 2 weeks after referral. Patients who could not be visited prior to beginning the PRP were excluded from the study.

Setting

Data collection for demographic information and measures of dyspnea and self-care was done during pre- and post-PRP visits to each patient's home. With the patient's written consent, pulmonary function results were obtained from medical records at the PRP for treatment group patients. Copies of pulmonary function results for control group patients were mailed to the investigator.

Instrumentation

All measures of demographic variables, dyspnea, and self-care were assessed using paper and pencil instruments. Pulmonary function test results were obtained from medical records. All paper and pencil instruments were typed in pica print with the text in short lines to increase readability (Fry, 1972). Each patient was given a ballpoint pen to complete the instrument and was allowed to keep the pen at the conclusion of the visit. For patients with visual impairment or reading difficulty, the instruments were verbally administered. A total of seven instruments were used during the pre-PRP home visit: (a) Patient Information form, (b) Modified MHLC (Multidimensional Health Locus of Control) Scale, (c) Usual Dyspnea VAS, (d) Worst Dyspnea VAS, (e) Usual Dyspnea Modified Borg Scale, (f) Worst Dyspnea Modified Borg Scale, and (g) the Self-Care Questionnaire. All instruments were also used for the post-PRP home visit except the Patient Information form and the Modified MHLC Scale.

Each instrument was reproduced on a different color of paper and a designated section was used for scoring purposes. Pre- and post-pulmonary function results were obtained from medical records as previously described and recorded on a coding form used for all data.

Patient Information Form

The Patient Information Form collected demographic data and included such variables as age, sex, race, marital status, education, income range, pack years, years since first noticed dyspnea, and co-existing health problems (see Appendix E). The demographic variables were used to describe the sample and to determine the amount of variance explained by these variables as tested by Hypotheses 4, 5, and 6. The form was copied on cream paper and contained a section in the right margin for the investigator to code data for analysis.

Modified MHLC Scale

The Modified Multidimensional Health Locus of Control Scale measures the psychological variable of perceived locus of control over one's health. As a result of the pilot study, the investigator chose to define the results from the Modified MHLC Scale as demographic variables. The reader is referred to the discussion of the pilot studies for further explanation of this decision.

Permission was granted by the authors of the MHLC Scale for use in this study (see Appendix F for related correspondence). The original MHLC Scale published by Wallston and Wallston (1978), actually consists of three subscales with a total of 36 items in a 6-point Likert format. The MHLC Scale is also available in two 18-item equivalent forms identified as Form A and Form B. Form B was selected for this study and modified by collapsing the 6-point Likert format to a 4-point Likert scale (see Appendix G). The instructions, which were problematic in the

pilot, were simplified. These modifications were made with the full support of the principle author who was contacted by telephone (K. A. Wallston, personal communication, October 24, 1986). This modification of the scale was also used in a study reported by Peterson and Rubinson (1982).

The Form B MHLC Scale contains three subscales of six items each to measure: (a) internal health locus of control (IHLC), (b) chance health locus of control (CHLC), and (c) powerful others health locus of control (PHLC). People who generally believe their own actions determine health outcomes usually score highest on the IHLC scale. Those who believe health outcomes are determined by chance, fate, or luck usually score highest on the CHLC scale. Those who believe health outcomes are most influenced by others, such as health care providers or significant others, usually score highest on the PHLC scale. The numerical values representing the Likert scale are summed to obtain the subscale scores. Appendix G lists the specific items from the Modified MHLC Form B representing each of the subscales.

Wallston, Wallston, and DeVillis (1978) reported alpha reliabilities for the original 36-item scale as ranging from .83 to .86. Reliabilities for the shorter equivalent forms ranged from .67 to .77. A heterogenous sample of 115 persons waiting at the gates of a metropolitan airport was used to assess reliability. The reliability of an instrument is a characteristic of that instrument tested with a specific population under certain conditions (Polit & Hungler, 1983). Data assessing the reliability of the MHLC Scale with chronically ill patients were not found. Nagy and Wolfe (1984) used the MHLC Scale in a study of patients with COPD, but the reliability statistics provided were those previously given from the sample at the airport. Other studies evaluating the

instrument have been done with college students (Lau & Ware, 1981; Wallston & Wallston, 1981) and similar results obtained. Validity of the instrument was not addressed in published studies.

Usual Dyspnea VAS

A 100mm visual analog scale, anchored at the extremes as no difficulty breathing and unable to breathe, was used to measure usual dyspnea. The investigator verbally explained the instructions which were also printed on the instrument copied on yellow paper (see Appendix H). Usual dyspnea was defined as how short of breath you feel most of the time. The patient was instructed to use the pen to put a mark through the 100mm line corresponding to usual dyspnea. When scoring the instrument, the investigator applied the 0-point of a millimeter ruler to the 0 point of the 100mm line, and recorded the patient's usual dyspnea score as the millimeter point at which the patient's mark transected the VAS. The same ruler was used for all measurements.

Carrieri et al. (1984) stated that visual analog scales measure dyspnea with increasing sensitivity and accuracy. Stark and Gambles (1980) used a VAS in healthy subjects to assess breathlessness and found that the relationship between the VAS score and ventilation showed within-subject, or intra-rater reliability, and supported concurrent validity. Woodcock, Gross, and Geddes (1981) found that VAS breathlessness scores decreased in patients with emphysema with the administration of oxygen during exercise as one would expect. Limited documentation was available regarding the validity and reliability of visual analog scales as a measurement of dyspnea.

Worst Dyspnea VAS

The VAS used to assess worst dyspnea was identical to the VAS for usual dyspnea with the exception of the instructions and that the scale

was copied on goldenrod paper (see Appendix J). The patient was instructed to mark the line at the point corresponding to the most short of breath you have ever felt. Both levels of dyspnea, usual and worst, were measured in this study for the purpose of assessing whether the patient conceptually understood this symbolic form of measurement. Logically, the worst dyspnea score should have been greater than the usual dyspnea score. VASs have been extensively used in assessing dyspnea (Carrieri et al., 1984). Carrieri was contacted by telephone and recommended the use of both measures with the VAS and also recommended the use of the Modified Borg Scales to assess criterion-referenced validity. Carrieri stated a correlation of .90 was obtained between dyspnea scores measured by the VAS and Modified Borg Scale in a small study involving intensive care patients (Virginia Carrieri, personal communication, October 25, 1986). The data have not been published to date.

Usual Dyspnea Modified Borg Scale

The same definition of usual dyspnea used for the VAS was also used for the Modified Borg Scale. With this instrument, however, the patient was to select the phrase on a scale which best described usual dyspnea. The instrument was reproduced on light pink paper and the patient was instructed to circle the number corresponding to the appropriate phrase (see Appendix K).

A modified version of the original Borg Scale which measured perceived exertion was first published by Burdon et al. (1982) to assess dyspnea. These authors reported a .88 correlation between breathlessness, as measured by the modified scale, and FEV_1, providing a measure of criterion-reference validity. These patients were assessed after the inhalation of histamine. Data from the modified scale were treated

as interval data, although the intervals were unequal. The levels were numbered as 0, 0.5, 1, 2, and 3 with equal intervals numerically through level 10. All levels had descriptive phrases except levels 6 and 8 which made discrimination between levels difficult.

The Modified Borg Scale (Burdon et al., 1982) was revised by using equal interval digits to label the levels as 0 through 9 and by using phrases to describe all levels. The title of the instrument was retained. The level circled by the patient was the score recorded for usual dyspnea.

Worst Dyspnea Modified Borg Scale

The revised Modified Borg Scale was also used to measure worst dyspnea as previously defined. This instrument was reproduced on dark pink paper and scored in the same manner.

The use of both the VAS and Modified Borg Scale to measure usual and worst dyspnea allowed the investigator to assess criterion-referenced validity. The results are reported in the findings.

Self-Care Questionnaire

The 31-item Self-Care Questionnaire was developed by the investigator for this study based on specific self-care actions for COPD patients described in research, patient education materials, and other literature. The self-care actions were identified within the context of Orem's universal, developmental, and health-deviation self-care requisites as illustrated by the matrix in Appendix I.

Each item had five interval options assigned point values of 0 to 4 that were summed to obtain the score. For 28 of the items, the more frequently the patient performed the action, the higher the score received. For items 3, 9, and 11 reverse scoring technique was used because the avoidance of these behaviors (e.g., smoking) constituted

self-care. Much care was taken to develop an instrument providing interval level data so that inferential statistical methods could be applied to test the hypotheses in this study.

As with the other instruments used in this study, the Self-Care Questionnaire was prepared in pica type, double-spaced, with short line lengths. The questionnaire was printed on green paper and instructions were verbally given and stated on the instrument (see Appendix J).

To assess content validity, the Self-Care Questionnaire was submitted to a panel of experts consisting of seven nurses with expertise in the nursing care of patients with respiratory disease. Six nurses returned evaluations of the instrument. Two nurses were directors of pulmonary rehabilitation programs. Three members of the panel had extensive clinical experience, were prepared as pulmonary clinical specialists, and had a master of science of nursing degree. One panel member was a former head nurse of a chronic respiratory care unit at a large southeastern medical center. One nurse, who was a clinical specialist, was also doctorally prepared. The nurses were mailed a cover letter, the Self-Care Questionnaire, and an evaluation form asking them to evaluate each item using three criteria: (a) Does this item reflect a self-care behavior?, (b) Is the behavior appropriate for a patient with COPD?, and (c) Are the items and options worded appropriately? This evaluation tool was based on a form developed by Pace (1986) to assess content validity of an instrument. The correspondence mailed to the panel of experts and the summary of their evaluations are included in Appendix K. The nurses wrote many comments, but generally agreed that most of the items reflected self-care actions which were appropriate for patients with COPD. The panel was divided in their evaluations of items 21 through 25 which cluster actions in which patients allow others

to do things for them such as bathing, grooming, housework, or yard work. Some members of the panel did not consider these behaviors to be self-care actions, stressing the need for the patient to maintain independence. Others interpreted these actions as acceptance of the limitations imposed by the disease and that allowing others to do these things for them was a self-care action. Due to the lack of consensus among the panel, the investigator decided to leave these items on the questionnaire and evaluate the results. Some revisions were made and the final form of the instrument used in the study is provided in Appendix J.

Assessment of construct validity was not appropriate due to the small sample. A minimum sample size of 10 patients per item or a total of 310 patients would be necessary to meet the criteria for performing factor analysis (Nunnally, 1978). Assessment of reliability using alpha to measure internal consistency is reported in the findings.

Pulmonary Function

FVC, FEV_1, $FEF_{25\%-75\%}$, and MVV measurements were obtained from the medical record with written consent from each patient (see Appendix L). Three spirometry testing devices were used to obtain the results reported in this study. Each patient was pre- and post-tested on the same device by the same respiratory therapist or technician. All three devices provided a digital print-out of the results. The Gould 2100 Pulmonary Function Testing (PFT) Lab was used to measure spirometry of all treatment group patients. Another Gould 2100 PFT Lab was used with seven control patients, and the Eagle I Spirometer manufactured by Collins was used to test the other four patients in the control group. All three devices used in this study were reported to meet the manufacturers' specifications for calibration and standardization.

Protection of Human Subjects

The Institutional Review Board of the University of Alabama at Birmingham approved the study for protection of human subjects (see Appendix M). Each patient was sent a letter introducing the study. The letter was followed by a telephone call from the investigator who explained the study using the dialog in Appendix N. Patients who chose not to participate received no further communication from the investigator. Patients who chose to participate could withdraw at any time. Each patient gave written consent for the investigator to obtain pulmonary function test results. All data were treated confidentially and coded for analysis.

Written permission was given by the administrator of the pulmonary rehabilitation center for the investigator to communicate with the staff to obtain information needed for potential treatment group patients (see Appendix O). In accordance with institutional policies in a clinic-based practice, one physician sent an explanatory letter to potential control group patients with a form enclosed authorizing the physician to release their names, address, and telephone number to the investigator. Information needed to contact other potential patients for the control group was provided by a staff member working with a physician in another clinic-based practice.

Procedure

Pulmonary specialists who referred patients to the PRP were sent letters to: (a) explain the study, (b) ask permission to contact their patients regarding participation in the study, and (c) request the physicians to provide the post-PRP spirometry testing for control group patients in their offices (see Appendix Q). Nine of ten physicians responded positively.

The investigator met with the nurse coordinator and staff of the PRP each week to identify potential patients. Obtaining the sample proved to be the most difficult aspect of this study. Originally, the control group was to be composed of patients who had been referred to the PRP, but elected not to enroll in the program. Very early in implementation of the study, the investigator had to redefine the method of sample selection for the control group because the patients who chose not to enroll were also not willing to participate in the study.

To maintain the study design and obtain a control group of patients not enrolled in the PRP, the investigator sent a letter to other pulmonary specialists located in the same metropolitan area, who did not refer patients to multidisciplinary rehabilitation programs (see Appendix R). All the physicians were willing to allow the investigator to contact their patients and provide the necessary information but most lacked the capability of providing the spirometry testing. Patients of two physicians were used for the control group; patients of seven physicians were used for the treatment group.

All patients received the letter in Appendix N explaining the study. Several days later, the investigator telephoned the patients and explained the study in more depth using the dialog in Appendix N. If the patient refused to participate, there was no further communication from the investigator. If the patient agreed to participate, a mutually convenient time was arranged for the investigator to visit the patient at home to collect data.

The day before the scheduled visit, the investigator called to verify the appointment. Most patients were home at the designated time. All patients lived within a 100-mile radius of the metropolitan area.

Upon arrival at the home, a well-lighted area with seating near the patient was requested. The study was explained again with emphasis on the post-PRP visit which would follow in 3 months. The patient was given the investigator's home phone number in the event of any questions or desire to withdraw from the study. The need for pre- and post-pulmonary function testing was explained, and the patient's cooperation was solicited. Written consent was obtained to request the results of pulmonary function tests.

A clipboard was used to hold the instruments which were administered in the following order: (a) Patient Information form, (b) the four dyspnea scales, (c) Self-Care Questionnaire, (d) and the Modified MHLC Scale. The patient was given a ballpoint pen to complete the instruments which were removed from the clipboard as completed. Four patients experienced visual impairment or difficulty reading. Instruments were administered verbally to these patients. To facilitate this process, the five possible responses to most of the items on the Self-Care Questionnaire were printed in large letters on a letter size sheet of cardstock paper. The four options of the Modified MHLC Scale were printed on the reverse side (see Appendix S).

The total length of the visit, for data collection purposes only, averaged 30 to 45 minutes. However, many of the patients were conversant and most visits lasted an hour or longer. The investigator concluded the visit by reminding the patient of the return visit in 3 months which would be arranged a few weeks in advance by phone.

Sample selection and data collection for both groups extended over a 12-month period. Through weekly meetings with the staff of the PRP, the investigator learned of patients who developed problems and withdrew from the program. A sample size of 20 patients in each group was desired;

however, due to attrition, limited access to control group patients, and the extended time period since the first patients became involved in the study, sample selection ended with 15 treatment group patients and 11 control group patients. Data collection extended another 3 months until post-PRP data were collected from the last few patients.

An appointment was made by phone, and the investigator returned to the patient's home 3 months after the first visit to collect post-PRP data. The same procedures used for the pre-PRP visit were followed with the omission of the administration of the Patient Information form and the Modified MHLC Scale. Arrangements for the post-pulmonary function testing of control group patients were made during the visit. All pulmonary function tests were completed within 2 weeks of the post-PRP home visit.

A copy of the digital print-out results of pulmonary function tests were mailed to the investigator for each control group patient. The investigator obtained the results for treatment group patients from medical records at the PRP.

Summary of Pilot Studies

The procedure proposed for sample selection in this study was used without difficulty in the initial pilot study. Pre-PRP data only were collected from eight patients, with four in each group. The treatment group was composed of patients who entered the PRP. The control group consisted of patients who chose not to enter the PRP. The dependent variables were severity of illness, self-care, and health locus of control.

The instrument to measure severity of illness, developed by the investigator, was problematic in administration and scoring. The

instrument attempted to measure dyspnea and, because of the problems encountered, was replaced by the VAS and Modified Borg Scales for use in this study.

The Self-Care Checklist used in the first pilot study was developed by the investigator and listed eight items considered to be critical self-care behaviors. Although the options indicated frequency of performance of the behaviors, the instrument did not yield data that could be scored. The inadequacies of the tool led to total revision of the instrument.

Health locus of control was treated as a dependent variable in the first pilot study. The original 6-point Likert Scale of the MHLC Form B was problematic. Only one of the eight patients completed the scale without asking for clarification. All had difficulty with the written instructions and wording of items. Although the items are written at a 5th- to 6th-grade reading level (Wallston et al., 1978), the instructions contained many polysyllabic words in lengthy sentences. All items were worded in the form of I statements with verbage most applicable to healthy individuals. Chronically ill patients had difficulty expressing agreement or disagreement with statements such as: "If I become sick, I have the power to make myself well again" (MHLC, Form B, p. 1). As a result of these problems, scores were questionable.

Follow-up pilot studies were designed to test only the instruments, since the method of sample selection was not a problem in the initial study. Patients participating in the PRP composed the samples to test the instruments. The Usual Dyspnea VAS, Worst Dyspnea VAS, Usual Dyspnea Modified Borg Scale, and the Worst Dyspnea Modified Borg Scale were administered to nine PRP patients who followed the written instructions and completed the scales without difficulty. High correlations

were found between the Usual Dyspnea VAS and Modified Borg Scales and between the Worst Dyspnea VAS and Modified Borg Scales. The new Self-Care Questionnaire was administered to 12 PRP patients who completed the instrument without difficulty. The Modified MHLC Scale (Form B), witn a 4-point Likert scale and simplified instructions was administered to 10 PRP patients who completed the instrument with less difficulty than the control group.

Health locus of control (HLC) was retained in this study as one of many demographic variables because of the investigator's interest in psychological variables which may be a factor in the performance of self-care actions. Problems encountered with administration of the MHLC scales in the initial pilot study led to the decision to delete HLC as a dependent variable in the current study.

The initial pilot study, subsequent instrument revisions and re-evaluations, followed by further pilot testing of instruments extended over a 6-month period. This process allowed the identification of major problems with instrumentation which were addressed and appropriately resolved prior to implementation of this study.

Statistical Analysis

Descriptive statistical procedures were used to analyze data from the Patient Information form to describe the sample. Demographic variables were also entered into stepwise multiple regression equations to test hypotheses 4, 5, and 6 which state that the variance in dyspnea, self-care, and pulmonary function, respectively, explained by the demographic variables is equal to 0.

Multivariate analysis of co-variance (MANCOVA) was used to test hypotheses 1, 2, and 3 which stated that there was no difference post-PRP

between groups in dyspnea, self-care, and pulmonary function, respectively. MANCOVA was selected to allow control for pre-PRP differences between groups.

Reliability of the Self-Care Questionnaire was tested with Cronbach's alpha. Correlation procedures were used to assess criterion-referenced validity of the VAS and Modified Borg Scales.

All statistical analyses were done with the SPSSPC Plus statistical package except for alpha reliabilities which were done using SPSSX on a mainframe computer. Hypotheses were tested at the .05 level of significance. Findings are reported in the next chapter.

CHAPTER IV

Findings

Presented in this chapter are a description of the sample, testing of hypotheses, supplemental analyses, and additional findings. Findings are discussed in relation to previous research.

Description of Sample

The total convenience sample initially consisted of 34 patients with 21 in the treatment group and 13 in the control group. Pre-PRP data were obtained for these patients; however, as a result of attrition, post-PRP data were collected from only 15 treatment and 11 control group patients. Reasons for attrition are given in Table 1. Data from the eight patients who did not complete the study were not entered into analysis.

The attrition rate for the PRP patients was 24%. This is not consistent with the overall attrition rate for the PRP which the nurse coordinator reported as 20%. The rate and reasons for attrition are consistent with those identified by Shenkman (1985) who found a 73% attrition rate in a specific pulmonary rehabilitation program. In a study that addressed factors contributing to attrition rates, Shenkman reported that patients who failed to complete the program had higher scores on measures of psychological variables such as helplessness, hopelessness, and alienation when compared to those who completed the program.

Table 1

Reasons for Attrition in Study Sample

Patient	Group	Reason
1	T	Developed gastrointestinal symptoms. Did complete PRP at a later time.
2	T	Hospitalized for acute gastrointestinal bleeding. Did not return.
3	T	Unknown, stopped coming.
4		Developed back pain. Did not return.
5	T	Hospitalized with large spontaneous pneumothorax. Did complete PRP at later time.
6	T	Developed life-threatening arrhythmias with exercise, refractory to treatment. Did not return.
7	C	Failed to have pre-PRP pulmonary function testing as scheduled.
8	C	Failed to keep post-PRP home visit appointments with investigator.

T = Treatment group; C = Control group

The development of complicating health problems, such as those identified in Table 1, was not identified by Shenkman as a contributing factor.

All patients in the study lived within a 100-mile radius of the metropolitan area. The most distant PRP patient lived 75 miles from the rehabilitation facility but was brought each day to the center by family. Many patients used the van service provided by the facility.

Descriptive data for the sample, obtained from the Patient Information form, are presented in Table 2. The mean age was 66 years. The ratio of males to females for the total group was almost equal; however, the ratios within groups were not.

Table 2

Comparison of Control and Treatment Groups on Demographic Variables

Variable	Treatment n = 15	Control n = 11	Total n = 26
Age			
Mean	69.50	61.73	66.20
Standard Deviation	6.36	6.70	7.50
Sex			
Male	10	4	14
Female	5	7	12
Race			
Black	0	2	2
White	15	9	24
Other	0	0	0
Educational Background			
8th grade or less	1	3	4
9th - 12th grade	5	0	5
H.S. diploma or GED	5	3	8
Some college or technical school	3	3	6
College degree	1	2	3
Marital Status			
Married	14	9	23
Widowed	1	2	3
Income Range			
Less than $4,999	0	0	0
$5,000 - $9,999	0	5	5
$10,000 - $14,999	2	2	4
$15,000 - $19,999	0	0	0
$20,000 - $24,999	0	0	0
$25,000 - $29,999	4	3	7
$30,000 - $34,999	2	0	2
Over $35,000	2	0	2
Not sure	5	1	6

The sample was most noticeably skewed and least representative of the total population of patients with COPD in relation to the variable of race. Only two patients, both in the control group, were black; however, COPD is not more common to either race. The same etiologies, such as cigarette smoking and environmental exposure, are common to both races. Fewer black patients are referred to the PRP. The physicians in private practice who refer patients to the PRP see fewer black patients in proportion to white patients. Two black males, one in each group, went through the pre-PRP data collection phase, but neither patient completed the study.

The patients in both groups were diverse in educational background. All patients were literate, but several were unable to read data collection instruments because of visual impairments.

All patients in the study were married, living with their spouse, or widowed. Income range was collected as an indicator of socioeconomic status. Patients in the treatment group had Medicare and/or other insurance that paid 80% to 100% of the costs of the program. In general, control group patients reported a lower income than the treatment group.

The two groups were compared on other selected demographic variables; the descriptive statistics are given in Table 3. The number of years since the patient first noticed shortness of breath was markedly different between the groups with means of 24 years for the control group and 5.50 years for the treatment group. The treatment group reported a greater pack year history with a mean of 48.9 years, compared to a mean of 26.60 years for the control group. An unusual characteristic of the total sample was that seven patients (26.9%) stated they had

Table 3

Comparison of Treatment and Control Groups on Selected Demographic Variables

Variable/Group	Mean	Standard Deviation	Range
Age			
Treatment (n = 15)	69.50	6.36	58-82
Control (n = 11)	61.73	6.70	50-74
Years Short of Breath			
Treatment	5.53	5.58	1-40
Control	24.09	22.97	2-56
Pack Years			
Treatment	48.90	35.30	0-120
Control	26.55	34.47	0-90
Modified MHLC Scores			
IHLC (Internal)	15.70	1.50	13-19
Treatment	16.00	1.95	13-19
Control			
CHLC (Chance)			
Treatment	12.40	2.03	8-16
Control	12.45	1.70	13-19
PHLC (Powerful Others)			
Treatment	16.87	1.89	13-20
Control	19.27	2.41	16-23

never smoked. Five of these seven patients were in the control group. Four reported shortness of breath since childhood and did not smoke for this reason.

Health locus of control was treated as a demographic variable in this study. In comparing the groups on the Modified MHLC subscales, the mean scores were similar for both groups on IHLC and CHLC scales. The control group scored slightly higher on the PHLC scale. The

possible score range for each scale is 6 to 24. Both groups scored lowest on the Chance HLC scale and higher on the Powerful Others HLC scale than on the Internal HLC scale.

The Patient Information form also requested information about work history, hospitalizations, and co-existing health problems. Only two patients reported that they had quit work because of lung problems. Only three patients had been hospitalized in the last year because of lung problems. The most commonly reported co-existing health problem was arthritis. Only one treatment group patient had a co-existing health problem when he entered the program that made him unable to complete the PRP. His cardiopulmonary disease led to the development of life threatening dysrhythmias, refractory to treatment, with the PRP exercise component.

Descriptive data were assessed for outliers using statistical procedures. The presence of outlying data was assessed using standardized scores. Scores outside of three standard deviations were considered to be outliers (Tabachnick & Fidell, 1983). No dependent variables had outliers. The only outlying data were collected from one subject in the treatment group. Age and years since first noticed shortness of breath were the outliers. This patient was 45 years old, the youngest in the treatment group, and was the only patient in the treatment group with a history of asthma since childhood. This patient reported a 40-year period since first noticed shortness of breath.

Tabachnick and Fidell (1983) described a method for handling outliers which avoids the deletion of the subject but "preserves the deviancy of the data without allowing it to be so deviant that it perturbs correlation" (p. 76). The outlying score for age was lowered to 1 year below the lowest non-outlying score for age in the treatment

group. The outlying score for years since first noticed shortness of breath was lowered to 1 year above the highest non-outlying score for this variable. The data in Table 3 reflect these changes.

Normality of the sample was assessed by skewness, calculated as the ratio of skewness to its standard error. A z value within $\pm$ 2.58 deviations from the mean supported the assumption of normality. Prior to changing the outlying observation for years since first noticed shortness of breath, the z value was + 4.60. After lowering the observation for this patient, the z value was 1.19. Studentized residuals and Cook's distance showed no significant outliers after adjustments.

Analysis of Data

The SPSSPC Plus statistical package was used for data analysis. Multivariate analysis of covariance (MANCOVA) was used to test hypotheses 1, 2, and 3. A separate analysis was done for each hypothesis. Multiple regression procedures were used to test hypotheses 4, 5, and 6 with an analysis for each dependent variable in each hypothesis. Hierarchial analysis adjusted for nonorthogonality resulting from unequal sample sizes (SPSS, Inc., & Norusis, 1986a). There were no missing data for the 26 patients. Data for the dependent variables contained no outliers. Hypotheses were tested at the .05 level of significance.

Hypothesis 1 stated there is no significant difference in dyspnea between control and treatment groups post-PRP as measured by usual dyspnea VAS, worst dyspnea VAS, usual dyspnea Modified Borg scale, and worst dyspnea Modified Borg scale. One MANCOVA analysis was done to test this hypothesis.

Assumptions were tested prior to the hypothesis. Box's M was used to test for homogeneity of variance. The multivariate test of covariance among pre- and post-PRP measures of dyspnea was not significant

(F = 1.15326, p = .246), supporting the assumption of homogeneity of variance. Tests for homogeneity of regression were also non-significant (p = .879), supporting this assumption. Scattergrams demonstrated no curvilinear relationships. The possibility of a violation of the assumptions of multicollinearity and singularity was suspected from the correlation matrix of the variables which reported multiple significant correlations. The matrix is given in Table 4. The presence of multicollinearity was confirmed by the determinant computed as .00692. Multicollinearity results in unstable regression coefficients and sampling instability due to increased standard errors (SPSS, Inc., & Norusis, 1986b). These problems decrease the probability of rejecting the null hypothesis (Cohen & Cohen, 1975).

The MANOVA procedure tests for covariance, allowing for control of pre-test differences between groups (Winer, 1962). Hotelling's T^2 was used to test the first hypothesis and was reported as .08374 with an approximate F (4, 17) of .35588 and a significance level of .836. The four combined post-PRP measures of dyspnea were not significantly affected by group when adjustment was made for covariate pre-PRP differences. With no significant difference in dyspnea found between the groups post-PRP, the null hypothesis was not rejected. Because the multivariate analysis was nonsignificant, examination of univariate results was not appropriate. As a result of the problem with multicollinearity, another MANOVA procedure was done deleting all but one of the variables for dyspnea. The results are reported in the supplemental analyses.

There were no comparable studies in literature which assessed dyspnea following completion of a rehabilitation program. Other investigators did not attempt to quantify dyspnea, but reported studies which

Table 4

Correlation Matrix of Dyspnea Variables

Variable	PUVAS	PWVAS	PUBORG	PWBORG	UVASP	WVASP	UBORGP	WBORGP
PUVAS	1.0000							
PWVAS	.4563*	1.0000						
PUBORG	.5891**	.3391	1.0000					
PWBORG	.4785*	.7784*	.3701	1.0000				
UVASP	.2603	.2212	.3431	.3908	1.0000			
WVASP	.2837	.6068**	-.0199	.3218	.0311	1.0000		
UBORGP	.2770	.1152	.4574*	.3092	.8247**	-.1712	1.0000	
WBORGP	.3110	.7264**	.0922	.5342*	-.0200	.6225**	.3380	1.0000

*$p < .01$
**$p < .001$
PUVAS = Pre-PRP Usual Dyspnea VAS
PWVAS = Pre-PRP Worst Dyspnea VAS
PUBORG = Pre-PRP Usual Dyspnea Modified Borg Scale
PWBORG = Pre-PRP Worst Dyspnea Modified Borg Scale
UVASP = Post-PRP Usual Dyspnea VAS
WVASP = Post-PRP Worst Dyspnea VAS
UBORGP = Post-PRP Usual Dyspnea Modified Borg Scale
WBORGP = Post-PRP Worst Dyspnea Modified Borg Scale

found symptomatic improvement in patients post pulmonary rehabilitation programs (Kimbel et al., 1971; Moser et al., 1980). These studies lacked control groups.

Cell means and standard deviations of pre- and post-PRP measures of dyspnea are given in Table 5. Usual dyspnea, measured by the VAS, increased slightly while the Modified Borg score decreased slightly for both groups. Patients were able to quickly select phrases to describe usual and worst dyspnea on the Modified Borg Scale but took longer to mark the VASs.

Table 5

Cell Means and Standard Deviations for Measures of Dyspnea

Variable/Group	Pre Mean	Pre S.D.	Post Mean	Post S.D.
UVAS				
Treatment (n = 15)	29.93	21.28	27.02	17.79
Control (n = 11)	30.27	32.55	34.27	29.26
Total (n = 26)	27.77	26.12	30.12	23.08
WVAS				
Treatment	79.73	21.72	81.40	15.08
Control	85.18	22.41	86.09	15.15
Total	81.15	24.46	83.38	15.40
UBORG				
Treatment	3.07	1.58	2.67	1.45
Control	3.45	1.69	3.09	2.12
Total	3.23	1.61	2.85	1.74
WBORG				
Treatment	7.20	1.66	6.93	1.53
Control	6.82	2.04	7.20	1.66
Total	7.04	1.80	7.08	1.49

UVAS = Usual Dyspnea VAS
WVAS = Worst Dyspnea VAS
UBORG = Usual Dyspnea Modified Borg Scale
WBORG = Worst Dyspnea Modified Borg Scale

The VAS and Modified Borg scales were both used for the purpose of evaluating criterion-referenced validity. In assessing criterion-referenced validity, the criterion to which an instrument is being related should be an operationalization of the same construct (Knapp, 1985). The matrix in Table 4 gives the correlations between the four scales which measure the construct of dyspnea. Although the multiple significant correlations created the problem with multicollinearity, the correlations do support criterion-referenced validity and indicate that the instruments are measuring the same construct. Significant correlations were found between usual dyspnea and worst dyspnea measured pre-PRP. The stronger correlation pre-PRP was in worst dyspnea (r = .78, $p < .001$). The correlation between the two pre-PRP measures of usual dyspnea was .59 ($p < .001$).

Hypotheses 2 stated there is no significant difference between groups post-PRP as measured by the summative score on the Self-Care Questionnaire. One ANCOVA analysis was done to test this hypothesis.

Homogeneity of variance was demonstrated by a nonsignificant Box's M (F = 1.05925; df = 3,39136; p = .065). The assumption of homogeneity of regression was supported (p = .883). The assumptions related to multicollinearity and singularity were met as demonstrated by a non-significant within cell correlation determinant of .54252. Scattergrams revealed no curvilinear relationships.

The MANOVA procedure tested for post-PRP differences between group means with adjustment for pre-PRP self-care score differences between groups. The F statistic for adjusted covariance of sequential sums of squares testing the difference between groups was 3.72 with 1, 23 degrees of freedom and a p value of .066. The null hypothesis of no significant difference between the groups in post-PRP self-care scores

was retained. Cell means, standard deviations, and ranges in self-care scores are given in Table 6. The pre-PRP mean self-care score was higher in the control group than the treatment group; the means were 80.18 and 69.60, respectively. This could be a function of the longer length of time reported for years by the control group since first noticed shortness of breath. The longer history of dyspnea, combined with the higher mean dyspnea score in the control group, could have led to the opportunity to learn more self-care actions and more frequent performance of the self-care actions identified in the questionnaire. Patients with COPD often discover the effectiveness of techniques, such as pursed lip breathing, without having been taught the skill (Carrieri et al., 1984). Orem (1985b) stated: "The ability for engaging in self-care develops in the course of day to day living through the spontaneous process of learning" (p. 106).

Table 6

Cell Means and Standard Deviations of Self-Care Questionnaire Scores

Score/Group	Mean	Standard Deviation	Range
Pre-PRP Self-Care Score			
Treatment (n = 15)	69.60	16.01	44-101
Control (n = 11)	80.18	15.59	57-105
Total (n = 26)	74.08	16.41	44-105
Post-PRP Self-Care Score			
Treatment	77.27	12.97	55-95
Control	76.00	20.00	51-111
Total	76.23	15.96	51-111

Post-PRP mean self-care scores increased in the treatment group, but decreased in control subjects, resulting in group mean scores slightly more than one point apart. Due to changes within the groups, the total mean score for both groups increased by only two points.

There were no studies in the literature with which to compare these results. Several studies identified self-care actions, but none attempted to measure frequencies of self-care behaviors. The study by Howland et al. (1986) measured knowledge retained one year post-PRP but did not measure behaviors. The Cronbach alpha coefficient for the pre-PRP self-care scores was .82. Alpha estimates the internal consistency or homogeneity of an instrument (Sax, 1980). The alpha coefficient demonstrates a high degree of internal consistency but, as with other types of reliability, are a function of an instrument administered to a specific population under certain conditions (Waltz & Bausell, 1981).

Test-retest reliability was demonstrated by the stability of the pre- and post-PRP scores of the control group. Pearson r was computed as .77 ($p < .01$). The potential for memory effects is a recognized limitation of test-retest reliability; however, the measure is considered a useful addition to results supporting internal consistency (Polit & Hungler, 1983).

As previously stated, the panel of experts who evaluated the Self-Care Questionnaire for content validity were divided in their evaluations of items 21 through 25 which cluster actions in which patients allow others to do things for them such as bathing, grooming, housework, or yard work. Eight patients reported allowing help with bathing rarely or sometimes. Six reported allowing assistance with grooming with a frequency range of rarely to sometimes. Twenty patients stated they needed help with yard work ranging in frequency from rarely to very

often; while 17 patients rarely to very often needed assistance with house chores. Self-care was defined for this study as the process by which an individual assumes an active decision-making role in the performance of activities which allow the individual to function effectively in promoting or maintaining the individual's optimum state of health. Within the context of this definition, the decision to allow others to assist with self-care actions constitutes self-care.

Pre-PRP total sample rank-ordered means and standard deviations for item scores on the Self-Care Questionnaire are given in Table 7. The items are ranked from most frequently performed to least frequently performed self-care actions. Each action was performed at least rarely by one or more patients. Item 31 had the greatest mean because of the possibility of multiple answers. The item asked: "What do you do to help you relax when you get short of breath?" Each specific action was listed and scored by frequency of performance then totaled to obtain the item score. All other items had a maximum possible mean of 4.0. The self-care actions receiving the lowest frequency ratings were using steam, allowing help with bathing, and allowing help with grooming.

Hypothesis 3 stated there is no significant difference in pulmonary function post-PRP as measured by the FVC, FEV_1, $FEF_{25\%-75\%}$, and MVV. One MANCOVA analysis was done to test this hypothesis.

The test of homogeneity of variance in pulmonary function variables was nonsignificant (Box's M: $F = 1.03043$, $p = .420$), supporting the assumption of homogeneity of dispersion matrices. A common slope could be assumed from the regression coefficient which was nonsignificant at $p = .446$, supporting the assumption of homogeneity of regression. No curvilinear relationships were found in examining the scatterplots.

Table 7

Rank-Ordered Pre-PRP Self-Care Mean Scores For Total Sample

Rank	Item		Mean	SD
1	31.	Activities to relax	8.54	3.29
2	26.	Keeps appointments	3.96	.20
3	11.	(Avoids) OTC sleep meds	3.92	.39
4	8.	Takes medications as prescribed	3.69	.74
5	29.	Takes all of antibiotic	3.69	.79
6	28.	Reports signs of infection	3.65	.89
7	27.	Reports reactions to drugs	3.62	1.10
8	3.	(Does not) smoke cigarettes	3.42	1.39
9	9.	(Avoids) OTC drugs	3.15	1.12
10	10.	Gets adequate sleep and rest	2.69	1.23
11	13.	Changes position when SOB	2.58	1.55
12	6.	Drinks 8 glasses or more/day	2.46	1.61
13	30.	Uses distractions	2.19	1.70
14	25.	Reduces activities	2.19	1.30
15	23.	Allows help with yard work	2.12	1.56
16	2.	Exercise	2.12	1.77
17	4.	Take flu vaccine	2.08	1.79
18	15.	Uses physical distancing	2.00	1.52
19	5.	Uses inhaler as prescribed	1.81	1.81
20	19.	Wears loose clothing	1.73	1.73
21	14.	Sits, leans forward when SOB	1.65	1.55
22	7.	Uses pursed lip breathing	1.58	1.45
23	24.	Allows help with house work	1.46	1.33
24	12.	Knows air quality index	1.38	1.60
25	26.	Changes hygiene habits	1.27	1.34
26	1.	Uses abdominal breathing	1.27	1.34
27	17.	Changes grooming habits	1.15	1.32
28	18.	Wears slip on shoes	1.15	1.38
29	20.	Uses steam	.85	1.22
30	21.	Allows help with bathing	.46	.76
31	22.	Allows help with grooming	.38	.40

Multicollinearity and singularity were suspected from the high correlations between the four variables given in Table 8 and confirmed by the determinant of $< .00001$. When multicollinearity exists, the

stability and interpretation of the results are questionable (SPSS, Inc., 1986). The probability of retaining a hypothesis that should be rejected is increased (Huck, Cormier, & Bounds, 1974).

Hotelling's T^2 multivariate test of significance resulted in a value of .03814, with an approximate F (4, 17) of .16634 and a p value of .953. The null hypothesis of no significant differences between the groups was not rejected. Because of the problem with multicollinearity, another MANOVA procedure was done, using only the pre-FEV_1 as the dependent variable. Results are presented in the supplemental analyses.

The results of pre-PRP pulmonary function testing are given in Table 9. Cell means and standard deviations are given in Table 10. The findings were consistent with previously cited studies which found no significant improvement in the FEV_1 following a formal PRP or exercise program (Atkins et al., 1984; Kimbel et al., 1971; Pineda et al., 1986; Zack & Pallange, 1985). The only study reporting results which conflict was by Mungall and Hainsworth (1980) who found a small but significant increase in FEV_1 in a sample of 10 patients who completed an exercise program.

Hypothesis 4 stated the amount of variance in dyspnea explained by the demographic variables of age, sex, race, marital status, education background, income range, number of years since first noticed shortness of breath, pack years, and health locus of control is equal to 0. For the purpose of statistical analysis, this hypothesis was treated as four sub-hypotheses. Four stepwise multiple regression procedures were done in which each of the four measures of dyspnea were treated as dependent variables. The sub-hypotheses were:

1. The amount of variance in usual dyspnea VAS scores explained by the demographic variables is equal to 0.

Table 8

Correlation Matrix of Pulmonary Function Variables

Variable	PFVC	PFEV1	PFEF	PMVV	FVCP	FEV1P	FEFP	MVVP
PFVC	1.0000							
PFEV1	.8816**	1.0000						
PFEF	.6842**	.9205**	1.0000					
PMVV	.8404**	.9437**	.8389**	1.0000				
FVCP	.9214**	.8802**	.7200**	.7933**	1.0000			
FEV1P	.7755**	.9438**	.8996**	.8751**	.8672**	1.0000		
FEFP	.3964*	.7622**	.8898**	.6919**	.5826**	.8655**	1.0000	
MVVP	.7186**	.8616**	.7733**	.9031**	.7772**	.9194**	.7674**	1.0000

*$p < .01$
**$p < .001$
PFVC = Pre-FVC
PFEV1 = Pre-FEV1
PFEF = Pre-FEF
PMVV = Pre-MVV
FVCP = Post-FVC
FEV1P = Post-FEV1
FEFP = Post-FEF
MVVP = Post-MVV

Table 9

Pre-PRP Pulmonary Function Results for Study Group

Group/Patient	PFVC*	$PFEV_1$*	$PFEF_{25\%-75\%}$*	PMVV*
Treatment Group				
1	69	72	70	86
2	87	82	62	76
3	98	63	24	74
4	99	66	20	68
5	101	92	60	105
6	83	35	12	39
7	74	49	18	58
8	88	78	51	67
9	140	119	81	116
10	52	33	11	38
11	55	42	19	46
12	86	68	33	66
13	47	43	28	33
14	33	11	5	13
15	76	65	30	86
Control Group				
1	71	55	25	50
2	72	77	54	103
3	33	22	12	21
4	54	27	10	22
5	124	125	103	117
6	55	49	29	50
7	16	13	7	12
8	76	76	48	72
9	63	53	28	42
10	80	85	60	97
11	16	13	7	12

*Values are expressed as percent of predicted

2. The amount of variance in worst dyspnea VAS scores explained by the demographic variables is equal to 0.

3. The amount of variance in usual dyspnea Modified Borg scores explained by the demographic variables is equal to 0.

Table 10

Cell Means and Standard Deviations for Pulmonary Function Variables

Variable/Group	Pre Mean	Pre SD	Post Mean	Post SD
FVC				
Treatment (n = 15)	79.33	26.37	79.47	19.94
Control (n = 11)	65.55	27.35	73.55	32.82
Total (n = 26)	73.50	27.31	76.96	25.73
FEV_1				
Treatment	61.20	26.80	57.53	21.31
Control	60.64	33.09	62.91	37.46
Total	60.96	28.99	59.81	28.68
$FEV_{25\%-75\%}$				
Treatment	34.93	23.79	28.87	17.58
Control	41.55	30.90	41.82	37.31
Total	37.73	26.65	34.35	27.79
MVV				
Treatment	64.73	27.83	60.73	20.08
Control	59.64	35.36	61.55	38.87
Total	62.58	30.66	61.08	28.81

4. The amount of variance in worst dyspnea Modified Borg scores explained by the demographic variables is equal to 0.

Assumptions were tested prior to hypotheses. Outliers listed in studentized residuals and Cook's Distance were nonsignificant. Examination of scatterplots supported the assumptions of normality, linearity, and homoscedasticity of data. The lack of multicollinearity and singularity among the demographic variables was evident in the correlation matrix. The only significant correlations were between sex and pack years (r = .6856, $p < .001$), and between education and Chance Health Locus of Control (r = .5617, $p < .01$).

The demographic variables of race and marital status were deleted from analysis because of the lack of variability in the data. Only 2 of the 26 patients were black, and all were married except for 3 patients who were widowed.

The first multiple regression procedure tested the sub-hypothesis that the variance in usual dyspnea VAS explained by the demographic variables was equal to 0. Using the default values for F-to-enter (PIN) and F-to-remove (POUT) in stepwise regression, the only variables to enter the equation before PIN was reached were years since first noticed shortness of breath and sex. These two variables accounted for 37% of the variance in the pre-PRP usual dyspnea VAS scores as reflected in Table 11. The individual correlations of these variables with the dependent variable were not significant.

Table 11

Stepwise Multiple Regression for Demographic Variables on Dyspnea

Variables Entered in Equation*	Multiple R	R^2	R^2 Change	Beta	df	F to enter	p
VARIABLE:							
Usual Dyspnea VAS							
Years short of Breath	.4351	.1893	.1893	.4351	2.23	5.604	.026
Sex	.6074	.3689	.1796	-.4241	2.23	4.723	.005

*Only variables which entered equations are listed

Because of the problems inherent in using multivariate analysis with small samples, these results should be interpreted with caution

because results could vary substantially across samples (Prescott, 1987). Based on the results, however, the first null sub-hypothesis was rejected.

In the subsequent stepwise regression procedures to test the other three sub-hypotheses, no variables met the PIN limit to enter an equation. The demographic variables did not explain significant variance in the remaining three measures of dyspnea; and the respective sub-hypothesis failed to be rejected. However, because significant variables was explained in one of the measures of dyspnea, Hypothesis 4 was rejected.

Hypothesis 5 stated the amount of variance in self-care explained by the demographic variables is equal to 0. Demographic variables included age, sex, education, income, range, number of years since first noticed shortness of breath, pack years, and health locus of control.

Assumptions for multiple regression analysis were met. None of the correlations between demographic variables and pre-PRP self-care scores were significant. In the stepwise regression procedure, years since first noticed shortness of breath was the only variable to enter the equation, explaining only 19% of the variance in self-care scores ($p = .026$). The null hypothesis was rejected. This is consistent with the previously noted observation of a higher pre-PRP mean self-care score in the control group who reported a higher mean for years since first noticed shortness of breath.

Hypothesis 6 stated the variance in pulmonary function explained by demographic variables is equal to 0. This hypothesis is similar to the fourth hypothesis in that there were four sub-hypotheses:

1. The amount of variance in FVC explained by the demographic variables is equal to 0.

2. The amount of variance in FEV_1 explained by the demographic variables is equal to 0.

3. The amount of variance in $FEF_{25\%-75\%}$ explained by the demographic variables is equal to 0.

4. The amount of variance in MVV explained by the demographic variables is equal to 0.

The assumptions of normality, linearity, and homoscedasticity were met. The only significant correlations in demographic variables were those previously identified between sex and pack years, and between Chance HLC and education. Sex was significantly correlated with each of the four dependent variables of pulmonary function. The norms for pulmonary function are based on age, sex, and height.

To test the first sub-hypothesis stepwise multiple regression was done with FVC as the dependent variable. Three variables entered into the equation: sex, years since first noticed shortness of breath, and education. The $\underline{R}^2$ and $\underline{R}^2$ change are given in Table 12. These variables accounted for 53% of the variance in pre-PRP FVC. The null sub-hypothesis was rejected.

In testing the other three sub-hypotheses for pulmonary function, sex was the only variable to enter the equations for FEV_1, $FEF_{25\%-75\%}$, and MVV explaining 44%, 42%, and 33% of the variance, respectively, as reported in Table 12. The variance in each of the four pulmonary function variables was partially explained by at least one or more demographic variables; therefore, the null hypothesis of the explained variance in pulmonary function being equal to 0 was rejected.

Summary of Hypotheses Testing

The first three hypotheses stating there was no significant differences between groups post-PRP in dyspnea, self-care, and pulmonary

Table 12

Stepwise Multiple Regression for Demogaphic Variables on Pulmonary Function

Variables Entered in Equation*	R	R^2	R^2 Change	Beta	df	F to enter	p
VARIABLE: FVC							
Sex	.4984	.2484	.2484	.4984	1,24	7.932	.010
Years SOB	.6488	.4209	.1725	-.4156	2,23	8.358	.002
Education	.7248	.5254	.1045	.3456	3,22	8.118	.001
VARIABLE: FEV_1							
Sex	.6634	.4401	.4401	.6444	1,24	17.044	.001
VARIABLE: $FEF_{25-75\%}$							
Sex	.6440	.4153	.4153	.6444	1,24	17.044	.001
VARIABLE: MVV							
Sex	.5698	.3247	.3247	.5698	1,24	11.538	.002

*Only variables which entered equations are listed

function were all accepted. If there had been significant differences, the last three hypotheses would have been important in identification of variables, other than the independent variable of the PRP program, which could contribute to explanation of differences between groups. Demographic variables partially explained variance in pre-PRP usual dyspnea VAS scores, pre-PRP self-care scores, and all four measures of pulmonary function. The last three null hypotheses of variance in dyspnea, self-care, and pulmonary function being equal to 0 were rejected.

Supplemental Analyses

As a result of the problem with multicollinearity among the measures of dyspnea, another MANOVA analysis was done with post-PRP usual dyspnea VAS as the dependent variable, group as the independent variable, and pre-usual dyspnea VAS as the covariate. All assumptions were met; however, the results showed no significant difference between groups in post-PRP usual dyspnea VAS scores.

The usual dyspnea VAS was selected for secondary analysis because more significant correlations were found with this variable and pulmonary function variables as shown in Table 13. All significant correlations were inverse relationships indicating that the higher the VAS score, the lower the spirometry value. Previous studies did not correlate these variables.

Table 13

Correlation Matrix of Measures of Dyspnea with Pulmonary Function Variables

Variable		PUVAS	PUBORG	UVASP	PWBORG
Pre-PRP	FVC	-.5230*	-.1512	-.2470	-.2370
	FEV_1	-.4878*	-.0367	-.1994	-.1590
	$FEF_{25\%-75\%}$	-.3302	-.1307	-.1669	-.1855
	MVV	-.5051*	-.0377	-.1914	-0.974
Post-PRP	FVC	-.6063**	-.2598	-.3935	-.4056
	FEV_1	-.5412	-.1204	-.2186	-.1484
	$FEF_{25\%-75\%}$	-.3403	-.1396	-.0468	.0753
	MVV	-.5268*	-.1204	-.2211	-.0909

*p .01, **p .001

A secondary MANOVA procedure was also done with post-PRP FEV_1 as the dependent variable, group as the independent variable, and pre-PRP FEV_1 as the covariate. In the previous analysis, using all measures of pulmonary function, the assumption of multicollinearity was violated. No significant differences were found between groups in post-PRP FEV_1 ($\underline{F} = 2.51$, $\underline{df} = 1,23$, $\underline{p} = .127$).

The high significant correlations, given in Table 4, support the test-retest reliability of the spirometry measures for this sample of patients. The stability of these measures over a 3-month time period was supported.

Summary

No significant differences were found between the treatment and control groups in the variables of dyspnea and pulmonary function. Difference in self-care scores approached significance. Sex and years since first noticed shortness of breath were the only demographic variables accounting for significant variance in dyspnea, self-care, and pulmonary function. Education also contributed to explanation of variance in pulmonary function.

Supplemental analyses did not provide support for significant differences between groups in specific measures of dyspnea and pulmonary function. Small sample size and multicollinearity among variables contributed to the failure to reject the null hypotheses for differences between groups.

The content validity, as assessed by a panel of experts, and internal consistency, as a measure of reliability, of the Self-Care Questionnaire were supported by the results of this study. Criterion-referenced validity of the VAS and Modified Borg Scales was also supported.

CHAPTER V

Discussion, Conclusions, Implications, and Recommendations

The purpose of this study was to ascertain the effects of a specific pulmonary rehabilitation program on dyspnea, self-care, and pulmonary function of patients with chronic obstructive pulmonary disease. The pulmonary rehabilitation program (PRP) was multidisciplinary and located in a free-standing rehabilitation center located in a large southeast metropolitan area.

The study utilized a quasi-experimental nonequivalent control group design. A sample of 21 treatment group patients and 13 control group patients agreed to participate in the study. All 34 patients completed the pre-PRP phase of the study, but only 26 completed the post-phase. The attrition rate was 24% for the total sample, 29% for the treatment group patients, and 15% for the control group. Attrition was primarily due to complicating health problems.

Hypotheses were tested utilizing data from the 15 treatment group patients and 11 control group patients who completed both pre- and post-PRP phases of the study. All patients had a medical diagnosis of COPD, stated their dyspnea interfered with desired activities and lifestyle, and had a physician who was a pulmonary specialist.

Data collection for demographic variables and the dependent variables of dyspnea and self-care was done through home visits. Although this method of data collection necessarily limits the sample size, the

home visit was the most appropriate method for this study because of the multiple instruments used and the patient population studied (Sexton, 1983). The variable dyspnea had four levels and was measured with the usual and worst dyspnea visual analog scales (VASs) and the usual and worst dyspnea Modified Borg scales. Self-care was the summative score on the Self-Care Questionnaire developed by the investigator for this study. Results of pulmonary function tests were obtained by the investigator from medical records at the PRP for treatment group patients. A copy of the digital print-out of results of control group patients was mailed to the investigator. The variable pulmonary function had four levels and was measured by the FVC, FEV_1, $FEF_{25\%-75\%}$, and MVV. Data for demographic variables were obtained with the Patient Information form and the three subscales of the Modified Multidimensional Health Locus of Control Scale (Form B).

Differences between groups post-PRP in dyspnea, self-care, and pulmonary function were analyzed to test hypotheses 1, 2, and 3. Demographic variables were analyzed to determine variance explained in dyspnea, self-care, and pulmonary function to test hypotheses 4, 5, and 6.

Discussion of Findings and Summary Of Conclusions

This section presents a discussion of the findings and a summary of conclusions of the study in relation to demographic data and in relation to each of the six hypotheses. A discussion of the findings and conclusions in relation to previous research is integrated in this section.

Demographic Data

Statistical analyses demonstrated homogeneity of the treatment and control groups on all demographic variables except years since first

noticed shortness of breath and pack year history. The sample is described in relation to these two variables following a general discussion of common demographic variables.

The mean age of the total group was 66 years which is consistent with the COPD patient population described in literature (Guenter & Welch, 1982). The proportion of males to females in the total sample was almost equal. A total of 14 males and 12 females completed the study. In a previous longitudinal study of patients who completed a pulmonary rehabilitation program, 87% of the sample was male (Petty, 1982). Petty's study population consisted of patients who enrolled in a pulmonary rehabilitation program in 1966. The large percentage of women in this study (46%) is consistent with the increase in COPD in women which has been attributed to an increase in cigarette smoking by women over the last several decades (Burton & Hodgkin, 1984).

The study sample was least representative of the total population of patients with COPD in regard to race. Only two patients, both in the control group and both female, were black; the remaining 24 patients were white. COPD is not considered a disease more common to either race. This study finding is consistent with the population of patients referred to the rehabilitation center and is reflective of patients seen in the private practices of the physicians who refer patients to the center. The rehabilitation center does not receive government funding other than Medicare reimbursement.

The study sample had diverse educational backgrounds within both groups. All patients were literate, but several had visual impairments which necessitated verbal administration of the instruments. To maximize readability, all instruments were printed in large type with short lines.

All patients in the sample were married, living with their spouse, except for three who were widowed. Six patients were uncertain of the amount of their income or preferred not to indicate the income range. In general, the treatment group reported a higher income range than the control group.

The two groups were not homogeneous on the variable of years since first noticed shortness of breath. The treatment group reported a mean of 5.50 years compared to a mean of 24 years for the control group. Four (36%) of the 11 control group patients stated they had shortness of breath with asthma as a child compared to only one patient with this history in the treatment group.

The two groups were also not homogeneous on the variable of pack years. The treatment groups had a much higher mean of 48.9 pack years compared to 26.6 mean pack years in the control group. Two patients (13%) in the treatment group stated they had never smoked while five (45%) control group patients made this claim. The highest pack year reported was 120 years by a patient in the treatment group. Four of the control group patients had never smoked because of the history of asthma.

Modified Multidimensional Health Locus of Control (MHLC) subscale scores were treated as demographic variables in this study. Both groups scored highest on the Powerful Others HLC (PHLC) subscale, with the mean of the control group higher than the treatment group. Most of the patients in this study had been seriously ill with respiratory problems at some time and attributed living through the experience to care provided by their physician. The two physicians who provided the patients for the control group had been in practice in the area longer than the physicians of the treatment group patients. The control group patients

had seen their physician over a longer period of time which could explain the higher PHLC scores. Almost all patients spoke very positively about their physician. This information was not solicited by the investigator but was volunteered by most patients while completing the Modified MHLC Scale.

The mean scores on the Internal HLC subscale were similar between groups with only a 0.3 difference. Both groups scored lowest on the Chance HLC subscale with only 0.05 difference between groups.

The results from the Modified MHLC Scale would indicate the strongest health locus of control orientation toward powerful others with also a strong orientation toward internal health locus of control. Nagy and Wolfe (1984) found a health locus of control orientation toward both powerful others and internal in a sample of chronically ill patients. Wallston also stated others had reported to him this finding in samples of chronically ill patients (K. Wallston, personal communication, October 24, 1986).

No attempt was made in this study to control for severity of disease. Previous studies discussed findings in relation to severity of disease (Howland et al., 1986; Sahn et al., 1980). Ex post facto examination of this variable in this study was done to enhance interpretation of the outcomes. The objective measurement most often used to determine severity of obstructive pulmonary disease is the ratio of the FEV_1 to FVC (Boushey & Dawson, 1982). A commonly used classification defines severe obstructive disease as an FEV_1 to FVC ratio of less than 45%, moderate disease as a ratio of 45% to 59%, and mild disease as a ratio of 60% to 70% (Howland et al., 1986). An FEV_1 to FVC ratio greater than 70% is indicative of normal lung function unless there

is marked reduction in both the FEV_1 and FVC, a finding which would be consistent with restrictive lung disease (Carroll, 1986).

Nine of the 26 patients, four in the treatment group and five in the control group, had a normal FEV_1 to FVC ratio with no indication of obstructive or restrictive lung disease based on pulmonary function. Six patients, four in the treatment group and two in the control group, had mild obstructive disease. Eight patients, five in the treatment group and three in the control group, had moderate obstructive disease. Only three patients in the total sample, two in the treatment group and one in the control group, had severe disease with an FEV_1 to FVC ratio of less than 45%. Severity of illness is considered to be a major extraneous variable affecting the outcomes of the study and is addressed in the discussion of hypothesis testing.

Hypothesis 1

In relation to the finding of no significant difference in dyspnea, possible explanations were considered. Worst dyspnea on both the VAS and Modified Borg Scale was not expected to change post-PRP unless, during the course of the study, the patient experienced an acute episode of dyspnea subjectively described as the most short of breath the patient had ever felt. The rationale for measuring worst dyspnea was to determine if the patient could conceptually discriminate between usual and worst dyspnea and to assist in the assessment of criterion-referenced validity of the VAS and Modified Borg Scales.

Although the difference was not significant, usual dyspnea on the VAS decreased for the treatment group but increased for the control group. Usual dyspnea on the Modified Borg Scale decreased in both groups with a greater decrease in the treatment group. With a larger

sample, the difference may have demonstrated significance. Multicollinearity among the scales may have contributed to the lack of significance.

Most patients took longer to mark the VASs than the Modified Borg Scales and sought more clarification. All but one patient pre-PRP conceptually appeared to understand that worst dyspnea should receive a higher rating than usual dyspnea on both scales. The VAS seemed more difficult for the patients, especially for those with less than a high school education. Use of the VAS required the patient to use abstract thinking to symbolically represent dyspnea on a 100 mm line. The Modified Borg Scale was more concrete. Patients frequently asked for more instructions when completing the VASs but quickly selected a phrase on the Modified Borg Scale to represent dyspnea. Other investigators who have used both instruments did not report this observation (Carrieri et al., 1984).

Although the measures of dyspnea used in this study did not demonstrate significant differences between groups, almost every treatment group patient reported during the post-PRP home visit that their level of activity had increased because of a decrease in dyspnea. One patient, who was on continuous oxygen and confined to his living room by dyspnea during the pre-PRP visit, reported during the post-PRP visit that he was able to ride his lawn mower to mow his large yard. Another patient reported she could do more housework with less dyspnea after completing the PRP. Remarks from other patients were similar to these.

One goal of pulmonary rehabilitaion is to recondition the patient to increase activity tolerance. An exercise program, which is a principle component of multidisciplinary pulmonary rehabilitation, is designed to strengthen and recondition large muscle groups. Although the

patient's usual dyspnea did not demonstrate a significant difference between groups, measures other than the VAS and Modified Borg Scale may more accurately reflect the effect of increased activity tolerance on dyspnea.

Severity of disease may have affected the outcome of this hypothesis. More than a third of the sample had normal lung function based on the FEV_1 to FVC ratio, but all patients reported that dyspnea interfered with desired activities and lifestyle. The FEV_1 to FVC ratios for the patients classified as normal ranged from 71% to 80% which is a low normal range.

Burdon et al. (1982) found a .88 correlation between dyspnea measured by the Modified Borg Scale and the FEV_1. The correlation was not reported as negative; however, one would expect an inverse relationship with a higher dyspnea level correlating to a lower FEV_1 value. The correlation between the Usual Dyspnea Modified Borg Scale and the FEV_1 for the sample in this study was not significant ($r = -.04$).

The VASs and Modified Borg scales significantly correlated with each other. This finding supports criterion-referenced validity of the instruments indicating the scales measure the same construct. Using only pre-PRP measures, to avoid the effects of treatment, usual dyspnea measured by the VAS was significantly correlated with usual dyspnea on the Modified Borg Scale ($r = .59$; $p < .001$). Worst dyspnea measured by the two scales had a correlation of .78 ($p < .01$).

In summary, although dyspnea was not significantly different between groups' post-PRP, treatment group patients reported an increased activity level with decreased dyspnea. The effect of a small sample size and multicollinearity among variables is that these factors increase the possibility of a Type II error of accepting a false null hypothesis.

Hypothesis 2

Although no significant difference between groups was found in self-care, the p value approached significance (p = .066). This finding may indicate a trend that with a larger sample size, significant difference between groups may be found in self-care scores.

The control group had a higher mean score on the pre-PRP Self-Care Questionnaire (see Table 6). The control group also reported a much longer history of years since first noticed shortness of breath. A possible explanation for the higher scores in the control group pre-PRP is that the control group had a longer period of time over which to learn self-care actions. Post-PRP the Self-Care mean score increased for the treatment group with a slight decrease in the control group. The higher mean score for the treatment group post-PRP, compared to the control group's pre-PRP mean score, would be an expected and desired result of the educational component of the PRP. In this study, ANCOVA tested for post-PRP differences between groups while controlling for pre-PRP differences. Although the post-PRP mean Self-Care score for the treatment group was higher, the difference was not significant.

The Hawthorne effect (Polit & Hungler, 1983) was more evident in relation to the variable of self-care than any other measure used in the study and was especially evident with patients in the control group during the pre-PRP phase of the study. These patients really wanted to participate in the study. One patient, after receiving the introductory letter (see Appendix N), called three people to obtain the investigator's phone number so that she could arrange the home visit as soon as possible. Upon arrival to her home, the patient presented the investigator with three written pages about her medications, medical history, and self-care actions. Participation in the study may have

had an artificial effect on treatment group patients; however, participating in the PRP was a much more major event for those patients than participating in this study.

The Self-Care Questionnaire was developed for this study, and instrument testing was a component of the study. A panel of experts evaluated the instrument for content validity. A supporting consensus of opinion was obtained for all items except for four items that cluster actions related to allowing others to perform activities for the patient. Several patients reported allowing these actions. Construct validity of the instrument was not assessed. The universal, developmental, and health-deviation self-care requisites identified by Orem (1985a) were used as the basis for the actions identified on the questionnaire and were supported by literature and patient education resource materials.

Internal consistency of the Self-Care Questionnaire was demonstrated with a Cronbach alpha coefficient of .82 on pre-PRP Self-Care scores. Test-retest reliability was supported with the correlation between pre- and post-PRP scores for the control group only.

In summary, the null hypothesis of no difference between groups in self-care was accepted. With a p value approaching sig. ficance, a trend may be indicated that with a larger sample, significant difference between groups may be found. The Self-Care Questionnaire was found to have content validity, internal consistency, and test-retest reliability in this study.

Hypothesis 3

The finding of no significant difference in pulmonary function between groups post-PRP could be attributed to statistical and pathophysiological factors. The correlations among the four measures of

pulmonary function were very high (see Table 8). When multicollinearity exists, the probability of accepting a hypothesis that should be rejected is increased.

Pulmonary function measures gradually decrease with the progression of COPD (MacDonnell, 1981). With the exception of some of the changes which occur with asthma, the decline in lung function is considered irreversible (Guenter & Welch, 1982). Most of the previous studies have shown no significant improvement in pulmonary function following a PRP (Atkins et al. 1984; Pineda et al., 1986; Zack & Pallange, 1985). Petty (1982), in a study that extended over a 4-year period, reported that pulmonary function deterioration did not occur at the expected rate post-PRP.

The 3-month PRP time interval is probably too short an interval to detect changes in pulmonary function or a decrease in the rate of decline. Some patients may have stabilization of the decline in function without improvement. An analysis of this possible plateau effect would necessarily extend over several years.

Hypothesis 4

Demographic variables were analyzed to determine how much variance in dyspnea could be explained by these variables. If significant difference betweeen groups post-PRP had been found in measures of dyspnea, this hypothesis would have been important in identifying variables other than the PRP which could explain variance in dyspnea. Four separate stepwise regression procedures were done to test this hypothesis, using each of the four measures of dyspnea as a dependent variable. Usual Dyspnea VAS was the only dependent measure with demographic variables meeting the criterion to enter the regression equation. Sex and years

since first noticed shortness of breath explained 37% of the variance in Usual Dyspnea VAS scores of the subjects who participated in this study.

The usual course of dyspnea in COPD is a gradual increase in severity over a period of years (Feldman, 1982). The finding of significant variance in dyspnea explained by years since first noticed shortness of breath is consistent with current knowledge of the disease process. The null hypothesis was rejected because variance in dyspnea was partially explained by demographic variables.

Hypothesis 5

The demographic variables were also analyzed to determine how much variance could be explained in self-care. If significant difference between groups in post-PRP self-care scores had been found, this hypothesis would have been useful in identifying variables other than the PRP which could explain variance in self-care scores. The only demographic variable to enter the regression equation was years since first noticed shortness of breath accounting for 19% of the variance in self-care. The null hypothesis was rejected. The relationship between years since first noticed shortness of breath and self-care has been previously discussed.

Hypothesis 6

The variance in pulmonary function which would be explained by the demographic variables was examined. If there had been significant differences between groups post-PRP in pulmonary function measures, this hypothesis would have been important in identifying variables other than the PRP which could contribute to variance in pulmonary function measures. Each measure had at least one variable to enter the regression equation, thus the null hypothesis was rejected. Three variables,

sex, years since first noticed shortness of breath, and education entered the equation for forced vital capacity explaining 53% of the variance. The norms for pulmonary function testing are based on age, sex, and height, so the inclusion of sex in the equation is not surprising. The inclusion of years since first noticed shortness of breath is consistent with the usual progression of COPD. The relationship of education in explaining variance in FVC is unclear, and the variable probably would not have been included with a larger sample. Sex was the only variable to enter the equation for the other three measures of pulmonary function.

Effects of Pulmonary Rehabilitation

The purpose of this study was to ascertain the effects of a pulmonary rehabilitation program on dyspnea, self-care, and pulmonary function of patients with COPD. The need for this study was supported by the failure of many published studies to support the effectiveness of pulmonary rehabilitation when subjective statements and objective findings indicate improvement in the patient's condition.

The pulmonary rehabilitation program did not have a statistically significant effect on dyspnea, self-care, and pulmonary function of the subjects with COPD who participated in this study. The conclusion should not be drawn, however, that pulmonary rehabilitation is not effective in decreasing dyspnea, increasing self-care, and improving pulmonary function. The small sample size limited the possibility of finding significant differences between groups when using powerful statistical procedures such as multivariate analysis of covariance. The sample size was limited by the method of data collection, the availability of patients, and the research design. It is possible that with a larger sample, the measures used in this study could be more sensitive

to differences between groups. According to Thorndike (1978), a sample size of 90 was needed to use multivariate analysis to test Hypotheses 1 and 3. Hypothesis 2 would have required 60 subjects.

Severity of illness, a variable not controlled in this study, may have contributed to the failure to find significant differences between groups. The Hawthorne effect with the control group, inability to randomly select control group patients, and longer history of shortness of breath in the control group may have contributed to inclusion of subjects who were not typical of most patients with COPD. Part of the sample seemed more representative of the "ideal" patient in terms of assuming more responsibility for self-care.

Theoretical Framework

The Self-Care Theoretical Framework provided structure to guide this study. Many of the concepts in the framework were supported. Self-care is learned behavior by which individuals regulate their day-to-day living. Patients in this study engaged in many self-care actions some more frequently than others. Self-care actions performed most frequently were those directed toward meeting universal self-care requisites. Universal self-care requisites are essential to life. The universal, developmental, and health deviation self-care requisites were used to develop the Self-Care Questionnaire tested in this study.

Patients involved in the rehabilitation program increased the number of specific actions and frequency of performance. This observation supports the inherent assumption that self-care can be taught. Performance of self-care is a characteristic of maturing individuals (Orem, 1985b). Higher scores on the Self-Care Questionnaire by those with a longer history of shortness of breath supports the concept of maturation.

PRP nurses in this study functioned within the supportive-educative nursing system with the treatment group. The nurse regulates the exercise and development of self-care agency, but the patient actually performs the self-care. The patient is capable of learning and performing self-care actions but needs the guidance and support of the nurse. Self-care must be learned and continuously performed. The education sessions of the PRP taught self-care actions which were reinforced throughout the program. Patients were constantly reminded of self-care actions during exercise sessions. Nurses in this rehabilitation setting participated in the development of a comprehensive plan of care for rehabilitation specific to each patient. Actions were implemented by the nurses to assist the patient in development of self-care skills.

Although Orem's theoretical framework is considered especially appropriate for nurses who function in a rehabilitation setting (Knust & Quarn, 1983), the perceived complexity of the framework may limit its use by some professionals. Smith (1981) described the framework as "Oremization: The curse of nursing." Initially, the theoretical framework may appear too abstract for use in nursing practice, but its practicality and applicability have been repeatedly demonstrated (DeVito, 1985; Knust & Quarn, 1983; Zinn, 1986).

Implications for Nursing

Based on the results of this study, the implications for nursing are identified:

1. Nurses need to be involved in research to determine the effectiveness of pulmonary rehabilitation programs. Variables which measure the goals of maximizing independent functioning in activities of daily living, increasing activity tolerance and efficient energy expenditure,

and educating patients of the disease process, medications, and therapeutic techniques should be addressed.

2. The use of dyspnea scales in evaluation of the patient's response to exercise should be evaluated for possible use as a criterion measure for goal achievement in the plan of care.

3. Orem's theoretical framework provided a practical basis to guide this study and is an appropriate basis for nursing practice in a rehabilitation setting. Further application and testing of the framework is needed as are tools to test the theory.

4. Evaluation of knowledge gained by patients was not assessed by the PRP. Evaluation of learning is an important aspect of teaching and should address behavioral change as well as knowledge gained.

5. To promote the learning of self-care actions, these actions need to be reinforced by the nurse in the supportive-educative system until the behaviors become habits.

6. Nurses need to be prepared at the generic level to function in the supportive-educative nursing system.

Recommendations for Research

Based on the results of this study, the following recommendations are made for research.

1. Procedural difficulties encountered in studying chronically ill patients should not limit research with these groups. The home visit was the most appropriate method of data collection for the population studied (Sexton, 1983).

2. Instruments need to be developed and tested to measure self-care within specific patient populations.

3. Factors which could explain why some treatment group patients did not receive higher scores, post-PRP, in self-care should be explored.

4. This study should be repeated with a larger sample, adequate funding, and the involvement of several investigators, in PRPs in different geographic areas.

5. A 1-year follow-up study should be done using the Self-Care Questionnaire with treatment group patients 1 year after completion of the PRP.

6. Further testing should be done to assess the reliability and validity of the Self-Care Questionnaire and the dyspnea VAS and Modified Borg Scales.

7. A parallel form of the Multidimensional Health Locus of Control Scale should be developed with statements more appropriate to the chronically ill. This instrument could be administered concurrently with the Modified MHLC Scale.

8. The effectiveness of pulmonary rehabilitation should be evaluated using measures other than those identified in this study. Variables should address measurable goals of pulmonary rehabilitation, as well as quality of life measures, psychological variables, and results of pre- and post-PRP exercise stress testing.

9. Studies addressing effectiveness of pulmonary rehabilitation programs should control for severity of disease.

10. Psychological variables which influence the individual's response to chronic illness and the performance of self-care actions should be further explored.

Summary

This chapter presented a discussion of the findings and conclusions of the study in relation to the sample and each of the six hypotheses. Conclusions in relation to effectiveness of pulmonary rehabilitation

were presented. A discussion of findings in relation to the self-care theoretical framework was included. Implications of this study for nursing and recommendations for future research were given.

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Appendix A

Correspondence Related to Use of Orem's Diagrams

April 21, 1988

Carol Patricia Riley
6624 Court M
Birmingham, AL 35228

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I used Dorothea Orem's self-care framework to guide dissertation research which is near completion. I am requesting permission to reproduce the three figures listed below from the book Nursing: Concepts of Practice (3rd ed.) by Dorothea Orem which was published in 1985. The figures would be used in the dissertation.

Figure 2 - 3	A Conceptual Framework for Nursing	p. 32
Figure 6 - 1	Adequacy values of self-care agency as related to self-care demand . . .	p. 106
Figure 7 - 4	Basic nursing systems	p. 153

Proper citation with the exact title and specifications you require will be given with each figure.

Thank you for your consideration. I look forward to receiving your response.

Sincerely,

Carol P. Riley

Carol Patricia Riley
Doctoral Candidate
University of Alabama at Birmingham

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TO: Ms. Carol Patricia Riley
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DATE: April 28, 1988

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Appendix B

Spirometry Standards for FVC, FEV_1, $FEF_{25\%-75\%}$, and MVV

SPIROMETRY STANDARDS FOR FVC, FEV_1, $FEF_{25-75\%}$, AND MVV

SOURCE: American Thoracic Society (1979). Snowbird workshop on standardization of spirometry. American Review of Respiratory Disease, 119, 831-838.

FVC	The spirometer should be capable of measuring volumes up to at least seven liters independent of flow rates up to 12 liters/second. The instrument should be capable of accumulating volume for at least 10 seconds.
FEV_1	The spirometer should be capable of measuring volumes up to at least seven liters with a volume accuracy of at least ±3 per cent of reading or ±50 milliliters, whichever is greater over the flow range of 0-12 liters per second.
$FEF_{25-75\%}$	The spirometer should be capable of measuring volumes up to at least seven liters with flow in the range of 0-12 liters/second and capable of recording volume for at least 10 seconds. Accuracy must be ±5 per cent of the reading or ±100 milliliters per second. A wider deviation is accepted because two measurements of volume and time are required.
MVV	The spirometer graphic recording should be flat within ±10 per cent up to 4 Hz at flow rates up to 12 liters per second over the volume range. The time should be no less than 12 or more than 15 seconds. The total time should be accurate within ±3 per cent.

Appendix C

Correspondence Related to Reproduction of Graphic Spirometry Figures

May 24, 1988

Carol Patricia Riley
6624 Court M
Birmingham, AL 35228

Copyrights and Permissions Department
J. B. Lippincott Company
East Washington Square
Philadelphia, PA 19105

Dear Madam/Sir:

I am requesting permission to reproduce in my dissertation two figures from Respiratory Care: A Guide to Clinical Practice, second edition, edited by George Burton and John Hodgkin and published in 1984. The first figure is 10-2 on page 233. If permission is granted, I would reproduce the first two drawings (FEV_1 and $FEF_{25-75\%}$). The second figure is 10-5 on page 237.

I will follow the specifications you require. Thank you for your consideration. I look forward to receiving your response.

Sincerely,

Carol P. Riley

Carol Patricia Riley, MSN, RN
Doctoral Candidate
University of Alabama at Birmingham

Appendix D

Educational Sessions of Pulmonary Rehabilitation Program

Pulmonary Rehabilitation Program

Educational Sessions

Your Lungs and How They Work. Normal lung function is presented and the effects of various diseases on lung function are discussed.

Panic Breathing. The cycle is described of how the patient's response to shortness of breath can and often does lead to more shortness of breath. Patients are taught how to ease the work of breathing during acute episodes of shortness of breath and how to break the cycle.

Medications (Series I). Bronchodilators, mucolytics, and expectorants are discussed in relation to expected side effects and side effects to report.

Medications (Series II). The same type of presentation is done with corticosteroids, digitalis preparations, diuretics, and antimicrobials.

Breathing Equipment. The proper techniques for use, care, and cleaning of commonly used devices such as ultrasonic nebulizers and oxygen administration devices are discussed.

After the Program, What Next? The importance of a planned schedule of exercise so that the patient can maintain the achieved level of fitness is discussed.

Appendix E

Patient Information Form

DO NOT WRITE IN THIS SECTION

CODE NO: 1 2 3(G)

PATIENT INFORMATION

PART 1. (Completed by nurse)

NAME: _____ SEX: _____

ADDRESS: _____

_____ ZIP: _____

PHONE: _____ PHYSICIAN: _____

****

PART 2. (Completed by the patient)

INSTRUCTIONS: Please fill in the requested information or check (✓) the space that applies to you for each of the following.

PSESS

SESSP

1. What is your age? _____ 6 7

2. What is your race? black ____ white ____ other ____ 8

3. What is your marital status?

   Never married: _____ Widowed: _____

   Married: _____ Separated: _____

   Divorced: _____ 9

4. How much formal education have you had?

   8th grade or less: _____

   9th - 12th grade: _____

   High school diploma or GED: _____

   Some college or technical training: _____

   College degree: _____ 10

5. Which of the following best describes your annual income?

   Less than $4,999: _____ $25,000 - $29,999: _____

   $ 5,000 - 9,999: _____ $30,000 - 34,999: _____

   $10,000 - 14,999: _____ Over $35,000 : _____

   $15,000 - 19,999: _____ Not sure: _____

   $20,000 - 24,999: _____ 11

PLEASE GO ON TO THE NEXT PAGE . . .

Patient Information
Page 2

DO NOT WRITE IN THIS SECTION

CODE NO.: _____

6. How long have you noticed being short of breath?

_____ years — 12 13

7. How many times were you in the hospital last year because of lung problems?

_____ times — 14

8. Do you work? yes: _____ no: _____ — 15

If you work, what is your occupation?

_____ — 16

9. Have you ever had to quit a job because of lung problems?

yes: _____ no: _____ — 17

If you answered "yes", what type work were you doing?

_____ — 18

10. Which of the following health problems do you have at this time?

Diabetes (or high blood sugar): _____ — 19
High Blood Pressure: _____ — 20
Heart Problems: _____ — 21
Kidney Problems: _____ — 22
Arthritis: _____ — 23
Cancer: _____ — 24
None of the above: _____ — 25
Other: _____ — 26

****

Part 3. (To be completed by the nurse)

Smoking history? yes: _____ no: _____
Packs smoked per day: _____ — 27 28
Number of years: _____

Diagnosis: _____ — DIAG

Appendix F

Correspondence Regarding Use of MHLC Scale

6624 Court M
Birmingham, AL 35228
June 23, 1986

Kenneth A. Wallston, PhD
Associate Professor of Psychology
in Nursing
Vanderbilt University
Nashville, TN 37240

Dear Dr. Wallston:

I am a doctoral student in the School of Nursing at the University of Alabama in Birmingham and am writing to you and Dr. Barbara Wallston to request permission to use the Multidimensional Health Locus of Control Scale for dissertation research. The purpose of the study is to describe the relationship between health locus of control and performance of self-care activities by patients with chronic obstructive pulmonary disease (COPD). I have found published studies addressing the relationship between self-care and locus of control (or the more specific construct HLOC) in different populations, studies addressing self-care in COPD patients, and studies addressing LOC in COPD patients, but none seeking to examine the relationship between both theoretical constructs in this specific patient population.

As you are probably aware, the MHLC scales have been utilized in several doctoral studies in the School of Nursing at UAB. In the past, you have requested that results be shared with you. I will be glad to do this.

If you have data related to the reliability of the scales in patient populations with COPD, I would be most appreciative if you would share this with me. In your contribution to H.B. Lefcourt's book, Research with the locus of control construct (Volume 1) published in 1981, you provided norms for the scale in patients with chronic obstructive pulmonary disease and indicated that the information was a personal communication from Brown, 1979. If Brown has since published the study or if you have further information, please inform me in your letter or by attachment.

Thank you for your time and assistance. I look forward to hearing from you soon.

Sincerely,

Carol P. Riley

Carol P. Riley, RN, MSN
Doctoral Student

VANDERBILT UNIVERSITY

NASHVILLE, TENNESSEE 37240 TELEPHONE (615) 322-7311

Health Care Research Project • School of Nursing • Direct phone 322-2520

July 1, 1986

Ms. Carol Riley, RN, MSN
6624 Court M
Birmingham, AL 35228

Dear Ms. Riley:

In regard to your letter dated June 23rd, you have, of course, permission to utilize our MHLC scales in your dissertation research with COPD patients. I have enclosed one of our basic MHLC information packets for you, in case you do not already have one.

Offhand, I do not know of any research which has used the Multidimensional HLC scales with COPD patients, although I do know of two studies which used our earlier unidimensional HLC scale. These were the Brown study which you mentioned in your letter (which eventually was published in Medical Care, 1981, 19(11), 1136-1146) and one by Kaplan et al. (see Health Psychology, 1984, 3, 223-242.) We no longer advocate the use of the HLC scale, especially with chronic illness samples, because old 11-item measure only contains one item tapping beliefs in control of one's health by powerful other persons--an important dimension for those with a chronic illness.

I hope this information is of some help. I would very much appreciate eventually hearing about the results of your study. Good luck, and if I can be of further assistance please do not hesitate to get back in touch with me.

Sincerely,

Kenneth A. Wallston, Ph.D.
Professor of Psychology in Nursing

Enclosure: MHLC packet

Appendix G

Modified MHLC Scale Form B and Subscales Used for Scoring

MHLC (Form B)

DO NOT WRITE IN THIS SECTION

CODE NO.: _____

INSTRUCTIONS TO PATIENT:

The statements below are beliefs some people have about health and illness. Please show whether you agree or disagree with each statement by drawing a circle around the number you select to the right of the statement.

If you strongly agree with what the statement says, draw a circle around the number 4, like this (4) .
If you agree with what the statement says, draw a circle around the number 3.
If you disagree with what the statement says, draw a circle around the number 2.
If you strongly disagree with what the statement says, draw a circle around number 1.

You should choose the numbers based on what you believe. There are no right or wrong answers. Circle only one number for each statement.

1 = Strongly Disagree
2 = Disagree
3 = Agree
4 = Strongly Agree

1.	If I become sick, I have the power to make myself well again.	1	2	3	4	__
2.	Often I feel that no matter what I do, if I am going to get sick, I will get sick.	1	2	3	4	__
3.	If I see an excellent doctor regularly, I am less likely to have health problems.	1	2	3	4	__
4.	It seems that my health is greatly influenced by accidental happenings.	1	2	3	4	__
5.	I can only maintain my health by consulting health professionals.	1	2	3	4	__

PLEASE GO TO THE NEXT PAGE . . .

MHLC (Form B)

DO NOT WRITE IN THIS SECTION

CODE NO.: _____

1 = Strongly Disagree
2 = Disagree
3 = Agree
4 = Strongly Agree

6.	I am directly responsible for my health.	1	2	3	4	_
7.	Other people play a big part in whether I stay healthy or become sick.	1	2	3	4	_
8.	Whatever goes wrong with my health is my fault.	1	2	3	4	_
9.	When I get sick I just have to let nature run its course.	1	2	3	4	_
10.	Health professionals keep me healthy.	1	2	3	4	_
11.	When I stay healthy, I'm just plain lucky.	1	2	3	4	_
12.	My physical well-being depends on how well I take care of myself.	1	2	3	4	_
13.	When I feel ill, I know it is because I have not been taking care of myself properly.	1	2	3	4	_
14.	The type of care I receive from other people is what is responsible for how well I recover from an illness.	1	2	3	4	_
15.	Even when I take care of myself, it's easy to get sick.	1	2	3	4	_
16.	When I become ill, it's a matter of fate.	1	2	3	4	_
17.	I can pretty much stay healthy by taking good care of myself.	1	2	3	4	_
18.	Following doctor's orders to the letter is the best way for me to stay healthy.	1	2	3	4	_

☐☐☐

Modified MHLC Scale Form B

Subscales Used for Scoring

CHLC Subscale (Chance Health Locus of Control)	IHLC Subscale (Internal Health Locus of Control)	PHLC Subscale (Powerful Others Health Locus of Control)
ITEMS	ITEMS	ITEMS
1	2	3
6	4	5
8	9	7
12	11	10
13	15	14
17	16	18

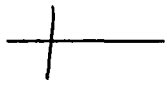
Appendix H

Instruments Used to Measure Dyspnea

VISUAL ANALOG SCALE

Usual Dyspnea

INSTRUCTIONS TO THE PATIENT:

On the line below, 0 represents "no difficulty breathing" and 100 represents "unable to breathe". Think about how short of breath you feel most of the time. On a scale of 0 to 100, put a mark straight down through the line below where you think it best shows how short of breath you feel most of the time.
Make sure your line crosses the line, like this:  .

0	100
No difficulty breathing	Unable to breathe

CODE NO.: _____

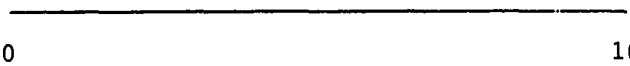
U-VAS: _____

VISUAL ANALOG SCALE

Worst Dyspnea

INSTRUCTIONS TO THE PATIENT:

On the line below, 0 represents "no difficulty breathing" and 100 represents "unable to breathe". Think about a time when you were the most short of breath you have ever been. On a scale of 0 to 100, put a mark straight down through the line below where you think it best shows how short of breath you felt when you were the most short of breath you have ever been. Make sure your line crosses the line, like this: ——+——.



0	100
No difficulty breathing	Unable to breathe

CODE NO.: _____

W-VAS: _____

MODIFIED BORG SCALE

Usual Dyspnea

INSTRUCTIONS TO THE PATIENT:

Read over the scale below. Think about how short of breath you feel most of the time. Circle the number on the scale which best describes how short of breath you feel most of the time.

0	NO SHORTNESS OF BREATH AT ALL
1	VERY, VERY SLIGHT
2	VERY SLIGHT
3	SLIGHT
4	MODERATE
5	SOMEWHAT SEVERE
6	SEVERE
7	VERY SEVERE
8	VERY, VERY SEVERE
9	CAN NOT BREATHE AT ALL

CODE NO.: _____

U-BORG: _____

MODIFIED BORG SCALE

Worst Dyspnea

INSTRUCTIONS TO THE PATIENT:

Read over the scale below. Think about a time when you were more short of breath than you have ever been. Circle the number on the scale which best describes how short of breath you felt at that time.

0	NO SHORTNESS OF BREATH AT ALL
1	VERY, VERY SLIGHT
2	VERY SLIGHT
3	SLIGHT
4	MODERATE
5	SOMEWHAT SEVERE
6	SEVERE
7	VERY SEVERE
8	VERY, VERY SEVERE
9	CAN NOT BREATHE AT ALL

CODE NO.: _____

W-BORG: _____

Appendix I

Matrix of COPD Self-Care Actions and Orem's Self-Care Requisites

RELATIONSHIP BETWEEN ITEMS ON SELF-CARE QUESTIONNAIRE
AND SELF-CARE REQUISITES

SELF-CARE REQUISITES (see attached list)

ITEMS ON QUESTIONNAIRE	UNIVERSAL SELF-CARE REQUISITES								DEVELOP-MENTAL S.C. REQ.		HEALTH-DEVIATION SELF-CARE REQUISITES					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Uses abdominal breathing	●											●	●	●		
2. Exercise					●				●				●			●
3. Smokes cigarettes*							●									
4. Taken flu vaccine							●									
5. Uses inhaler as prescribed	●										●			●		
6. Drinks 8 glasses or more	●	●														
7. Uses pursed lip breathing	●											●	●	●		
8. Takes medications as prescribed	●									●	●		●	●		●
9. Takes OTC drugs*	●															
10. Adequate sleep and rest					●				●	●						●
11. Takes OTC sleep meds*					●											
12. Knows air quality index	●						●									
13. Changes position when short of breath	●															
14. Sits leaning forward when short of breath	●															
15. Physical distancing	●					●										
16. Changes hygiene habits	●											●				
17. Changes grooming habits	●														●	
18. Wears slip-on shoes	●													●		
19. Wears loose clothing	●													●		
20. Uses steam	●													●		
21. Allows help with bathing	●			●				●							●	●
22. Allows help with grooming	●			●				●							●	●
23. Allows help with yard work	●							●							●	●
24. Allows help with house work	●							●							●	●
25. Reduces activities	●				●										●	●
26. Keeps appointments											●					
27. Reports reactions to drugs							●			●				●		
28. Reports signs of infection							●			●				●		
29. Takes full prescription of antibiotics										●	●		●	●		●
30. Uses distractions	●				●				●	●		●		●		●
31. Activities to relax	●				●				●	●		●		●		●

*Avoidance of these behaviors constitutes self-care. Items are scored in reverse.

SELF-CARE REQUISITES

Universal Self-Care Requisites

1. The maintenance of a sufficient intake of air.
2. The maintenance of a sufficient intake of water.
3. The maintenance of a sufficient intake of food.
4. The provision of care associated with elimination processes and excrements.
5. The maintenance of a balance between activity and rest.
6. The maintenance of a balance between solitude and social interaction.
7. The prevention of hazards to human life, human functioning, and human well-being.
8. The promotion of human functioning and development within social groups in accord with human potential, known human limitations, and the human desire to be normal.

Developmental Self-Care Requisites

9. The bringing about and maintenance of living conditions that support life processes and promote the processes of development.
10. Provision of care either to prevent the occurrence of deleterious effects of conditions that can affect human development or to mitigate or overcome these effects from conditions.

Health-Deviation Self-Care Requisites

11. Seeking and securing appropriate medical assistance in the event of exposure to specific physical or biological agents or environmental conditions associated with human pathological events and states, or when there is evidence of genetic, physiological, or psychological conditions known to produce or be associated with human pathology.
12. Being aware of and attending to the effects and results of pathological conditions and states, including effects on development.
13. Effectively carrying out medically prescribed diagnostic, therapeutic, and rehabilitative measures directed to the prevention of specific types of pathology, to the pathology itself, to the regulation of human integrated functioning, to the correction of deformities or abnormalities, or to compensation for disabilities.
14. Being aware of and attending to or regulating the discomforting or deleterious effects of medical care measures performed or prescribed by the physician, including effects on development.
15. Modifying the self-concept (and self-image) in accepting oneself as being in a particular state of health and in need of specific forms of health care.
16. Learning to live with the effects of pathological conditions and states and the effects of medical diagnostic and treatment measures in a lifestyle that promotes continued personal development.

from: Orem, D. (1985). Nursing: Concepts for practice (3rd ed.). New York: McGraw Hill.

Appendix J

Self-Care Questionnaire

SELF - CARE QUESTIONNAIRE

DO NOT WRITE IN THIS SECTION

CODE NO. _____

INSTRUCTIONS TO THE PATIENT:

For each question below select one choice that best describes what you do. Put a check mark in the space provided.

1. How often do you use your stomach muscles to help you breathe?

a. never _____	0	
b. occasionally _____	1	
c. several times a week _____	2	
d. once a day _____	3	
e. twice a day _____	4	
		_____ 1

2. How often do you do some type of physical activity you consider to be exercise?

a. never _____	0	
b. once a week _____	1	
c. twice a week _____	2	
d. three times a week _____	3	
e. four times or more a week _____	4	
		_____ 2

3. How many cigarettes do you smoke?

a. none _____	4	
b. less than 5 a month _____	3	
c. less than 5 a week _____	2	
d. less than 5 a day _____	1	
e. more than 5 a day _____	0	
		_____ 3

PLEASE GO ON TO THE NEXT PAGE . . .

Self-Care Questionnaire
Page 2

DO NOT WRITE IN THIS SECTION

CODE NO. _____

4. How many times in the last four years have you taken the flu vaccine?

a. none _____	0	
b. once _____	1	
c. twice _____	2	
d. three times _____	3	
e. four times _____	4	
		4

5a. Do you use an inhaler or breathing treatments prescribed by your physician?

yes _____
no _____ (go on to question 6)

5a

5b. If your doctor prescribes an inhaler or breathing treatments for you, which of the following do you do?

a. I use the inhaler or breathing treatments exactly as often as prescribed. _____	4	
b. I rarely use the inhaler or take the breathing treatments more often than prescribed. _____	3	
c. Sometimes I use the inhaler or take the breathing treatments more often than prescribed. _____	2	
d. I often use the inhaler or take the breathing treatments more often than prescribed. _____	1	
e. I use the inhaler or take the breathing treatments a lot more often than prescribed. _____	0	
		5b

PLEASE GO ON TO THE NEXT PAGE . . .

Self-Care Questionnaire
Page 3

DO NOT WRITE IN THIS SECTION

CODE NO. _____

6. How often would you say that you drink eight glasses or more (2 quarts or more) of water or other liquids in a day?

a. never _____	0	
b. once a month _____	1	
c. once a week _____	2	
d. 2 - 3 times a week _____	3	
e. every day _____	4	
		6

7. When you are short of breath, how often do you use "pursed lip breathing" (puckering your lips like you were blowing out a candle, except that you breathe out slowly)?

a. never _____	0	
b. rarely _____	1	
c. sometimes _____	2	
d. often _____	3	
e. very often _____	4	
		7

8. How often do you take prescription medicine just as your doctor prescribes it?

a. never _____	0	
b. rarely _____	1	
c. sometimes _____	2	
d. often _____	3	
e. very often _____	4	
		8

PLEASE GO ON TO THE NEXT PAGE . . .

Self-Care Questionnaire
Page 4

DO NOT WRITE IN THIS SECTION

CODE NO. _____

INSTRUCTIONS:

Read each question and mark with a check (✓) the column of the choice that best describes what you do.

	NEVER	RARELY	SOMETIMES	OFTEN	VERY OFTEN	
9. How often do you take over-the-counter drugs without consulting your doctor?						(R) ___ 9
10. How often do you get enough sleep and rest?						___ 10
11. How often do you take over-the-counter medicine to help you sleep?						(R) ___ 11
12. How often do you keep up with the air quality index or air pollution count report?						___ 12
13. When you become suddenly short of breath, how often do you change your position?						___ 13
14. When you are short of breath, how often do you sit on the edge of a chair leaning forward?						___ 14

PLEASE GO ON TO THE NEXT PAGE . . .

Self-Care Questionnaire
Page 5

DO NOT WRITE IN THIS SECTION

CODE NO. _____

	NEVER	RARELY	SOMETIMES	OFTEN	VERY OFTEN	
15. If someone or something upsets you or does anything else that causes you to get short of breath, how often do you try to get away from that person or thing?						15
16. On days when you are more short of breath than usual, how often do you change your usual habits of hygiene (such as bathing, showering, dental hygiene, etc.)?						16
17. On days when you are more short of breath than usual, how often do you change your usual habits of grooming (such as shaving, putting on make-up, hair styling, etc.)?						17
18. How often do you wear slip-on type shoes to avoid having to bend over or stoop?						18

PLEASE GO ON TO THE NEXT PAGE . . .

Self-Care Questionnaire
Page 6

DO NOT WRITE IN THIS SECTION

CODE NO.

	NEVER	RARELY	SOMETIMES	OFTEN	VERY OFTEN	
19. How often do you wear loose fitting clothing especially because you can breathe more easily?						19
20. How often do you use a vaporizer, humidifier, or anything else that produces steam (such as a hot shower) to help you breathe better?						20
21. When you are short of breath, how often do you ask or allow someone else to do things for you (such as bathing) that you normally do for yourself?						21
22. When you are short of breath, how often do you ask or allow someone else to do things for you (such as grooming) that you normally do for yourself?						22
23. When you are short of breath, how often do you ask or allow someone else to do yard work which you normally do?						23

PLEASE GO ON TO THE NEXT PAGE . . .

Self-Care Questionnaire
Page 7

DO NOT WRITE IN THIS SECTION

CODE NO.

	NEVER	RARELY	SOMETIMES	OFTEN	VERY OFTEN	
24. When you are short of breath, how often do you ask or allow someone else to do activities around the house (such as housework or housechores) which you normally do?						24
25. How often do you reduce or cut down on things you usually do because of shortness of breath?						25
26. How often do you keep scheduled appointments with doctors?						26
27. When you have side effects or a reaction to a drug, how often do you report it to your doctor?						27
28. If you develop signs of an infection, how often do you report it to your doctor?						28

PLEASE GO ON TO THE NEXT PAGE . . .

Self-Care Questionnaire
Page 8

DO NOT WRITE IN THIS SECTION

CODE NO. _____

	NEVER	RARELY	SOMETIMES	OFTEN	VERY OFTEN	
29. When you are given a prescription for an antibiotic, how often do you take it until all the pills are gone?						29
30. How often do you get involved in activities or other things to help get your mind off your lung problems?						30

THE NURSE WILL ASK YOU THE REST OF THE QUESTIONS ON SELF-CARE.

Self-Care Questionnaire
Page 9

DO NOT WRITE IN THIS SECTION

CODE NO. _____

INSTRUCTIONS:

The nurse will ask the patient the questions and mark the appropriate response.

	NEVER	RARELY	SOMETIMES	OFTEN	VERY OFTEN	
31. What do you do to help you relax when you become short of breath? (List) _____ _____ _____ _____ _____						
How often do you do each of the following when you become short of breath? (List each activity on a line)						
a. _____						31a
b. _____						31b
c. _____						31c
d. _____						31d
e. _____						31e

Appendix K

Correspondence with Panel of Experts and Results of Review

6624 Court M
Birmingham, Al 35228
November 26, 1986

Dear

Because of your knowledge and expertise in the care of patients with chronic lung disease, you have been asked to serve on a panel of experts to determine the validity of a questionnaire I have developed to measure self-care behaviors of patients with COPD. The questionnaire will be used in dissertation research entitled "The Effects of a Pulmonary Rehabilitation Program on Dyspnea, Self-Care Behaviors, and Pulmonary Function of Patients with Chronic Obstructive Pulmonary Disease".

The Self-Care Questionnaire contains 32 items with options selected by the the patient to indicate the frequency with which the behavior is performed. The items were taken from patient education literature and studies which used interview techniques to elicit self-care actions identified by patients with lung problems. Each item has five options and each option is assigned a point value. The points for the options selected by the patient are summed to obtain a Self-Care Behavior score. You will note as you read through the questionnaire that for items #5, #11, and #13, the avoidance of those behaviors constitutes self-care. A reverse scoring procedure is used so that patients who chose options which state that they do not or infrequently engage in those behaviors receive more points than those who do.

The validity of an instrument is concerned with whether the instrument actually measures what it is supposed to measure. In this case the question is: Does the Self-Care Questionnaire measure the self-care behaviors of patients with COPD? In order to answer this question, you are asked to evaluate each item on the questionnaire in regard to three questions:

1. Does the item reflect a self-care behavior?
2. Is the behavior appropriate for a patient with COPD?
3. Are the item and options appropriately worded?

Enclosed you will find a yellow evaluation form and the questionnaire. As you read through the questionnaire, please answer each of the three questions on the evaluation form by checking one of the three columns: "yes", "no", or "needs revision". Comment on any revisions you would suggest or make any other comments you may have. Also if you think any behaviors have been omitted which should be included, list these in the comment section. Please return the yellow evaluation form by mail to me in the envelop provided as soon as possible. You do not need to return the questionnaire unless you write comments on it.

I very much appreciate your time and willingness to serve on this panel of experts. I look forward to receiving your evaluation of the questionnaire. If you have questions, you can contact me at 939-7193 (work) or 923-7048 (home).

Sincerely,

Patsy Riley, RN, MSN
Doctoral Candidate

EVALUATION OF SELF-CARE QUESTIONNAIRE

INSTRUCTIONS: Read each item on the questionnaire and evaluate it according to the criteria specified by placing a check mark in the appropriate column. Please comment on items for which you mark "needs revision" in the space provided at the bottom of the page.

Summary of Item	Does this item reflect a self-care behavior?			Is the behavior appropriate for a patient with COPD?			Are the item and options worded appropriately?		
	Yes	No	Needs Revision	Yes	No	Needs Revision	Yes	No	Needs Revision
1. Pursed-lip breathing	___	___	___	___	___	___	___	___	___
2. Abdominal breathing	___	___	___	___	___	___	___	___	___
3. Exercise	___	___	___	___	___	___	___	___	___
4. Nourishing meals	___	___	___	___	___	___	___	___	___
5. Cigarettes (avoidance of, as indicated by reverse scoring)	___	___	___	___	___	___	___	___	___
6. Flu vaccine	___	___	___	___	___	___	___	___	___
7. Use of inhaler	___	___	___	___	___	___	___	___	___
8. Adequate hydration	___	___	___	___	___	___	___	___	___
9. Prayer	___	___	___	___	___	___	___	___	___
10. Medications taken as prescribed	___	___	___	___	___	___	___	___	___
11. Use of OTC drugs (avoidance of, as indicated by reverse scoring)	___	___	___	___	___	___	___	___	___

COMMENTS:

Continued on next page . . .

Evaluation of Self-Care Questionnaire
Page 2

Summary of Item	Does this item reflect a self-care behavior?			Is the behavior appropriate for a patient with COPD?			Are the item and options worded appropriately?		
	Yes	No	Needs Revision	Yes	No	Needs Revision	Yes	No	Needs Revision
12. Adequate sleep and rest	___	___	___	___	___	___	___	___	___
13. Use of drugs for sleep (avoidance of, as indicated by reverse scoring)	___	___	___	___	___	___	___	___	___
14. Air quality index	___	___	___	___	___	___	___	___	___
15. Positional change with SOB	___	___	___	___	___	___	___	___	___
16. Leaning forward position with SOB	___	___	___	___	___	___	___	___	___
17. Physical distancing	___	___	___	___	___	___	___	___	___
18. Changes in hygiene habits	___	___	___	___	___	___	___	___	___
19. Changes in grooming habits	___	___	___	___	___	___	___	___	___
20. Wears slip-on shoes	___	___	___	___	___	___	___	___	___
21. Wears loose clothing	___	___	___	___	___	___	___	___	___

COMMENTS:

Continued on next page . . .

Evaluation of Self-Care Questionnaire
Page 3

	Summary of Item	Does this item reflect a self-care behavior?			Is the behavior appropriate for a patient with COPD?			Are the item and options worded appropriately?		
		Yes	No	Needs Revision	Yes	No	Needs Revision	Yes	No	Needs Revision
22.	Use of steam	___	___	___	___	___	___	___	___	___
23.	Help with bathing	___	___	___	___	___	___	___	___	___
24.	Help with grooming	___	___	___	___	___	___	___	___	___
25.	Help with housechores	___	___	___	___	___	___	___	___	___
26.	Help with yardwork	___	___	___	___	___	___	___	___	___
27.	Reducing activities	___	___	___	___	___	___	___	___	___
28.	Keeps doctors' appointments	___	___	___	___	___	___	___	___	___
29.	Reports drug reactions	___	___	___	___	___	___	___	___	___
30.	Reports signs of infection	___	___	___	___	___	___	___	___	___
31.	Takes full course of antibiotics	___	___	___	___	___	___	___	___	___
32.	Use of diversional activities	___	___	___	___	___	___	___	___	___

COMMENTS:

RESULTS FROM EVALUATIONS BY PANEL OF EXPERTS

EVALUATION OF SELF-CARE QUESTIONNAIRE

INSTRUCTIONS: Read each item on the questionnaire and evaluate it according to the criteria specified by placing a check mark in the appropriate column. Please comment on items for which you mark "needs revision" in the space provided at the bottom of the page.

Summary of Item	Does this item reflect a self-care behavior?			Is the behavior appropriate for a patient with COPD?			Are the item and options worded appropriately?		
	Yes	No	Needs Revision	Yes	No	Needs Revision	Yes	No	Needs Revision
1. Pursed-lip breathing	6			6			4		2
2. Abdominal breathing	6			6			5		1
3. Exercise	6			6			5		1
4. Nourishing meals	6			6			2		4 *
5. Cigarettes (avoidance of, as indicated by reverse scoring)	6			6			5		1
6. Flu vaccine	5	1		6			6		
7. Use of inhaler	6			6			3		3 *
8. Adequate hydration	6			6			6		
9. Prayer	5		1	5		1	4		2 *
10. Medications taken as prescribed	6			6			6		
11. Use of OTC drugs (avoidance of, as indicated by reverse scoring)	6			6			6		

COMMENTS: *ITEMS:
4. deleted, not specific to COPD patients
7. wording was revised
9. item rewritten to encompass more coping activities, became item #32

Continued on next page . . .

Evaluation of Self-Care Questionnaire
Page 2

Summary of Item	Does this item reflect a self-care behavior?			Is the behavior appropriate for a patient with COPD?			Are the item and options worded appropriately?		
	Yes	No	Needs Revision	Yes	No	Needs Revision	Yes	No	Needs Revision
12. Adequate sleep and rest	5		1				5		1
13. Use of drugs for sleep (avoidance of, as indicated by reverse scoring)	5		1	5		1	5		1
14. Air quality index	5		1	5		1	5		1
15. Positional change with SOB	6			6			6		
16. Leaning forward position with SOB	6			6			6		
17. Physical distancing	6			6			6		
18. Changes in hygiene habits	6			6			6		
19. Changes in grooming habits	6			6			6		
20. Wears slip-on shoes	6			6			6		
21. Wears loose clothing	6			6			5		1

COMMENTS: no changes made in items 12-21

Continued on next page . . .

Evaluation of Self-Care Questionnaire
Page 3

Summary of Item	Does this item reflect a self-care behavior?			Is the behavior appropriate for a patient with COPD?			Are the item and options worded appropriately?		
	Yes	No	Needs Revision	Yes	No	Needs Revision	Yes	No	Needs Revision
22. Use of steam	6			6			6		
23. Help with bathing	3	3		3	3		3		3*
24. Help with grooming	3	2	1	2	4		3		3*
25. Help with housechores	4	1	1	4	2		4		2*
26. Help with yardwork	5	1		5	1		5		1*
27. Reducing activities	4	2		4	2		4		2*
28. Keeps doctors' appointments	6			6			6		
29. Reports drug reactions	6			6			6		
30. Reports signs of infection	6			6			5		1
31. Takes full course of antibiotics	6			6			6		
32. Use of diversional activities	6			6			5		1

COMMENTS:

Panel members were split in their evaluations of items 23-27. One asked if these actions are a function of illness or dependency. Dependency actions were not viewed as being self-care actions. Another stated that some patients use their health problems as a rationale for reducing activities and to get others to do things for them. These actions were considered detrimental, in that situation.

Because the panel of experts were more divided on these items than others, the investigator decided to retain the items without revision and evaluate patient response to these items.

Appendix L

Permission to Release Results of Diagnostic Tests

PERMISSION TO RELEASE RESULTS OF DIAGNOSTIC TESTS

TO: _____

My signature below indicates that I give you permission to release to Patsy Riley, RN, the results of tests I have had recently and will have in about 2½-3 months related to my lung problems.

I understand that this information is needed as part of a study Ms. Riley is doing with patients who have lung problems. I have agreed to take part in this study and understand that these test results will be treated confidentially.

_____ _____
Signature Date

Address: _____

_____

_____

Appendix M

Institutional Review Board Approval

The University of Alabama in Birmingham
Institutional Review Board for Human Use
205/934-3789

FORM 4: IDENTIFICATION AND CERTIFICATION OF RESEARCH PROJECTS INVOLVING HUMAN SUBJECTS

The Institutional Review Board (IRB) must complete this form for all applications for research and training grants, program project and center grants, demonstration grants, fellowships, traineeships, awards, and other proposals which might involve the use of human research subjects independent of source of funding.

This form does not apply to applications for grants limited to the support of construction, alterations and renovations, or research resources.

PRINCIPAL INVESTIGATOR Carol P. Riley

PROJECT TITLE Effects of a Pulmonary Rehabilitation Program on Dyspnea and Self-Care Behaviors of Patients with Chronic Osbtructive Pulmonary Disease

_____ 1. This is a training grant. Each research project involving human subjects proposed by trainees must be reviewed separately by the Institutional Review Board (IRB).

_____ 2. This application includes research involving human subjects. The IRB has reviewed and approved this application on _____, in accordance with UAB's assurance approved by the United States Public Health Service. The project will be subject to annual continuing review as provided in that assurance.

_____ This project received expedited review.

_____ This project received full board review.

_____ 3. This application may include research involving human subjects. Review is pending by the IRB as provided by UAB's assurance. Completion of review will be certified by issuance of another FORM 4 as soon as possible.

X 4. Exemption is approved based on number(s) 3a, 5.

11-17-86
Date

Russell Cunningham, M.D.
Interim Chairman of the
Institutional Review Board

Appendix N

Introductory Letter to Patients and Telephone Dialog

6624 Court M
Birmingham, AL 35228

Dear

I am a registered nurse and a student in the doctoral program at the University of Alabama at Birmingham. I am writing to ask you to take part in a study which is being done to help nurses, physicians, and other health care professionals better understand how breathing problems affect a person's way of living. We also want to know what people like you do to cope with or deal with the problems so that we may be better able to help others who have breathing problems.

I have been given permission by your physician, Dr. to ask his patients to take part in this study. I will call you in a few days to explain the study to you. If you agree to take part, you and I will schedule a convenient time for me to visit you in your home to talk with you and ask you some questions.

The results of this study could be very beneficial for patients like you who also have breathing problems. I would very much appreciate your participation in this study and look forward to talking with you soon.

Sincerely,

Patsy Riley, RN, MSN
Doctoral Student

Telephone Dialog

Hello, Mr./Miss/Mrs. _____, my name is Patsy Riley. I am a registered nurse, and I sent you a letter a few days ago about a study I am doing. Did you receive the letter?

"NO" . . . I'm sorry you haven't received it yet (continue . . .)
"YES". . . (continue)

Do you have a few minutes for me to explain the study to you and to find out if you would be interested in participating?

"No" . . . (arrange a more convenient time and call back)
"Yes". . . (continue)

As the letter explains, I am a registered nurse, and I am back in school. This study is part of required course work. I have worked with patients who have breathing problems for about 10 years, and I wanted to do a study which would hopefully be beneficial to these patients in the future. The purpose of this study is to help health care professionals better understand how breathing problems affect a person's way of living, and how people with breathing problems cope with or deal with the problems. We have found that many patients have found that certain things they do really help them, but other people may not have thought of or tried those things. I hope that as a result of this study, health care professionals will be able to more effectively help people with breathing problems.

If you agree to take part in the study, I would come to your home to talk with you and ask you some questions. We can arrange a time that is convenient for you. The visit would take about 30-45 minutes of your time. I am doing the first part of the study now. There is a second part. In about three months, I would come back to your home to talk with you again. The second visit would also take about 30-45 minutes. Whatever you say to me, I will treat confidentially.

CONTROL GROUP PATIENTS ONLY (included in PRP for treatment group): Patients in this study also need to have breathing tests done. If you decide to participate, and have not had a breathing test recently, I will arrange for you to have one done. In three months, you would need to have another breathing test done. I will make arrangement for the tests. The breathing tests will be done at no expense to you.

There will probably be no real benefit to you for taking part in this study other than the satisfaction of knowing you have contributed to research which may help health care professionals to better help patients with breathing problems in the future.

Would you be willing to take part in this study?

"YES". . . Do you have any questions?
(Arrange time and check address; get directions. Explain I will call back to re-confirm appointment on date scheduled.)

"NO" . . . Do you have any questions?
(Answer any questions. If the answer is still "no", thank the patient and end the conversation.)

Appendix O

Permission from Administrator of Pulmonary Rehabilitation Program

HEALTHSOUTH
Rehabilitation Center of Birmingham

January 28, 1987

Carol P. (Patsy) Riley, RN, MSN
6624 Court M
Birmingham, AL 35228

Dear Ms. Riley,

This is to grant you permission to conduct the research project as you described in your letter to me dated January 20, 1987. We at HEALTHSOUTH feel that research on an ongoing basis, provides the basis for improving those services we provide to our patients.

Sincerely,

Don Myers
Administrator

DM/dl

410 Tenth Avenue South | Birmingham, Alabama 35205 | (205) 324-4500

Appendix P

Introductory Letter from Physician Received by Some Patients in the Control Group

June 22, 1987

Dear

I am writing to ask you to consider taking part in a research study which involves patients with breathing problems. The study is being done by Patsy Riley, a registered nurse who is also a doctoral student at UAB. She is visiting patients in their homes to talk with them about how breathing problems affect their way of living and how they cope with or deal with the problems. She would make one visit to your home to see you, and then she will come back again in about 2½-3 months if you decide to take part in the study.

Each patient who takes part in the study is also being asked to have two breathing tests. If you have had a breathing test at our clinic in the last two months, this would count as one of the two tests. If you have not had a breathing test in the last two months, Ms. Riley will make arrangements for you to have come to the clinic, at your convenience, for a breathing test shortly after her first visit to your home. When she comes back to visit you in 2½-3 months, she will arrange for you to have another breathing test. These tests will be used to evaluate your progress. You will not be charged or have to pay for these breathing tests or for Ms. Riley's visits.

We hope this study will help physicians, nurses, and other health care professionals better understand how breathing problems affect a person's way of life so that we can better help these patients. Ms. Riley would like to call you and talk with you personally about the study. After she talks with you, then she will ask you to decide if you would be willing to take part in the study.

I would like to give Ms. Riley your name, address, and phone number so that she can talk with you, but I cannot do that without your permission. If you would be willing for me to give her your name, address, and phone number, please mark YES on the enclosed yellow form, sign it, and fill in your name, address, and phone number. Return it to me in the stamped envelop I have enclosed. If you do not want me to give Ms. Riley your name, mark NO on the yellow form, sign it, and mail it back to me. Whether you mark YES or NO, please send this yellow form back to me as soon as possible. I will respect your wishes, and your decision will not affect the care you receive from me in any way.

Thank you for considering this request.

Sincerely,

Richard Champion, MD

1528 North 26th Street • P.O. Box C-230 • Birmingham, Alabama 35283 • (205) 250-6000

PATIENT RESPONSE FORM

PLEASE MARK YOUR CHOICE:

YES _____ My signature below indicates that I give permission for Dr. Champion or Norwood Clinic to give my name, address, and phone number to Patsy Riley, RN, so that she can contact me about her research study.

NO _____ Do not give my name, address, and phone number to Ms. Riley.

_____
Signature

PLEASE PRINT:

NAME: _____

ADDRESS: _____

_____ ZIP CODE: _____

PHONE NUMBER: _____

Appendix Q

First Correspondence with Physician

Carol P. Riley RN, MSN
6624 Court M
Birmingham, AL 35228
December 19, 1986

Dear Dr.

I am a doctoral student in the School of Nursing at UAB. During the summer you gave me permission to contact your patients whom you had referred to the HealthSouth pulmonary rehabilitation program to ask them to participate in a pilot study I was doing as part of my dissertation research. The pilot study revealed many problems with the data collection instruments, to the extent that the findings were considered unreliable and invalid. As a result, the research proposal was rewritten and new data collection instruments were obtained or developed and pilot tested. The revised purpose of the study is to ascertain the effects of a pulmonary rehabilitation program on dyspnea, self-care behaviors, and pulmonary function of patients with COPD. A summary of the research proposal and data collection instruments which have been approved by my graduate committee and reviewed by the UAB Institutional Review Board are enclosed for your reference. This study will be funded by the investigator with no outside sources of funding.

As I did with the pilot study, I am requesting your written consent to ask patients to participate in the study whom you have referred to the HealthSouth pulmonary rehabilitation program. Patients will be informed that you have given approval for me to ask them to participate in the study. Data collection involves visiting the patient in his or her home to administer the paper and pencil instruments to be used to measure demographic variables and the dependent variables of dyspnea and self-care behaviors. Consent will be obtained from the patients to request results of pulmonary function studies in order to collect data related to this variable. The patient's confidentiality will be protected through all aspects of this study. The study uses a pre and post program design with control and treatment groups.

The inclusion of pulmonary function as a dependent variable is a major change from the pilot study and will provide a more objective measure of the effects of the pulmonary rehabilitation program. As with the variables of dyspnea and self-care, pulmonary function must be measured prior to the rehabilitation program (pre phase) and after the rehabilitation program (post phase, 3 months later). For the purposes of this study, measurements of pulmonary function are limited to spirometry measurements: FVC, FEV.5, FEV1, FEV1/FVC, FEF 25-75%, PEF, and MVV.

Spirometry measurements of the 20 patients who go through the program (treatment group) will be obtained from their records at HealthSouth. For the 20 patients in the control group (those who chose not to enroll in the rehabilitation program), I will request the results of spirometry studies from the referring physician. As an important aspect of maintaining the integrity of the research design, provision must be made to arrange for repeat spirometry during the post program phase of the study.

I am asking you and your office staff to provide the post phase spirometry testing for your patients in the control group at no charge to the patient or to me. The anticipated sample size of this group is 20 patients, of which only a few will be your patients, probably less than five. The post phase of this study is expected to begin in late March and end in early April and is determined by the time at which the patient enters the study.

If you give consent to ask your patients to participate in the study and are willing to provide the post phase spirometry testing, I will give you a soft-bound copy of the completed dissertation. The anticipated date of completion is June 1987. I very much appreciate your time and regret the need for such a lengthy letter. To facilitate your response I have enclosed two reply forms and a return envelop. Please return one copy to me as soon as possible and retain the other copy.

If you have questions you may contact me at 939-7193 (work) or 923-7048 (home). Dr. Allan Goldstein is serving as a member of my graduate committee guiding this study and would be glad to discuss the study with you. You may contact him at 591-2545. Thank you for your consideration.

Sincerely,

Carol Patricia (Patsy) Riley, RN, MSN
Doctoral Candidate
University of Alabama School of Nursing

PHYSICIAN REPLY FORM

TITLE OF STUDY: The Effects of a Pulmonary Rehabilitation Program on Dyspnea, Self-Care Behaviors, and Pulmonary Function of Patients with Chronic Obstructive Pulmonary Disease

Please indicate your response to the two questions below and return to me as soon as possible in the envelop provided. Retain the second copy of this form for your records. You may contact me at 939-7193 (work) or 923-7048 (home) if you have questions.

Thank you,

Patsy Riley

Carol P. Riley, RN, MSN

MAY I ASK YOUR PATIENTS WHOM YOU HAVE REFERRED TO THE HEALTHSOUTH PULMONARY REHABILITATION PROGRAM TO PARTICIPATE IN THIS STUDY?

Yes _____

No _____

WOULD YOU BE WILLING TO PROVIDE THE POST-PHASE SPIROMETRY TESTING FOR YOUR PATIENTS WHO ARE INCLUDED IN THE CONTROL GROUP (those who decided not to enroll in the rehabilitation program) AT NO CHARGE TO THE PATIENT OR TO ME?

Yes _____

No _____

_____

Signature

Appendix R

Correspondence with Physicians of Control Group Patients

Carol P. Riley RN, MSN
6624 Court M
Birmingham, AL 35228
April 20, 1987

Dear Dr.

I am a doctoral student in the School of Nursing at UAB. Dr. Allan Goldstein is serving on the Graduate Committee guiding my dissertation research and suggested that I write to you to request your involvement. The purpose of the study is to ascertain the effects of a pulmonary rehabilitation program on dyspnea, self-care behaviors, and pulmonary function of patients with COPD. The sample is composed of patients with the diagnosis of COPD; or the specific diseases of asthma, chronic bronchitis, or emphysema; or a combination of these problems. A major purpose of the study is to evaluate whether the rehabilitation program makes a difference in the variables of dyspnea, self-care, and pulmonary function. For this reason, control and treatment groups are being used in the study. The treatment group consists of patients participating in the pulmonary rehabilitation program at HealthSouth. The control group consists of patients not involved in any type of rehabilitation program.

I am writing to you and other physicians, not affiliated with an institution providing a pulmonary rehabilitation program, to request your assistance in obtaining a total sample of twenty for the control group. Specifically, I am requesting that you provide the names, addresses, and phone numbers of patients with the identified health problems who have had spirometry testing in the last two months. A summary of the research proposal and data collection instruments which have been approved by my Graduate Committee and reviewed by the UAB Institutional Review Board are enclosed for your reference. This study will be funded by the investigator with no outside sources of funding.

If you provide the patient information requested, I will contact your patients initially by letter and then by phone. The patients will be informed that you have given approval for me to ask them to participate in the study. Data collection involves visiting the patient in his or her home to administer the paper and pencil instruments to be used to measure demographic variables and the dependent variables of dyspnea and self-care behaviors. Consent will be obtained from the patients to request results of pulmonary function studies in order to collect data related to this variable. The patient's confidentiality will be protected through all aspects of this study. The study uses a pre and post program design with control and treatment groups.

The inclusion of pulmonary function as a dependent variable provides a more objective measure of the effects of the pulmonary rehabilitation program. As with the variables of dyspnea and self-care, pulmonary function must be measured prior to the rehabilitation program (pre phase) and after the rehabilitation program (post phase, 3 months later). For the purposes of this study, measurements of pulmonary function are limited to spirometry measurements: FVC, FEV.5, FEV1, FEV1/FVC, FEF 25-75%, PEF, and MVV.

After obtaining written consent from patients, the results of the recent spirometry test will be requested from your office. These results are considered the pre-phase measurements. As an important aspect of maintaining the integrity of the research design, provision must be made to arrange for repeat spirometry during the post program phase of the study.

I am asking you and your office staff to provide the post phase spirometry testing for your patients in the control group at no charge to the patient or to me. The anticipated sample size of this group is 20 patients, of which only a few will be your patients, probably five to seven, depending on the number of physicians involved. I hope to complete this study by late summer. The post phase testing of these patients will probably be during late July.

If you are willing to provide the patient information for the control group and are willing to provide the post phase spirometry testing, I will provide you with a soft-bound copy of the completed dissertation. The anticipated date of completion is late August.

I very much appreciate your time and regret the need for such a lengthy letter. To facilitate your response, I have enclosed two reply forms and a return envelop. Please retain one copy of the reply form for your records. If you have any questions or would like to discuss the study, please call me at 939-7193 (work: 7:30-4:00 P.M.) or 923-7048 (home). If you agree to provide the patient information, I will contact your office after I receive your response. Thank you very much for your consideration.

Sincerely,

Carol Patricia (Patsy) Riley, RN, MSN
Doctoral Candidate
University of Alabama School of Nursing

PHYSICIAN REPLY FORM
CONTROL GROUP

TITLE OF STUDY: The Effects of a Pulmonary Rehabilitation Program on Dyspnea, Self-Care Behaviors, and Pulmonary Function of Patients with Chronic Obstructive Pulmonary Disease

Please indicate your response to the two questions below and return to me as soon as possible in the envelop provided. Retain the second copy of this form for your records. You may contact me at 939-7193 (work) or 923-7048 (home) if you have questions.

Thank you,

Carol P. Riley, RN, MSN

WOULD YOU BE WILLING TO PROVIDE THE NAMES, ADDRESSES, AND PHONE NUMBERS OF PATIENTS WHO MEET THE CRITERIA FOR THE CONTROL GROUP?

Yes _____ Please give the name of the person in your office I should contact:

No _____

WOULD YOU BE WILLING TO PROVIDE THE POST-PHASE SPIROMETRY TESTING FOR YOUR PATIENTS?

Yes _____

No _____

_____
Signature

_____
Date

Appendix S

Enlarged Print of Options for
Visually Impaired Patients

STRONGLY DISAGREE

DISAGREE

AGREE

STRONGLY AGREE

NEVER

RARELY

SOMETIMES

OFTEN

VERY OFTEN

GRADUATE SCHOOL
UNIVERSITY OF ALABAMA AT BIRMINGHAM
DISSERTATION APPROVAL FORM

Name of Candidate Carol Patsy Riley

Major Subject Adult Health Nursing

Title of Dissertation Effects of a Pulmonary Rehabilitation Program on Dyspnea, Self-Care, and Pulmonary Function of Patients with Chronic Obstructive Pulmonary Disease

Dissertation Committee:

Ann Lewis, Chairman — Vernon Pegram

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Marguerite K. Kinney

Kathleen C. Brown

Mary Corette Bowles

Director of Graduate Program Grace Kellogg

Dean, UAB Graduate School Kenneth J. Boozer

Date

PS-1428