THE RELATIONSHIPS BETWEEN DYSPNEA, PHYSICAL ACTIVITY, AND FATIGUE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

by

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A thesis submitted in conformity with the requirements for the degree of the Master of Science Graduate Department of Nursing Science University of Toronto

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The relationship between dyspnea, physical activity, and fatigue
in patients with chronic obstructive pulmonary disease

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Abstract

A descriptive-correlational design was used to examine the relationships between dyspnea, physical activity, and fatigue in patients with chronic obstructive pulmonary disease (COPD). Lazarus and Folkman's (1984) theory of stress, appraisal, and coping provided a framework to guide the study. Dyspnea was measured by a vertical visual analogue scale, fatigue by the Profile of Mood States-Fatigue subscale, and physical activity by the 6 minute walk (6MW) test and an open ended question. A convenience sample of 7 male and 15 female patients with COPD provided data for analysis. The sample was characterized by relatively high FEV1 indicating mild lung impairment, predominantly female, and high mean levels of fatigue and dyspnea. No significant gender difference was found in the ratings of dyspnea and fatigue and the 6MW distance. Controlling for FEV1, dyspnea, physical activities, and fatigue were all significantly interrelated (P<0.001). Results indicated that the higher the dyspnea scores, the shorter the 6MW distance walked, and the higher the fatigue scores. Limitations and suggestions for nursing practice and future research were presented.
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Chapter I

Problem and Purposes

Background of Problem

Chronic obstructive pulmonary disease (COPD) includes emphysema, bronchitis, or a combination of both. It is a progressive debilitating health problem that is increasing in prevalence (Canadian Thoracic Society Workshop Group, 1992). In the United States, COPD affects 1 in 14 people over the age of 45 and is the fourth leading cause of restrictions of major life activities (Lewis & Bell, 1995). In Canada, COPD ranks as the fourth leading cause of death among men and the seventh leading cause of death among women (Hum & Semenciw, 1991). In 1993, 353 Canadians died from chronic bronchitis and 1147 Canadians died because of emphysema. It is estimated that COPD accounted for about 596 million dollars in hospital care expenditure in 1992. (Statistics Canada, 1993).

COPD patients experience a myriad of symptoms (Gift & Pugh, 1993). One of the most distressing and prevalent symptoms is fatigue (Graydon, Ross, Webster, Goldstein, & Avendano, 1995; Guyatt, Townsend, Berman,
& Pugsley, 1987). In a study of 146 patients with COPD, 91% of the respondents complained of experiencing fatigue from "sometimes" to "always" (Kinsman, et al., 1983). As a result of fatigue, the patients' quality of life in terms of physical, psychological, and social functioning is significantly and adversely affected (Moody, McCormick, & Williams, 1990). Therefore, fatigue is a significant problem for COPD patients.

Fatigue is an enduring, subjective feeling of generalized tiredness or exhaustion (Tack, 1990). It can be differentiated into acute and chronic types (Piper, 1993). Acute fatigue differs from chronic fatigue in that the former is localized and temporary, is proposed to protect one from over exertion and muscle damage, and can be mitigated by strategies like a good night's sleep, adequate rest, and proper diet. In contrast, chronic fatigue is general, pervasive, and continuous, may last over a long period of time, and cannot be mitigated by sleep or rest (Carpenito, 1992; Piper, 1993). The exact mechanism that leads to chronic fatigue in COPD remains elusive in light of the complexity of COPD and the paucity of research that has examined fatigue in this patient population (Woo, 1995).
Fatigue and dyspnea are significantly correlated (Kinsman, et al., 1983; Lee, Graydon, & Ross, 1991). However, it is not clear how dyspnea is related to fatigue. Dyspnea can be evoked in COPD as a result of decreased pulmonary function due to progressive destruction of the alveolar structure and inadequate alveolar gas exchange (Killian & Jones, 1988). Pulmonary function as indicated by forced vital capacity, forced expiratory volume in one second (FEV₁) (Mahler & Harver, 1992), peak expiratory flow rate (PEFR), and oxygen saturation (Gift, 1991) are significantly lower during periods of high dyspnea than periods of low dyspnea. As a result of decreased pulmonary function, oxygenation of locomotive muscles and the energy producing mechanism of the muscle is impaired in COPD. Therefore, COPD patients may feel fatigue. Fatigue in COPD may be related to dyspnea as a result of decreased pulmonary function.

Chronic fatigue in COPD may also arise from patients’ decreasing physical activity in order to avoid experiencing dyspnea. According to Leidy and Haase (1996), dyspnea is one of the major factors that interferes with the physical activities COPD patients want to perform. Decreased
physical activity will lead to morphological changes in locomotive muscles as evidenced by decreases in muscle cross-sectional area, contractile protein content, and capacity for oxidative metabolism (Brooks & Faulkner, 1994; Kasper, McNulty, Otto, & Thomas, 1993). As a result, muscle power generation and endurance are reduced and this may predispose one to fatigue during physical activity. As compensation for fatigue, COPD patients may further restrict their physical activities. This, however, is followed by decreased use and finally degeneration of muscle that may lead to more fatigue. The result is a progressive cycle of physical inactivity, muscle degeneration, and fatigue like a 'downward spiral' (Carter, et al., 1988). In other words, dyspnea and fatigue may be related to the ability to perform physical activity in COPD patients. However, a study reported by Larson et al. (1996) found that physical activity was significantly correlated with dyspnea; but not with fatigue. To understand the relationships among dyspnea, physical activity, and fatigue in COPD patients, further investigation was warranted.
Problem Statement

The relationship between dyspnea, physical activity, and fatigue in COPD patients is not clear. More information is needed regarding the physical activity level of COPD patients and its relationship to dyspnea and fatigue before specific nursing interventions can be stipulated to help this specific group of patients to cope with fatigue. This study explored the relationship between dyspnea, physical activity, and fatigue in patients with chronic obstructive pulmonary disease.

Review of Related Literature

Although fatigue has been recognized as a concern for COPD patients, only a paucity of studies has investigated the nature of chronic fatigue in these patients. For the purpose of the present study, literature that addresses dyspnea, physical activity, and fatigue in COPD patients was reviewed.
Dyspnea

COPD patients experience various symptoms including dyspnea. Kinsman and his colleagues (1983) reported that, among the 12 symptom categories listed on the Bronchitis Emphysema Symptom Checklist (BESC), dyspnea was the most commonly experienced by subjects with chronic bronchitis and emphysema (n=146). The severity of dyspnea cannot be solely explained by decreased pulmonary capacity as indicated by pulmonary function tests. Various other factors have been shown to be associated with dyspnea. Gift, Plaut, and Jacox (1986) found that COPD patients (n=110) had significantly higher anxiety, somatization, and accessory muscle use during periods of high dyspnea than during periods of low dyspnea. Feelings of depression (Gift & Cahill, 1990; Kellner, Samet, & Pathak, 1992; Moody, et al., 1990) and perceived stress (Leidy, 1990) have also been found to be positively correlated with dyspnea such that the more dyspnea experienced, the more depressed and stressed the subjects felt.
However, the exact mechanism of dyspnea in COPD remains unclear. Various factors may affect dyspnea. Dyspnea has shown to be precipitated by various physical activities. As identified by COPD patients, dyspnea may be evoked by simple activities, such as walking, doing housework, eating, and talking (Janson-Bjerklie, Carrieri, & Hudes, 1986). Dyspnea may emerge because performance of these motor activities recruits muscles that are otherwise used to assist ventilation (Breslin, Roy, & Robinson, 1992).

To avoid the distressing sensations of dyspnea and other symptoms, the majority of COPD patients reduce their physical activities (Carrieri & Janson-Bjerklie, 1986; Gift & Austin, 1992; Leidy, 1995; Narsavage & Weaver, 1994). As a result, some patients may lead an extremely sedentary lifestyle that may further decrease their abilities to perform physical activities. In one study, Schrier, Dekker, Kaptein, and Dijkman (1990) found that 77% of elderly COPD patients (n=70) had one or more limitations in performing activities of daily living (ADL) while only 11% of a healthy comparison group reported any limitation. The comparison group
was comprised of healthy blood donors who were younger than the COPD patients. The age difference may explain why the comparison group reported fewer limitations in performing daily activities than the COPD patients. However, two thirds of the COPD patients reported trouble walking several blocks, climbing a few flights of stairs, running, and lifting heavy objects. ADL was measured by the Daily Activity List (DAL) on which subjects were required to indicate if they had any limitation performing the 11 listed activities. Ninety-six percent of the patients from Schrier et al.'s (1990) study reported that they did not stay in bed or sit in a chair for most or all of the day; the amount and type of physical activities that these COPD patients performed on a day to day basis were not known.

In describing patients' physical activity level, their usual physical activities should also be included in future studies.

The level of physical activity in COPD patients cannot be solely explained by physiological variables such as percentage of predicted FEV1, arterial oxygen tension (PaO2), and arterial carbon dioxide tension (PaCO2). Some patients with severe disease are able to maintain physical
activities, while others with relatively mild impairment remain housebound (Leidy & Haase, 1996). Schrier et al. (1990) found that patients' difficulty in performing ADL was significantly (p<0.001) related to the degree of dyspnea. Patients who reported higher dyspnea were more restricted in performing ADL than those who reported lower dyspnea. The relationship of dyspnea and ADL was also reported by Kaptein and the Dutch chronic non-specific lung disease study group (1993). They recruited a sample of 274 COPD patients into a multicentre study in which subjects were asked to respond to six standardized tests including the Symptom Checklist and the DAL. The investigators found that the higher the dyspnea scores by COPD patients, the more restrictions they experienced in carrying out ADL.

Therefore, one of the reasons that COPD patients reduce their physical activities may be related to dyspnea. The relationship between FEV1 and DAL scores reported by Kaptein, Strawbridge, Camacho, and Cohen (1993) was not significant. Accordingly, dyspnea may be a better predictor of physical activity in COPD patients than measures of pulmonary function tests. Alsonso et al. (1992) found that although dyspnea was not correlated
to FEV1, it was significantly related to COPD patients' (n=76) performance on a six minute walk (6MW) test. The higher the dyspnea level, the shorter the distance patients could walk. A significant and negative correlation between dyspnea and 12 MW was also reported by Larson et al. (1996). Results of these studies support the notion that dyspnea and physical activity as measured by walking tests are related in COPD patients.

**Physical Activity and Fatigue**

As a result of decreased physical activity and immobility, the locomotive muscle undergoes morphological changes. Losses of skeletal muscle fibre area, contractile protein, energy generating enzymes, and energy stores (e.g. glycogen) are seen in human beings secondary to a reduction in physical activity by limb immobilization (Appell, 1990; MacDougall, Elder, Sale, Moroz, & Sutton, 1980; Mobily & Kelley, 1991). These changes will subsequently lead to decreased endurance performance, power output, force generation, and functional capacity of the muscles (Faulkner, Green, & White, 1992; Karlsson, Diamant, & Folkers, 1992). Muller (1970) reported that 5.5% of muscle strength can be lost each day as a
consequence of immobility. Reduced muscle strength and endurance as a result of inactivity is one factor that may lead to fatigue with activity (Edwards, 1981; McKenzie, Bigland-Ritchie, Gorman, & Gandevia, 1992).

Patients with rheumatoid arthritis (Belza, Henke, Yelin, Epstein, & Gilliss, 1993) and postoperative patients (Christensen, Nygaard, Stage, & Kehlet, 1990) reported increased fatigue with activity as a result of decreased physical mobility. COPD patients who are physically inactive may also experience a higher level of fatigue with activity than those who are physically active. Prigatano, Wright, & Levin (1984) found that COPD patients' scores of the Sickness Impact Profile (SIP) physical scale were significantly correlated to the scores on fatigue scale of the Profile Of Mood States (POMS). Hence, the more impairment in physical activities reported by the patients, the higher the levels of fatigue. It follows that fatigue may be mitigated by increasing one's physical activity. In COPD patients, ergometry performance (including both test time and test load), 6 minute walking distance (Lake, Henderson, Briffa, Openshaw, & Musk, 1990), 12 minute walking distance (Vale, Reardon, & ZuWallack, 1993), maximum
oxygen uptake (Punzal, Ries, Kaplan, & Prewitt, 1991), muscle force (measured by the torque force), and lactate threshold (Patessio, Carone, Ioli, & Donner, 1992) are significantly improved by exercise training. More importantly, COPD patients who exercised regularly after participating in a pulmonary rehabilitation program reported significantly less frequent (Perry, 1981) and less intense (Simpson, Killian, McCartney, Stubbing, & Jones, 1992) fatigue than before they started the exercise program. Fatigue is reduced by increased physical activity in relation to regular exercise. Although not verified by statistical tests, Simpson et al. (1992) suggested that a decreased perception of fatigue may be a result of increased muscle strength and increased exercise endurance.

**Dyspnea and Fatigue**

Fatigue is identified as a common experience in COPD patients, next to dyspnea in prevalence (Graydon, Ross, et al., 1995; Guyatt et al., 1987; Kinsman, et. al., 1983). Janson-Bjerklie and colleagues (1986) reported that up to 45% of their research participants when asked to describe dyspnea included fatigue as a descriptor. Not only are dyspnea and fatigue
commonly experienced by COPD patients, but they have also been shown to be related. The Pearson's correlation coefficients for the relationship between fatigue and dyspnea range between 0.62 (Lee, et al., 1991) and 0.76 (Kinsman, et al., 1983). Various explanations are proposed to explain dyspnea and fatigue. However, the mechanism that explains how dyspnea is related to fatigue remains elusive.

There are many causes of fatigue, one of which may be related to the level of physical activity. In COPD patients, the amount of physical activity they engage in may be dependant on their levels of dyspnea. Various studies suggest that the higher the level of dyspnea, the lower the level of physical activity. Dyspnea is associated with discomfort, frustration, and panic, which may lead to a gradual decrease in physical activities (Sassi-Dambron, Eakin, Ries, & Kaplan, 1995). As a result of decreased physical activity, fatigue may arise in relation to muscle disuse. Kinsman et al. (1983) noted that COPD patients (n=146) who experienced more difficulty with physical activities due to shortness of breath were more likely to have more frequent complaints of fatigue (p<0.001). However, the relationship
between fatigue and physical activity was not consistent. Larson et al. (1996) found that the ability to perform physical activity measured by the 12 MW was not related to the fatigue scores obtained from the modified BESC-Fatigue scale. On the BESC-Fatigue scale, COPD subjects, including 79 men and 29 women, were asked to rate the intensity of fatigue experienced over the last week. Patients’ performances of the 12 MW may not be influenced by the intensity of fatigue experienced over the last week but by various factors including the intensity of fatigue on the day of experiment. In addition, patients with exacerbations of symptoms in the last 2 months prior to the experiment were excluded from the study and not every subject included might have experienced fatigue. The lack of relationship between physical activity and fatigue reported may be misleading. The relationship between dyspnea, physical activity, and fatigue in COPD remained unclear and merited further investigation.
Conceptual Framework

This study of fatigue in COPD patients was based on the cognitive theory of stress and coping as postulated by Lazarus and Folkman (1984). Coping is determined by how a situation is appraised. Cognitive appraisal is 'a process through which the person evaluates whether a particular encounter with the environment is relevant to his or her well-being, and if so, in what ways' (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986, p.992). The situation may be appraised as irrelevant when the person does not perceive any threat to his or her well-being. The person may appraise the situation as benign-positive when his or her well-being is being enhanced. However, when threat, challenge, or harm and/or loss is present or has occurred, the person may appraise the situation as stressful. Appraisal describes the person's ongoing evaluation of the meaning and significance of the situation, it is dynamic and contextual.

According to Lazarus and Folkman (1984), the person will also take into account the available resources to decide if anything can be done to overcome or prevent harm and loss. The amount of resources available to
the person will affect how the situation is appraised. When few resources are available to the person, the situation may be appraised as more stressful than when more resources are available. Various personal and situational factors are identified as resources. Among the most important resources that influence appraisal are health and energy.

Individual differences in the appraisal of health and energy may explain why an encounter is appraised as a threat by one person and as benign-positive by another. When a person feels fatigue, the appraisal of the amount of energy available to him or her is low. Given a low level of energy, a person may appraise a situation as more threatening and stressful than someone who has a high level of energy.

The appraisal of low energy or fatigue in COPD may be related to various factors including dyspnea. On one hand, patients may feel fatigue due to the increased work of breathing and energy consumption during dyspnea. On the other hand, decreased power generation as a result of fatigue may heighten the perception of dyspnea.
The appraisal of low energy or fatigue may also be related to how much the patient can do on a day to day basis. Some patients experiencing fatigue may decrease their physical activities to avoid situations that may further deplete their energy and make them feel breathless. These patients may become more fatigued due to the decreased ability to perform physical activities as a result of muscle disuse than other patients who remain physically active.

Although the appraisal of low energy or fatigue in COPD may be related to dyspnea and decreased physical activity, the interrelationships between dyspnea, physical activity and fatigue are not clear. It is suggested that the more dyspnea one experiences, the lower the ability to perform physical activities, and the higher the fatigue.

Assumptions

1. The experience of COPD is perceived as a stressful situation by the patients.

2. Individuals with COPD are able to quantify and report their physical activities, dyspnea, and fatigue.
Research Questions

The study examined the following research questions.

In patients with COPD:

1. What is their level of fatigue as measured by the Fatigue subscale of the POMS (F-POMS)?

2. What is their level of dyspnea as measured by a vertical dyspnea analogue scale (VVAS)?

3. What is their level of physical activities as indicated by:

   a) the 6 Minute Walk (6MW); and

   b) response to the activity question?

4. What is the relationship between dyspnea, physical activity, and fatigue?

Research Purpose

The purpose of the study was to contribute to a knowledge base that could be used:
1. To understand the phenomenon of fatigue in COPD patients, and

2. To provide directions for future research in fatigue of COPD patients.
Chapter II

Methods

This section describes the methods that were used in this study. The study design is delineated and the sample described. Both the inclusion and exclusion criteria are elaborated. The instruments are then discussed in terms of their strengths and weaknesses, their administration, and their psychometric properties.

Study Design

This study used a nonexperimental, descriptive correlational design to explore the relationship between the level of fatigue and the level of physical activity and dyspnea.

Sample Selection

A nonprobability convenience sample of 22 outpatients with COPD was recruited from hospitals in the Metropolitan Toronto area. Only those
patients who met the sample selection criteria were included. Participants had to:

1. report the feelings of dyspnea and fatigue over the past few days when asked by their physicians at the end of their appointments;
2. be diagnosed with COPD;
3. be 21 years of age or over;
4. be living in the community of Metropolitan Toronto, rather than an institutional setting;
5. be able to speak, write, read, and understand English;
6. be independent in ambulation;
7. be mentally competent as determined by the referring physicians.

Patients with the following conditions were excluded from the study:
1. Those who had psychiatric problems that might have affected participants' ability to recall physical activities and to respond appropriately to interview questions;

2. Those who had concomitant neuromuscular disease that might have affected the performance of the walking test.

**Data Collection Procedure**

After the study proposal was approved by the thesis committee and the Office of Research Service (ORS) at the University of Toronto, the proposal was submitted to the hospital research committee of the participating pulmonary laboratory. After approval was obtained, physicians of the pulmonary laboratory were requested to identify potential subjects for this study in light of the inclusion and exclusion criteria (see section on sample selection).

Eligible participants for the study were initially approached by their physicians at the pulmonary function laboratory. These patients were introduced to the study by means of a standard verbal introduction
(Appendix A) by their physicians at the end of their appointments. Those patients who expressed interest in the study were identified to and contacted by the investigator after their appointments at the pulmonary function laboratory. A more detailed explanation (Appendix B) of the study was provided to the subjects by the investigator to make sure they understood the study. They were encouraged to ask questions and were informed that whether or not they agreed to participate in the study would not affect their medical care in the future. Informed consent (Appendix C) was then obtained from the participants. After consent was obtained, the study proceeded according to the procedure for data collection.

The data collection procedure consisted of five components. First, the Fatigue subscale of the Profile of Mood States (F-POMS) was administrated to participants. Next, the participants were asked to rate their dyspnea on the Vertical Visual Analogue Scale (VVAS) (Appendix D). Then, participants were asked to identify their daily physical activities (Appendix E). Following that, patients were asked to fill out a demographic collection sheet (Appendix F) that included questions about their age, gender,
education, and number of years diagnosed with COPD (patients' pulmonary functions were obtained from their medical records). Finally, the participants were asked to perform a six-minute walking (6 MW) test. The interview was terminated with standardized conclusion remarks. All interviews were conducted by the investigator himself.

The overall arrangement and ordering of the interview schedule allowed for more subjective feelings to be measured (the F-POMS and the VVAS) prior to the administration of the more objective measurement (the 6-MW test). In particular, the F-POMS was administrated first to avoid any potential alteration in the patients' perception of fatigue due to the length of the interview.

A pretest of the data collection procedure was carried out with five subjects to determine the feasibility of the data collection methods. No changes were required; the first five subjects were consequently included in the study sample.

**Instruments**

**Profile of Mood States (POMS)** The POMS was developed by McNair, Lorr, and Droppleman (1981) to measure the following mood states:
tension-anxiety, anger-hostility, vigor-activity, fatigue-inertia, depression-dejection, and confusion-bewilderment. Subjects were asked to indicate the degree or intensity of their feelings in the preceding few days by rating 65 adjectives on a five-point Likert scale. One end of the scale represents 'not at all' with the value of zero while the opposite end represents 'extremely' with the value of four. The summation of scores for adjectives corresponding to each subscale gives rise to the subscale scores. For the purpose of this study, only the fatigue subscale of the POMS (F-POMS) was used to measure fatigue. The F-POMS consists of seven items.

Internal consistency reliability for the F-POMS has been reported as 0.93 (Norcross, Guadagnoli, & Prochaska, 1984) and the test-retest reliability as 0.74 (McNair et al., 1981). According to McNair and his colleagues (1981), the POMS is sensitive to mood change. They reviewed several studies that used the POMS to study the change of mood due to effects of drugs or dental treatment and concluded that the instrument had substantial face and content validity. Concurrent validity was investigated by comparing the F-POMS with other instruments that were proposed to
measure fatigue; good results were reported. Reeves, Potempa, and Gallo (1991) found that the Pearson correlation coefficient between F-POMS and fatigue subscale scores of the Fatigue/Stamina Scale was 0.79 (p<0.001) in pregnant women.

**Vertical Dyspnea Visual Analogue Scale (VVAS)** To measure dyspnea, the Vertical Visual Analogue Scale (VVAS) was used. VVAS is a 100 mm vertical line rating scale with anchors of "no shortness of breath" at the bottom and "shortness of breath as bad as can be" at the top (see Appendix D). Patients are asked to mark the line to indicate the degree of shortness of breath experienced over the past few days. The visual analogue scale is a unidimensional and simple instrument. Since there is little to read or see on the scale, the VVAS can be used by people with some sight impairment (Gift 1989a). The anchor words at each end of the VVAS are precise and easy to interpret (Gift, 1989b).

Reliability of the VVAS is difficult to demonstrate because dyspnea is subject to change from time to time. However, the repeatability of HVAS
(horizontal visual analogue scale) was reported in a study of COPD patients (n=5) who were asked to rate dyspnea before, during, and after exercise for five consecutive days (Stark, Gambles, & Chatterjee, 1982). Peak expiratory flow rate (PEFR), heart rate, and minute ventilation were monitored continuously. Dyspnea scores were consistent (no significant differences were noted) given a level of PEFR, heart rate, and minute ventilation.

The VVAS is as effective in measuring dyspnea as the HVAS. In a study of dyspnea in COPD and asthmatic patients (n=36), Gift (1989b) reported that the Pearson's product moment correlations between the VVAS and HVAS was 0.97. Gift and her colleagues (1986) advocated the use of the VVAS because they found that fewer people had difficulty using the VVAS in comparison to the HVAS.

To demonstrate the concurrent validity of a tool that measures dyspnea, it is expected that dyspnea scores will be higher among patients who have greater airway obstruction than those who have less obstruction as indicated by the PEFR. By using the VVAS, Gift (1989b) showed significant
differences between dyspnea scores obtained during severe obstruction (PEFR less than 150 lpm) and those obtained during mild obstruction (PEFR more than 150 lpm) in asthmatic patients (p<0.01) and COPD patients (p<0.01). The Pearson’s product moment correlations between the VVAS and PEFR was -0.85 (Gift, 1989b). Gift (1989b) concluded that the results lent support to the construct validity of the VVAS. Furthermore, anxiety, depression, somatization, hostility, panic/fear, fatigue, hyperventilation/hypocapnia, congestion, rapid breathing, wheezing, accessory muscle use, and increased pulse are some of the factors that may precipitate or occur with dyspnea. These factors were all significantly higher (n=36; p<0.001) during times of high dyspnea in comparison to low dyspnea as measured by the VVAS (Gift, 1991).

Physical Activity Open-ended Question To understand what daily physical activities COPD patients were performing on a daily basis, an open ended question was used. Physical activities may include leisure, occupational, and other routine physical activities. The open question format allowed the investigator to know about the variety of physical activities that COPD
patients do on a day to day basis. Subjects were asked to think of a typical day and described what activities they usually do in the morning, afternoon, and evening. All their answers were tape recorded and later transcribed by the investigator.

The 6-Minute Walk (6 MW) The walking test is a simple, inexpensive, and safe method to assess a subject's ability to engage in physical activity. During the walking test, subjects were required to walk on a flat surface in an enclosed corridor of the pulmonary function laboratory from end to end within a time period of six minutes. Subjects were instructed to walk in a straight line along the corridor wall at their own pace. They were allowed to hold on to the side rails or corridor wall and to use a walking device while walking. At any time and for whatever reasons, subjects were allowed to slow down or stop to rest during the walking test. They could rest by sitting on a chair or leaning their body against the wall. The investigator walked behind subjects to act as a timekeeper. No encouragement was provided to subjects during the 6MW. After six minutes had elapsed, subjects were asked to stop walking and to sit down
and rest. The total walking distance was measured by a measuring tape and recorded. Guyatt et al. (1985) contended that the 6-minute walk imposes minimal stress on the patient and corresponds to the patient’s ability to undertake the physically demanding activities of day-to-day life, especially among moderately and severely limited patients.

The walking test was originally introduced by Cooper (1968) to assess exercise capacity. Guyatt et al. (1985) reported that the repeated measurement of 6 MW distance was consistent in the same subjects. The reproducibility and reliability of 6 MW are supported. Exercise capacity can also be indicated by pulmonary capacity such as forced vital capacity (FVC), oxygen uptake, and minute ventilation. Studies of COPD patients have demonstrated that the twelve-minute walking distance was significantly correlated with FVC ($n=35; r=0.406; p<0.05$), oxygen uptake ($r=0.52; p<0.01$), minute ventilation ($r=0.53; p<0.01$) (McGavin, Gupta, & McHardy, 1976); and perceived exertion ($n=50; r=-0.49; p<0.001$) (Rampulla, Baiocchi, Dacossto, & Ambrosino, 1992). Therefore, the use of the walking test to measure exercise capacity appears to be valid. Mak,
Bugler, Roberts, and Spiro (1993) demonstrated that the six minute walk was as valid in measuring exercise capacity as the 12 MW. Berstein and colleagues (1994) found that none of the walking distances in each 2-minute interval of the 12-minute walk differed significantly. The 6 MW distance was highly correlated to 12-MW distances ($r=0.97$). 6 MW distance was significantly correlated with the gas transfer index ($T_{LCO}$) ($r=0.68$), FEV$_1$ ($r=0.53$), breathlessness on the MRC scale ($r=-0.52$), and FVC ($r=0.48$) (all $p$ values were less than 0.001). The 6MW was used in this study because 6MW is less time consuming than 12 MW and imposes minimal risks on patients (Fitts & Guthrie, 1995).
Protection of Subjects' Rights

In order to protect subjects' rights, certain precautions were employed. First, each of the participants in the study was clearly informed of the purposes and nature of the study. The investigator emphasized that the study was not therapeutic but the results of the study might have some contributions to the future study of chronic fatigue in COPD patients. Second, written consent was obtained from those who agreed to participate in the study. Subjects were informed that their response to the physical activity question would be tape recorded. They were informed that they had a right to withdraw from the study at any time and that their decision to withdraw would not influence the care they received from the pulmonary function laboratory. Third, anonymity was maintained by assigning an identification code number to each participant in the beginning of the study, then only code numbers were used on the instruments.
Chapter III

Results

Data were collected over a five-month period, from July 5, 1995 to November 9, 1995. Data obtained from the subject profile sheet, Profile of Mood States Fatigue subscale (F-POMS), Vertical Visual analogue scale (VVAS), and 6 minute walk (6MW) were analyzed by using the Statistical Package for Social Science (SPSS) for personal computers. The level of significance for all statistical tests was set at 0.05. Taped responses to the physical activity question were transcribed verbatim for analysis. Each activity identified by the subjects was listed, tallied, and classified into categories of physical activities by the investigator. To establish interrater reliability for the categorizations, responses from ten randomly selected subjects were classified by a second rater. The number of physical activities classified the same by the two raters was calculated and converted to a percentage by dividing the number of congruent items by the total number of items identified. Discussion was carried out between the two raters since the initial
ierralter agreement was 74 percent. Discrepancies that arose from the
categorization of social activities, leisure activities, and exercise were
discussed and all responses were recategorized. The final level of
agreement was greater than 95 percent. The remaining data were
reclassified based on the agreed upon categorizations.

Twenty-two subjects were recruited to the study from the respiratory
clinic of a metropolitan Toronto acute care hospital. Not all the patients
approached by the physicians agreed to participate in the study. The
total number of patients approached by the physicians and the number
who refused to participate are not available since the physicians did not
keep track of refusals. However, the physicians indicated that some of
the reasons for refusal were related to transportation arrangements,
feeling sick, inconvenience, fatigue, and the lack of time. The
investigator explained the study to 22 participants, all of which agreed to
participate and signed the consent forms. All participants were able to
respond to all questions on the questionnaires and to participate in the
interview and six minute walk. The average time for data collection was
twenty minutes. To summarize the results of the study, the following headings will be used: (a) characteristics of the sample, (b) fatigue, (c) dyspnea, (d) physical activities, and (e) the relationships between dyspnea, physical activity, and fatigue.

Characteristics of the sample

The sample was composed of 7 males and 15 females who were diagnosed with bronchitis, emphysema, or COPD. Their ages ranged from 40 to 83 years with a mean of 66.32 years and a standard deviation of 10.44 years. The majority of the sample was married (54.5%). Thirteen (59.1%) of the subjects had received at least post secondary education. None of the sample worked full time and only 3 subjects worked part time. Demographic characteristics of the sample are summarized in Table 1.
Table 1. Demographic characteristics of the Sample (N=22)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Range</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>40 to 83 years</td>
<td>M=66.3</td>
<td>SD=10.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>7</td>
<td>31.8%</td>
</tr>
<tr>
<td>female</td>
<td>15</td>
<td>68.2%</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>single</td>
<td>2</td>
<td>9.1%</td>
</tr>
<tr>
<td>married</td>
<td>12</td>
<td>54.5%</td>
</tr>
<tr>
<td>widowed</td>
<td>6</td>
<td>27.3%</td>
</tr>
<tr>
<td>divorced</td>
<td>2</td>
<td>9.1%</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;high school</td>
<td>4</td>
<td>18.2%</td>
</tr>
<tr>
<td>high school</td>
<td>5</td>
<td>22.7%</td>
</tr>
<tr>
<td>community college</td>
<td>10</td>
<td>45.5%</td>
</tr>
<tr>
<td>university</td>
<td>3</td>
<td>13.6%</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>not employed</td>
<td>19</td>
<td>86.4%</td>
</tr>
<tr>
<td>part time</td>
<td>3</td>
<td>13.6%</td>
</tr>
<tr>
<td>Oxygen use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>not used</td>
<td>19</td>
<td>86.4%</td>
</tr>
<tr>
<td>night only</td>
<td>2</td>
<td>9.1%</td>
</tr>
<tr>
<td>during exercise</td>
<td>1</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

Pulmonary function of this sample was measured by FEV1. The lowest FEV1 was 40% whereas the highest was 72% with a mean FEV1 of 59.32% (standard deviation of 7.35%) (see Table 2). As
indicated in Figure 1, the majority of the sample had a FEV1 greater than 55%. Only two subjects had a FEV1 of less than 50%, indicating severe obstructive disease. The calculated skewness for the distribution of FEV1 was -1.0.
Table 2 Illness characteristics: ranges, means and standard deviations

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Range</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV1</td>
<td>40-72</td>
<td>59.32</td>
<td>60.00</td>
<td>7.35</td>
</tr>
<tr>
<td>Fatigue</td>
<td>3-27</td>
<td>15.91</td>
<td>17.00</td>
<td>6.71</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>21-97</td>
<td>55.82</td>
<td>54.00</td>
<td>21.24</td>
</tr>
<tr>
<td>6MW (meters)</td>
<td>6.04-681.12</td>
<td>401.02</td>
<td>416.80</td>
<td>170.01</td>
</tr>
</tbody>
</table>

The subject profile for this study was a 66-year old woman or man, not working, married, with a FEV1 of 59%, not requiring oxygen, and had received post secondary education.

**Fatigue**

All the questions on the Profile of Mood States Fatigue subscale were answered with no missing data. The possible range of scores for the fatigue score was from 0 to 28. The actual range of scores was from 3.00 to 24.00, with a mean of 15.91, and a standard
deviation of 6.71 (see Table 2). The distribution of the fatigue score was normal with a skewness of -0.18 (Figure 2).

![Figure 2. Distribution of fatigue scores](image)

The Cronbach’s alpha of the F-POMS was 0.80 indicating strong internal consistency reliability. Using a t-test for independent samples, no significant difference in total score was noted between males and females, subjects who were currently married and those who were not; and subjects who received at least post secondary education and those who did not. The fatigue score was negatively and significantly correlated with FEV1 level (r = -0.76, p<0.0001). The worse their pulmonary function, as indicated by the lower FEV1, the more fatigue...
subjects reported. No significant correlations were found between total fatigue scores and age.

**Dyspnea**

Dyspnea was measured by the VVAS. The possible scores on the VVAS ranged from 0 to 100. The scores actually ranged from 21 to 97, with a mean of 55.8, and a standard deviation of 21.24 (see Table 2). The dyspnea scores were evenly distributed with a skewness of 0.28 (Figure 3).

Figure 3. Distribution of dyspnea scores
There was no significant difference noted in dyspnea scores between males and females, subjects who were currently married and those who were not, and subjects who received at least post secondary education and those who did not when tested using the t-test for independent samples. Dyspnea scores were negatively and significantly correlated with FEV1 level ($r = -0.73; P < 0.0001$). The higher the dyspnea score the lower the FEV1. No significant correlation was found between subjects’ VVAS scores and the subjects’ age.

**Physical Activity**

Physical activity was measured by 6MW and from interviews with each subject. All subjects were able to perform the 6 MW tests along an air conditioned corridor 30 m in length, with handrails on both sides of the corridor. Traffic in the corridor was kept to a minimum during the test. Subjects were allowed to pause during the test and to resume whenever they were ready. The actual 6MW distance ranged from 6.04 m to 681.12 m, with a mean of 401.02 m, and standard deviation of
170.01 m. The calculated skewness for the distribution of walking distances was -0.70 (Figure 4).

Figure 4. Distribution of 6 MW distance

![Histogram showing distribution of 6-minute walk distance](image)

One subject was only able to walk 6.04 m in distance due to extreme shortness of breath and anxiety. Although the walking distance of 6.04 m was 2 standard deviations below the mean of 401.02 m, the subject was included in the sample for analysis after finding that deleting the subject from the analysis did not alter the result. Positive correlation was found between 6MW and FEV1 (r=0.78; p<0.0001). The higher the FEV1 the further the subjects were able to walk. No correlation was found between 6MW and age. Utilizing a t-test for independent
samples, no significant difference in walking distance was found between males and females, subjects who were currently married and those who were not; subjects who received post secondary education and those who did not.

The variety of physical activities that COPD patients in this study engaged in on a regular basis was examined. Subjects were asked to think of a typical day and describe their physical activities in the morning, afternoon, and evening. A wide range of activities was reported and they were grouped into categories. Six categories of activities were identified including leisure activities, social activities, home management, food preparation, self care, and exercise. The frequency with which each category of physical activities was reported by the subjects is presented in Table 3. Twenty subjects reported engaging in leisure activities including reading, listening to radio, watching television, sewing, shopping, gardening, taking care of animals, watering plants, clipping newspapers, collecting coupons, and playing crossword puzzles. Social activities were also frequently
reported including sitting in the park, talking to the phone, playing cards or bingo, visiting friends, and baby-sitting. Activities that were classified as home management was shining shoes, doing laundry, hanging clothes, making beds, washing dishes, ironing clothes, dusting, vacuuming, washing the floor, shopping for groceries, and cutting the grass. Food preparation was any activities related to making a meal for self or for others. Not every subject mentioned self care activities. The self care activities mentioned in the interviews were taking a shower/bath, brushing teeth, washing face, combing hair, shaving, dressing, putting hair rollers, and putting on make up. Only two subjects mentioned exercise including walking, bowling, stretching, curling, and golfing.
Table 3  Physical activities and the number of subjects reported engagement in the following activities.

<table>
<thead>
<tr>
<th>CATEGORIES</th>
<th>NUMBER OF SUBJECTS REPORTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leisure activities</td>
<td>20</td>
</tr>
<tr>
<td>Social activities</td>
<td>16</td>
</tr>
<tr>
<td>Home management</td>
<td>15</td>
</tr>
<tr>
<td>Food Preparation</td>
<td>14</td>
</tr>
<tr>
<td>Self care</td>
<td>11</td>
</tr>
<tr>
<td>Exercise</td>
<td>2</td>
</tr>
</tbody>
</table>

Relationship between dyspnea, physical activity, and fatigue

The relationships between dyspnea, physical activity, and fatigue are illustrated by the scatterplots depicting linear relationships (see Appendix H). Dyspnea, 6MW, and fatigue may relate to each other because of their significant correlations to FEV1. To ensure the relationships that exist between dyspnea, 6MW, and fatigue were not confounded by the influence of FEV1, FEV1 was controlled in the
following analysis. As presented in Table 4, all variables were significantly correlated (p<0.001), dyspnea and fatigue were negatively correlated with (physical activity) and dyspnea was positively correlated with fatigue. Results indicated that the more dyspnea COPD patients felt, the more fatigue experienced, and the shorter the 6MW distance they were able to complete.

Table 4  Summary of correlations between dyspnea, fatigue, and 6MW controlling for FEV1

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>6MW</th>
<th>DYSPNEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>6MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DYSPNEA</td>
<td>-0.82*</td>
<td></td>
</tr>
<tr>
<td>FATIGUE</td>
<td>-0.78*</td>
<td>0.81*</td>
</tr>
</tbody>
</table>

* P<0.0001
Chapter IV
Discussion

According to Lazarus and Folkman (1984), health and energy are among the most important resources for coping. They postulated that a person who is fatigued may have less energy to expend on coping than a healthy, robust person. The extent that COPD patients are fatigued may be related to feelings of dyspnea and ability to perform physical activities. The appraisals of dyspnea and fatigue and the ability to perform physical activity may, in turn, influence how COPD patients cope. Results of this study demonstrated the existence of interrelationships among dyspnea, physical activity, and fatigue. The more dyspnea subjects experienced, the less able they were to perform physical activities as indicated by the 6 MW, and the higher the fatigue reported.

Dyspnea and fatigue are the two most commonly reported symptoms in COPD and they often exist together (Graydon, Ross, et al., 1995; Janson-Bjerklie, et al., 1986; Kinsman et al., 1983). The positive and
significant relationship between dyspnea and fatigue is consistent with previous research reports (Kinsman, et al., 1983; Lee, et al. 1991). The underlying mechanism that explains how dyspnea and fatigue are related remains elusive. Fatigue may be related to dyspnea as a result of an ineffective energy producing mechanism that is unable to meet the energy demands as the cost of breathing increases during dyspnea.

Patients in this study reported different but relatively high mean levels of dyspnea and fatigue. This is also consistent with Lazarus and Folkman’s hypothesis that appraisal is personal and individual. Patients appraise dyspnea and fatigue individually based on the meaning and significance of the symptoms to the person. In this study, dyspnea ranged from 21-97 with a mean of 55.8 (SD=21.24) whereas fatigue ranged from 3-27, with a mean of 15.9 (SD=6.71); FEV1 ranged from 40% to 72%. In comparison, in a study of 76 COPD patients, Alsonso, et al. (1992) reported that their subjects rated dyspnea between 0 and 64, with a mean of 25 (SD=16). The mean dyspnea score and variability in distribution (SD) were lower than those reported in this study.
Although these authors used the VAS to measure dyspnea and recruited a sample whose mean FEV₁ was lower than that of this study, not every subject experienced dyspnea and only males were included. Other research has demonstrated gender differences in the rating of symptoms by people with COPD, with females reporting more symptoms (Leidy & Traver, 1995) and rating dyspnea higher (Janson-Bjerklie, et al., 1986) than males. Females may be more sensitive and attuned to their feelings and symptoms than males. Since the majority of this current study’s sample (68.2%) was female, this may account for the high mean dyspnea score. Although the number of females suffering with COPD is increasing (Statistics Canada, 1993), it was not certain why more females than males were recruited in the sample.

The high levels of fatigue in this study may also be explained by the over-representation of females in the sample and the sample inclusion criteria that specified patients must report fatigue in order to be recruited. In comparison to other research findings, the mean F-POMS score was 10 for 941 COPD participants with mild hypoxemia.
(Prigatano, et al., 1984). Even for COPD patients who were oxygen dependent due to severely impaired lung function with a mean FEV1 of 26%, their mean fatigue score reported was 11.27 (SD=7.02; ranging from 1-26) (Lee, 1988). However, not every one recruited in these studies experienced fatigue.

Dyspnea and physical activity were highly correlated to each other ($r=-0.82$) which is consistent with findings from other studies (Alsonso, et al., 1992). Physical activity may lead to an overall increase in ventilatory demand and recruitment of accessory respiratory muscles (Gift and Pugh, 1993) that may be related to the feeling of dyspnea. As dypsnea increases, physical activity may be limited or avoided. Continued inactivity may result in decreased muscle strength and decreased ability to perform further physical activity.

It is suggested that decreased physical activity may also lead to fatigue due to the disuse and degeneration of the locomotive muscle. To alleviate fatigue, one of the most common strategies reported is the cessation and reduction of physical activities (Gift & Austin, 1992;

Although physical activity was significantly correlated with fatigue in this study, this finding is not consistent with previous studies (Larson, et al., 1996; Thompson, 1989). Thompson (1989) found that fatigue, measured by the POMS, was significantly correlated with the 12 MW distance for a sample of 31 COPD patients ($r=-0.33$; $p<0.05$). After controlling for gender, the previously significant relationship between fatigue and walking distance became nonsignificant. Results did not indicate how gender might have affected the relationship between fatigue and physical activity.

In a study reported by Larson et al. (1996), physical activity as measured by the 12 MW was not related to fatigue. Of the 108 COPD patients recruited, over 70% were male. In contrast to the result of the current study, a significant relationship was found in the sample that was over 68% female. Therefore, the relationship between physical activity
and fatigue may be more specific to females than males among COPD patients. Self-rated physical functioning had been shown to be significantly influenced by fatigue and other symptoms in women but not in men with COPD (Leidy & Traver, 1995). Leidy and Traver (1995) also suggested that walking test may be more specific and useful in evaluating the performance of physical activities in women than in men.

The existence of a relationship between fatigue and physical activity reported in this study should also be discussed in light of certain measurement error. Although the reliability and validity of the six minute walk to measure the ability to perform physical activities in patients suffering with lung diseases has previously been supported, performance could be affected by various factors. These factors may account for measurement error and they are, unfamiliarity with the environment and experiment procedure, anxiety, lack of motivation to perform, misunderstanding of instructions, exacerbation of symptoms, variation of temperature and humidity on the day of data collection, endurance, weight, cardiovascular fitness, and neuromuscular
functioning. For instance, one subject in the current study was only able
to walk a distance of 6.04 m due to anxiety and exacerbation of
dyspnea. In comparison, healthy male athletes (n=115) were able to
complete a distance between 800 m to 1600 m in 6 minutes (Cooper,
1968). The mean 6MW distance for healthy elderly men was 412.7m
(Duncan, Chandler, Studenski, Hughes, & Prescott, 1993). Even
pulmonary patients with a low mean FEV1 of 40.3% (Mak, et al., 1993)
and 49.8% (Alsonso, et al., 1992) were able to manage mean walking
distances of 406 m (SD=149, n=42) and 551.9 m (SD=88.1, n=76)
respectively. However, the majority of the sample in these studies were
males and not all patients in their studies reported dyspnea. Gender
differences in the walking distances among COPD patients have been
reported (Thompson, 1989), with males walking significantly further
than females (p<0.01).

To improve the reliability, Larson and her colleagues (1996)
suggested that the results of the first two walking tests be discarded so
that subjects could familiarize themselves with the test. These authors
observed a total of 13 % improvement in the subjects’ performances from the first to the fourth 12 MW tests. Repeated walking tests allowed the subjects to learn the task and determine a strategy for optimal performance. However, repeated testing was not implemented in this study.

In order to understand what physical activities COPD patients are able to perform on a daily basis, all subjects were interviewed and asked to describe their daily physical activities. However, many subjects found the physical activity question vague and difficult to answer. The question did not specify a particular day for the subjects to describe their activities. Some subjects were unable to think of a typical day to describe their activities. One female subject mentioned:

I don’t know what a typical day is? Every day is slightly different. Well, of course I brush my teeth every day, is that what you mean?

In addition, the level of detail was unclear. The majority of subjects did not include detailed descriptions of their physical locomotive
activities when responding to the physical activity question. Simple activities such as, washing their face, taking a shower, eating, were not consistently mentioned in the interviews. Subjects may only report activities that were satisfying and important to them (Leidy & Haase, 1996). It was possible that some subjects took certain activities for granted and expected the interviewer to understand what they did routinely. As one subject responded:

I don’t know what to tell you? I do what everybody does everyday. Nothing out of ordinary really! I don’t go out a lot, especially in the winter. Now, I like to go for a walk from time to time in the morning! Is that what you are asking? Let’s see, What else do I do? There’s nothing much I can tell you!

Another person said:

I don’t usually do anything in the afternoon. Occasionally I’ll do some shopping with my girl friend.

Activities reported by the subjects were brief, specific, and isolated.
To facilitate recall, prompts were used to elicit more detailed descriptions. Examples of these questions were: What do you do for exercise? Tell me some of the housework you do in the morning? What do you do for fun? Furthermore, some subjects may not have felt comfortable disclosing certain physical activities to the interviewer. Of all the subjects interviewed, for instance, no one reported any sexual activities. Information obtained from the open ended question may not represent patients’ daily activity pattern.

Despite the limitations of the open ended question, the most commonly reported activities from the interviews were leisure, home management and social activities. Activities reported in this study may have been affected by the predominantly unemployed, female sample. These activities may also be more recognizable and specific, thus facilitating recall. Knowing that people do not seek the same type and level of performance, the development of a more structured interview or self-report standardized instrument that is sensitive to individual preferences may be useful in future studies measuring physical activities.
Chapter V

Summary, implications and conclusion

Fatigue is one of the most common symptoms experienced by patients with COPD. However, the understanding of fatigue remains incomplete. Fatigue may be related to various factors including dyspnea and a decreased ability to perform physical activity. However, the literature review indicated inconsistent relationships among dyspnea, physical activity, and fatigue in patients with COPD.

A descriptive correlational design was used in this study to verify the relationships between dyspnea, physical activity, and fatigue. Lazarus and Folkman's (1984) theory of coping was employed for the conceptualization of the research problem. These authors suggested that coping is affected by the appraisal of various available resources including health and energy. When a person feels fatigue, the appraisal of energy available to him or her is low. Among COPD patients, the appraisal of low energy or fatigue may be related to dyspnea and the ability to perform physical activities. COPD patients may decrease
physical activities to avoid dyspnea such that the disuse and eventually degeneration of the muscle may bring about fatigue. Fatigue may lead to more inactivity to preserve energy.

In this study, dyspnea was measured by the vertical visual analogue scale, physical activities by 6MW, and fatigue by the Fatigue subscale of the Profile of the Mood States. To understand the variety of physical activities that COPD patients are able to participate in on a daily basis, each subject was interviewed by the investigator.

Results indicated that dyspnea, physical activity, and fatigue were all significantly interrelated. The higher the dyspnea, the less ability to perform physical activities, and the more fatigue reported. This finding supports the Lazarus and Folkman's (1984) framework that the appraisal of low energy or fatigue is related to dyspnea and physical activities. Information obtained from interviewing the subjects by using the open ended question did not render useful information.


Limitations

Results of this study have implications for nursing practice, theory development, and future research. However, a few limitations should be discussed and the results of this study should be interpreted with caution. First, the study was limited by its statistical power for analysis. This study has insufficient power because the sample used was too small. A low statistical power indicates a high risk of committing error and that the results may be attributable to chance. A larger sample size can increase the power and increase the confidence in the reported findings. Second, the nonprobability convenience sampling method was used. Nonprobability sampling procedure does not assure that each element in the population has the same chance of being included in the sample. The available subjects in this study may not represent the typical population of COPD patients. The sample recruited was characterized by relatively high FEV1 indicating mild lung impairment, predominantly female, and high mean levels of fatigue and dyspnea. Caution should be exercised in generalizing the findings from this
sample to other COPD patients. Third, the inclusion criteria specified that only patients who complained of both fatigue and dyspnea could be recruited. The results obtained from this sample are not generalizable to the entire COPD population. Fourth, the 6 MW was not measured repeatedly; subjects were not allowed to practice the 6MW test. It was discussed that repeated measures may have improved the reliability of 6MW test. Fifth, the use of the open-ended question did not provide comprehensive and useful information about participants’ physical activity pattern.

**Implications for Nursing Practice**

Health and energy are among the most important resources that may affect coping. People who perceive themselves to be healthy and full of energy may cope better than those who are sick and tired. Nurses may help people to cope through a better understanding of how energy is appraised. In COPD patients, the individual differences in their appraisal of fatigue were related to the appraisal of dyspnea and the ability to perform physical activities. The higher the dyspnea, the lower
the ability to perform physical activity, and the higher the fatigue. COPD patients who complain of dyspnea may also be limiting their physical activities and experiencing fatigue. Nurses should be aware that dyspnea may be an indicator of patients’ decreased ability to engage in physical activity and their fatigue. Knowing the existence of possible relationships, nurses caring for COPD patients complaining of dyspnea should also complete an assessment of fatigue and physical activities. Nurses should also help patients to understand the relationship between dyspnea, fatigue and physical activity in order to break the downward spiral of increasing dyspnea, inactivity, and increasing fatigue.

Implications for Theory and Research

Lazarus and Folkman’s (1984) theory of stress and coping was used to provide the conceptualization of this study. Health and energy are among the most important resources available for coping. The evaluation of energy may be related to dyspnea and physical activity among COPD patients. Other factors that may influence coping, besides
energy, should be considered. Some of these factors that are mentioned by Lazarus and Folkman (1984) are anxiety, depression, and social support and the roles these factors play in affecting coping should be explored.

The mechanism that explains how dyspnea, physical activity, and fatigue are related remains elusive due to the circularity of their relationships. COPD patients may avoid dyspnea by decreasing their physical activities such that morphological changes of the muscle as a result of disuse may bring about fatigue. Physical activity may have a mediating effect between dyspnea and fatigue. The examination of the mediating effect of physical activity between dyspnea and fatigue in future studies is recommended in order to unravel the circularity of their relationships. Other recommendations for future research include:

1. replicating this study with a larger sample and patients with various levels of FEV1;

2. examining the gender differences in the relationship between physical activity and fatigue;
3. examining other variables that may influence the relationship between dyspnea and fatigue, such as anxiety, depression, and social support;

4. examining how the reduction of dyspnea may influence physical activity and fatigue;

5. developing a standardized questionnaire to measure the physical activities that COPD patients are able to engage in on a daily basis.

**Conclusion**

In this study, a descriptive correlational design was used to examine how the appraisal of fatigue was related to dyspnea and physical activity among patients with COPD. Fatigue, dyspnea, and physical activity, were all significantly correlated with each other. The higher the dyspnea, the lower was the ability to perform physical activities indicated by the 6 MW, and the higher the fatigue.
References


Lewis, D., & Bell, S. K. (1995). Pulmonary rehabilitation, psycho-
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MacDougall, J. D., Elder, G. C. B., Sale, D.G., Moroz, J. R., & Sutton,
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ratings, respiratory muscle strength, and lung function in
patients with chronic obstructive pulmonary disease. *American
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Effect of arterial oxygen desaturation on six minute walk
distance, perceived effort, and perceived breathlessness in


Appendix A    Introduction

A graduate student in nursing at the University of Toronto, Kevin Woo, is doing a study of people with chronic lung diseases. He is inviting patients who feel fatigued and have difficulty breathing to take part in this study. This study will involve about 45 minute. You will be asked questions about your breathing, fatigue, and usual activities. At the end of the interview, you will be asked to walk up and down the corridor for six minutes.

Would you be willing to have Kevin Woo explain the study to you?
Appendix B   Information Form

Title of the study: Relationship of dyspnea and physical activity to fatigue in patients with chronic obstructive pulmonary disease.

Investigator: Kevin Woo R.N., BScN.

Phone: 337-4776

University of Toronto Supervisor: Jane Graydon R.N., Ph.D
Associate Professor
Faculty of Nursing,
University of Toronto

My name is Kevin Woo. I am a registered nurse and a graduate student in nursing at the University of Toronto. I am presently doing a study to understand why some people with chronic lung diseases may feel fatigued.

Patients who feel fatigued and have difficulty breathing are being invited to take part in this study. The purpose of this study is to explore the relationships between breathing difficulty, physical activities, and fatigue. It is not anticipated that there will be any direct benefits to you from participating in this study. However, results of this study may help us
better care for patients with COPD in the future. This study will be about 45 minutes. You will be asked to respond to two short questionnaires about your breathing difficulties and fatigue. I will then ask you to describe the physical activities that you do on a typical day. Your answer about physical activities will be tape recorded. Afterwards, I will ask you for some personal information such as your age, educational background, and number of years being diagnosed with lung diseases. At the end of the interview, you will be asked to walk up and down the corridor for six minutes. You can walk with your own pace and stop at any time for whatever reasons. I also ask for your permission to get information about your lung function from your medical chart.

All the information obtained will be strictly confidential. You will be identified by number only and your name will not appear on any of the papers. The tape will be destroyed after the study is over. Should you decide to part take in this study you are free to withdraw from the study at any time. In no way will your decision to part take or withdraw from this study affect the care you receive from your physician.
Do you have any questions for me?

Are you willing to take part in the study?
Appendix C  Consent Form

I ____________________ agree to participate in a study conducted by Kevin Woo BScN, RN, who is the graduate student in nursing at the University of Toronto. This study is being conducted under the supervision of Dr. Jane Graydon, Faculty of Nursing, University of Toronto.

I understand that the main purpose of this study is to learn about the relationship between breathing difficulty, physical activities and fatigue in patients with chronic lung disease.

In agreeing to participate in this study, I realize that:

A. I will be asked to respond to questions about my tiredness and breathing difficulties.

B. I will be asked about my usual daily activities.

C. My response to the daily activities question will be tape recorded.

D. I will be asked to walk up and down the corridor for six minutes.

E. I will be asked for some personal information such as my age and educational background.

F. Information about my medical history and pulmonary function tests will be taken from my medical record.
I understand that the interview will take maximally 45 minutes of my time.

I understand that my replies to all questions are strictly confidential. I understand that all the recording tapes will be destroyed after the study is completed. I also understand that I will be identified by a number only. I am aware that I may refuse to answer any questions, or withdraw from the study, at any time for any reason. Should I choose not to participate or decide to withdraw, it will in no way affect the care I receive from my Doctor.

I understand that I may experience discomfort or shortness of breath during the six minute walking test. I understand that I will be instructed to walk at my own pace and to stop or rest at any time for whatever reason.

I understand that if I have any questions or concerns about the study at any time, I can reach Kevin Woo at 337-4776.

Participant signature ______________________________
Witness signature ________________________________
Date ____________________________
Appendix D  Vertical Visual Analogue Scale

Code #_____

How much shortness of breath did you have in the past few days? Please indicate by putting a short line across the column.

shortness of breath
as bad as can be

no shortness of breath
Appendix E  Physical Activity Question

I would like to know more about the physical activities that you do on a day to day basis. Physical activities may include leisure activities, working, cleaning up your home, or taking care of yourself. I am going to ask you a few questions, please take time to respond.

a) Think of a typical day, what do you do in the morning?

b) Think of a typical day, what do you do in the afternoon?

c) Think of a typical day, what do you do in the evening?
Appendix F  Subject Profile

Code Number:  Date:  

Date of birth:  
Gender:  1. Male  2. Female  

When were you first diagnosed with lung disease?

__________________________

What type of lung disease do you have?

__________________________

Do you use oxygen?  1. No  
   2. Yes, continuously  
   3. Yes, night only  
   4. Yes, exercise only  
   5. Other, specify ________
What was the highest level you completed in school?

1. less than high school
2. high school
3. post-secondary certificate/diploma
4. some university/bachelor's degree
5. some post graduate training.

Are you presently working outside the home

1. No
2. Yes, specify:__________

If Yes, are you working

1. Full time
2. Part time

FEV1 level:______________
Appendix G  Detailed physical activities summary

Morning activities:

<table>
<thead>
<tr>
<th>CATEGORIES</th>
<th>PHYSICAL ACTIVITIES</th>
<th>FREQUENCIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>SELF CARE</td>
<td>brushing teeth</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>washing face</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>combing hair</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>taking a shower/bath</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>changing clothes</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>fixing self</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>making bed</td>
<td>9</td>
</tr>
<tr>
<td>FOOD PREPARATION</td>
<td>cooking for self</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>cooking for others</td>
<td>7</td>
</tr>
<tr>
<td>LEISURE ACTIVITIES</td>
<td>reading newspaper</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>listening to radio</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>listening to music</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>watching TV</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>taking care of animals</td>
<td>7</td>
</tr>
<tr>
<td>EXERCISE</td>
<td>stretching</td>
<td>2</td>
</tr>
<tr>
<td>HOME MANAGEMENT</td>
<td>washing dishes</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>doing laundry</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>dusting</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>fixing things in the house</td>
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</tr>
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### Afternoon Activities:

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<th>FREQUENCIES</th>
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</thead>
<tbody>
<tr>
<td><strong>FOOD PREPARATION</strong></td>
<td>cooking lunch for self</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>cooking lunch for others</td>
<td>6</td>
</tr>
<tr>
<td><strong>LEISURE</strong></td>
<td>clipping newspaper</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>playing crossword puzzle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>reading books</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>collecting coupons</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>watching TV</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>gardening</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>watering plants</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>*shopping</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>having a drink</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>sewing</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>doing laundry</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>drying clothes</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>hanging clothes up</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>washing dishes</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>dusting</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>cleaning up</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>fixing up around the house</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>vacuuming</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>cutting grass</td>
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</tr>
<tr>
<td></td>
<td>shopping for groceries</td>
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<tr>
<td></td>
<td>washing floors</td>
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</tr>
<tr>
<td></td>
<td>sweeping floors</td>
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</tr>
<tr>
<td></td>
<td>ironing clothes</td>
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</tr>
<tr>
<td></td>
<td>shinning shoes</td>
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<tr>
<td></td>
<td>washing floors</td>
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<td></td>
<td>making jam</td>
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<td></td>
<td>baking</td>
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<tr>
<td></td>
<td>sitting</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>taking a walk</td>
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<tr>
<td></td>
<td>curling</td>
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<tr>
<td></td>
<td>golfing</td>
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<td><strong>HOME MANAGEMENT</strong></td>
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<td>14</td>
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<td></td>
<td>visiting friends by driving</td>
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<tr>
<td></td>
<td>baby-sitting</td>
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<td>spending time in the park</td>
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<tr>
<td><strong>REST</strong></td>
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<td><strong>EXERCISE</strong></td>
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<td><strong>SOCIAL ACTIVITIES</strong></td>
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Evening activities:

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<th>PHYSICAL ACTIVITIES</th>
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<tr>
<td>FOOD PREPARATION</td>
<td>making supper for self</td>
<td>18</td>
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<tr>
<td></td>
<td>making supper for others</td>
<td>4</td>
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<tr>
<td>HOME MANAGEMENT</td>
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<td>11</td>
</tr>
<tr>
<td></td>
<td>drying dishes</td>
<td>4</td>
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<tr>
<td>SELF CARE</td>
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<tr>
<td></td>
<td>taking a bath</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>putting hair rollers</td>
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<tr>
<td>LEISURE</td>
<td>watching TV</td>
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<tr>
<td></td>
<td>reading</td>
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<tr>
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<td>walking dogs</td>
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<td>going for a sauna</td>
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<tr>
<td></td>
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<tr>
<td></td>
<td>walking</td>
<td>4</td>
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</tbody>
</table>
Appendix H  Scatterplots

Relationship between 6MW and fatigue

Relationship between dyspnea and 6MW
Relationship between dyspnea and fatigue
IMAGE EVALUATION
TEST TARGET (QA-3)

1.0
1.1
1.25
1.4
1.6
2.0
2.2
2.5
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6
4.8
5.0

150mm
6"