

ASSESSMENT OF FATIGUE IN
PATIENTS WITH COPD
PARTICIPATING IN A
PULMONARY REHABILITATION
PROGRAM: A FEASIBILITY
STUDY

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Graduate Studies and Research
in Partial Fulfillment of the Requirements
for the Degree of Master of Nursing
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Saskatoon

By

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Abstract

Fatigue is a distressing, complex, and multidimensional sensation, that is common in individuals with chronic obstructive pulmonary disease (COPD), and impacts negatively on their functioning and quality of life. Limited research has been conducted to examine how various factors may influence the different dimensions of subjective fatigue experienced in these individuals. Four dimensions of subjective fatigue including: emotional, behavioural, cognitive, and physical, were examined in a convenience sample of 42 participants with COPD who attended an outpatient pulmonary rehabilitation program. The primary purpose of this feasibility study was to determine the proportion of individuals experiencing the four dimensions of fatigue, and to examine the relationships between these dimensions of fatigue and various influencing factors (dyspnea, depression, anxiety, sleep quality, activity limitation, heart rate, and oxygen saturation). The secondary purpose was to compare the four dimensions of fatigue by sex, supplemental oxygen use, smoking status, and severity of dyspnea, and to examine the relationships between the four dimensions of fatigue and age, the number of co-morbidities, and the amount of pulmonary rehabilitation received. Self-report questionnaires were used to measure fatigue (Multidimensional Fatigue Inventory – MFI), anxiety and depression (Hospital Anxiety and Depression Scale – HADS), and sleep quality (Pittsburgh Sleep Quality Index – PSQI). Pulmonary rehabilitation health records were accessed to collect data on the remaining variables. The majority of the participants (61.9% - 81.0%) experienced moderate levels of subjective fatigue in all four dimensions. Moderate to severe levels of physical fatigue were experienced in 95.3% of the participants. The only significant relationship was between anxiety and emotional fatigue; all other relationships were statistically insignificant. There were no significant differences between sex, supplemental oxygen use, smoking status, and severity of dyspnea on the four dimensions of subjective fatigue. Many of the participants had probable presence of clinical anxiety (42.9%), where the prevalence of anxiety was nearly twice as high as depression (21.4%). Findings from this study can be used by healthcare professionals to gain a better understanding of fatigue in individuals with COPD who attend pulmonary rehabilitation, and help in developing effective interventions for reducing the distressing effects of fatigue.

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List of Abbreviations

The following is a list of commonly used abbreviations:

ADLs	Activities of daily living
COPD	Chronic obstructive pulmonary disease
FEV ₁	Forced expiratory volume in one second
FVC	Forced vital capacity
HADS	Hospital Anxiety and Depression Scale
LABA	Long-acting beta ₂ -agonist
<i>M</i>	Mean
<i>Md</i>	Mode
<i>Mdn</i>	Median
MFI	Multidimensional Fatigue Inventory
MRC	Medical Research Council
MWT	Minute walk test
<i>N, n</i>	Number of participants
PSQI	Pittsburgh Sleep Quality Index
<i>R</i>	Range
<i>r</i>	Pearson's product moment correlation coefficient
SABA	Short-acting beta ₂ -agonist
<i>SD</i>	Standard deviation
TOUS	Theory of Unpleasant Symptoms

CHAPTER 1

Introduction

1.1 Background and Significance of the Problem

Fatigue is common in individuals with COPD (chronic obstructive pulmonary disease) and has been referred to as the most distressing or one of the most distressing symptoms experienced (Kinsmen, Fernandez, Schocket, Dirks, & Covino, 1983; Theander & Unosson, 2004). Fatigue impacts negatively on functioning (Breslin et al., 1998; Gift & Pugh, 1993) in terms of quality of life, including physical, psychological, social, and cognitive functioning (Theander & Unosson).

Four dimensions of subjective fatigue including: emotional, behavioural, cognitive, and physical, were examined in a group of individuals with COPD who attended an outpatient pulmonary rehabilitation program. The primary purpose of this study was to determine the proportion of individuals experiencing the four dimensions of fatigue, and to examine the relationships between these dimensions of fatigue and various influencing factors (dyspnea, depression, anxiety, sleep quality, activity limitation, heart rate, and oxygen saturation). The secondary purpose was to compare the four dimensions of fatigue by sex, supplemental oxygen use, smoking status, and severity of dyspnea, and to examine the relationships between the four dimensions of fatigue and age, the number of co-morbidities, and the amount of pulmonary rehabilitation received. The study was guided by a conceptual framework that was modified from the Theory of Unpleasant Symptoms (TOUS) (Lenz, Pugh, Milligan, Gift, & Suppe, 1997) to examine the relationships among various dimensions of subjective fatigue and the influencing factors.

1.2 Statement of the Problem

Given the high prevalence of COPD, the high occurrence of fatigue in individuals with COPD, and the significant impact fatigue has on these individuals' quality of life, fatigue in COPD is an important area of focus for COPD research. Much controversy still exists today about the definition, the influencing factors, and the various dimensions of fatigue. Until more

research is conducted on fatigue in individuals with COPD, these gaps in research and knowledge will remain. To the author's knowledge, limited research has been conducted to examine various influencing factors of fatigue and the multidimensionality of fatigue in individuals with COPD. Most of the existing research on fatigue in COPD has focussed on quality of life or functional performance, and only one dimension: intensity of the fatigue. In addition, there are very few Canadian studies (Graydon & Ross, 1995; Graydon, Ross, Webster, Goldstein, & Avendano, 1995; Small & Lamb, 1999; Woo, 2000a; Woo, 2000b) that have examined fatigue in individuals with COPD. More research, however, has been conducted to examine fatigue in other chronic illnesses such as cancer.

1.3 Statement of the Purpose

To narrow the gap in research and knowledge, a feasibility study was conducted. The researcher examined the four dimensions of subjective fatigue (emotional, behavioural, cognitive, and physical) in a group of individuals with COPD who attended pulmonary rehabilitation on an outpatient basis in the Saskatoon Health Region. The primary purpose was to determine the proportion of individuals experiencing the four dimensions of fatigue, and to examine the relationships between each of the four dimensions of subjective fatigue, and some of the factors previously identified in the literature as influencing fatigue. These included: dyspnea, depression, anxiety, sleep quality, activity limitation, heart rate, and oxygen saturation. The secondary purpose was to compare the four dimensions of fatigue by sex, supplemental oxygen use, smoking status, and severity of dyspnea, and to examine the relationships between the four dimensions of fatigue and age, the number of co-morbidities, and the amount of pulmonary rehabilitation received.

1.4 Research Questions

The primary research questions were:

- 1. What proportion of the individuals with COPD receiving pulmonary rehabilitation experienced emotional, behavioural, cognitive, and physical dimensions of subjective fatigue?
- 2. What are the relationships between each of the four dimensions of subjective fatigue and various symptoms (dyspnea, depression, anxiety, sleep quality, activity limitation, heart rate, and oxygen saturation) in these individuals?

The secondary research questions were:

- 1. How do men and women compare on the four dimensions of subjective fatigue?
- 2. How do individuals who use supplemental oxygen and those who do not use supplemental oxygen compare on the four dimensions of subjective fatigue?
- 3. How do ex-smokers, non-smokers, and those who currently smoke compare on the four dimensions of subjective fatigue?
- 4. How do the individuals' severity of dyspnea according to the Medical Research Council (MRC) Dyspnea Scale grades compare on the four dimensions of subjective fatigue?
- 5. What are the relationships between the four dimensions of subjective fatigue and age, the number of co-morbidities, and the amount of pulmonary rehabilitation received?

1.5 Assumptions

Assumptions made in this study included that all participants: answered the questionnaires truthfully, were able to answer the questions, and understood what they are being asked in the questions. The assumption of participants having felt that fatigue was a distressing symptom was based on previous studies. Other assumptions made in this study were that some participants were fatigued due to activities of daily living (ADLs) and exercise, and that some of the fatigue could not be controlled.

1.6 Relevance and Significance

In this study, the factors influencing fatigue in COPD and fatigue itself, which has not been studied in depth, were examined. The study can facilitate a better understanding of the factors influencing fatigue as well as the multidimensionality of fatigue in a group of individuals with COPD who receive pulmonary rehabilitation on an outpatient basis in the Saskatoon Health Region. Guided by the results of this study, the researcher's knowledge translation methods such as providing participants with a summary of the study findings, presenting at conferences, and publishing the study in a scholarly journal, can spread awareness among clinicians, healthcare professionals, researchers, individuals with COPD and their families about the complex nature of fatigue. By building on this study, future studies can help develop effective interventions and

management strategies in reducing the distressing effects of fatigue to help improve the quality of life in individuals with COPD. Examining the relationships of some influencing factors and various dimensions of fatigue was a step towards reducing fatigue in individuals with COPD.

CHAPTER II

Review of the Literature

2.1 The Concept of Fatigue

Fatigue has been defined differently by various disciplines (Piper, 2003). Despite these numerous definitions of fatigue, there is no consensus on its definition (Aaronson et al., 1999; Groopman, 1998; Piper, 2004; Ream & Richardson, 1996), which poses a major challenge in measuring fatigue (Glaus, 1993; Glaus, Crow & Hammond, 1996). For the purpose of this study, Ream and Richardson's (1996) definition of fatigue, which is from the nursing discipline was used. According to Ream and Richardson, "fatigue is a subjective, unpleasant symptom which incorporates total body feelings ranging from tiredness to exhaustion, creating an unrelenting overall condition which interferes with individuals' ability to function to their normal capacity," (p. 527). Other definitions of fatigue range from a subjective perception or sensation (Glaus; Glaus et al.), a "feeling of lack of energy and tiredness not related to muscle weakness" (Colombo et al., 2000, p. 506), the effects on functional performance (Curt, 2000a; Curt, 2000b), an underlying biological nature (Piper, 2003), the descriptions of the origin or cause (Piper, 2003), to a clinical definition such as temporal patterns over time (Piper, Lindsey, & Dodd, 1987). A major factor for the lack of a universal definition is that the underlying mechanisms are unknown (Piper, 2003). Lenz et al. (1997) refer to these underlying mechanisms as influencing factors in the TOUS. Another contributing factor to the lack of a universal definition is the growing consensus that fatigue is a complex, multidimensional sensation (Piper, 2003; Potempa, 1993; Ream & Richardson, 1996). Due to these contributing factors, researchers and clinicians have various views about the signs, symptoms, indicators, outcomes, or effects of fatigue (Winningham et al., 1994).

2.2 Dimensions of Fatigue

There is an emerging consensus that fatigue is multidimensional (Piper, 2003; Potempa, 1993; Ream & Richardson, 1996); however, there is no agreement on what those dimensions may be (Glaus, 1993; Piper, 2003; Winningham et al., 1994). Focusing on the

multidimensionality of fatigue is considered to be important because comprehensive assessment of fatigue will facilitate the development of appropriate interventions and strategies (Piper, 2003). Dimensions commonly cited are: severity (Woo, 2000a; Woo, 2000b;), behavioural, temporal, cognitive, sensory, affective, and physiological (Piper, 2003). The behavioural dimension includes indicators of changes in physical performance, ADLs, or the amount of effort needed to perform physically (Piper, 2003). The affective dimension, also referred to as the emotional or psychological dimensions, includes the emotional effects of fatigue (Piper, 2003). The cognitive dimension, also referred to as mental, consists of indicators of changes in thought or concentration (Piper, 2003). The sensory dimension, also referred to as the physical, general or somatic dimension, consists of signs and symptoms of fatigue including the location and the intensity of the fatigue experienced (Piper, 2003). The temporal dimension, consists of indicators of the timing, pattern, and duration of fatigue (Piper, 2003). Lastly, the physiological dimension includes the underlying mechanisms of fatigue (Piper, 2003).

From the limited research focused on examining the multidimensionality of fatigue in individuals with COPD, a few studies identified the same four dimensions of subjective fatigue (emotional, behavioural, cognitive, and physical), which were examined in this study. The relationship between the four dimensions of subjective fatigue and various influencing factors, such as: pulmonary function (Breslin et al., 1998; Breukink et al., 1998); respiratory and peripheral muscle force, exercise capacity (Breukink et al., 1998); exercise tolerance, depression, and quality of life (Breslin et al., 1998) have been studied. Another study was conducted to examine fatigue in three other dimensions: frequency, intensity, and distress (Gift & Shepard, 1999).

2.3 Measurement of Fatigue

Many instruments have been developed by researchers and clinicians to measure fatigue. Some measure one dimension of fatigue while others are multidimensional. Some of the single-dimensional instruments contain only one item, while others contain multiple items. There has been some criticism that single-item, single-dimensional intensity rating scales are less reliable than multi-item measures (Lee, Hicks, & Nino-Murcia, 1991). However, these single-item, single-dimensional intensity rating scales can be useful in the clinical setting, as they provide a quick method of screening individuals who may need more in-depth fatigue assessments, or when fatigue is required to be assessed frequently (Piper, 2003). Likert-type scales, numerical

rating scales, and visual analogue scales (VAS) are commonly used single-item, single-dimensional scales for fatigue (Piper, 2003). There are numerous multiple-item, single-dimensional fatigue scales available. Some commonly used ones include the Brief Fatigue Inventory (BFI), Profile of Mood States Fatigue Subscale (POMS-F), Profile of Mood States Vigor Subscale (POMS-V), and Multidimensional Assessment of Fatigue (Piper, 2003). More complex fatigue scales are multidimensional, and some commonly cited ones are: Fatigue Impact Scale, Multidimensional Fatigue Inventory (MFI), and Piper Fatigue Scale-Revised (PFS-R) (Piper, 2003). Some of these multidimensional scales are lengthy, and may not be appropriate for individuals with COPD who may be experiencing fatigue. Therefore, choosing which fatigue scale to use for a study with persons with COPD should be considered carefully.

2.4 Factors Associated with Fatigue

Various factors have been found to be associated or predictive of fatigue in various populations. These factors include: age (Piper, 2003), anemia (Breitbart, McDonald, Rosenfeld, Monkman, & Passik, 1998; Mendoza et al., 1999), co-morbidities (Glaus et al., 1996; Loge, Ekeberg, & Kaasa; 1998), weakness and muscle wasting (Burns, 1991; Sliwa, 2000), medications (Piper, 2004), morbidity (Dunbar et al., 1999), mortality (Irvine et al., 1999), ethnicity (Lee, 1999; Lee, 2001), symptom burden and distress (Cimprich & Ronis, 2001; Irvine, Vincent, Graydon, Bubela, & Thompson, 1994), and quality of life (Curt, 2000a; Ream & Richardson, 1997). In addition, there have been conflicting results on the relationship between fatigue and several factors including: disease characteristics (Bakshi et al., 1999; Glaus et al., 1996; Groopman, 1998; Sliwa, 2000), depression and anxiety (Epstein, 1995), sex (Nardini, 1995; Piper, 2003), and socioeconomic status (Ang & Calabrese, 1999; Knobel et al., 2001).

2.5 Fatigue in Persons with COPD

Of the various symptoms individuals with COPD experience (Gift & Pugh, 1993), fatigue has been found to be common and distressing in these individuals (Gift & Shepard, 1999; Graydon & Ross, 1995; Graydon et al., 1995; Janson-Bjerklie, Carrieri, & Hudes, 1986; Kinsman et al., 1983; Theander & Unosson, 2004). COPD has a high prevalence, reported by the Canadian Lung Association (2008, ¶ 21), where 1.5 million Canadians have been diagnosed with COPD. In 2003, COPD was the fourth leading cause of death in Canada (O'Donnell et al., 2008). Furthermore, COPD is continuing to rise and is estimated to be the third leading cause of death in the world by the year 2020 (Canadian Lung Association, ¶ 22). COPD is a chronic lung

disease that is usually caused by smoking and characterized by shortness of breath, increased sputum production, and coughing (Canadian Lung Association, ¶ 1, 3). The effects of fatigue are substantial to the individual with COPD. Fatigue significantly impairs functioning (Breslin et al., 1998; Gift & Pugh, 1993) in terms of quality of life, including physical, psychological, social, and cognitive functioning (Theander & Unosson). As demonstrated, fatigue is a significant problem for individuals with COPD. However, pulmonary rehabilitation has been found to be effective in reducing fatigue and dyspnea according to a meta-analysis conducted by Lacasse, Maltais, and Goldstein (2004).

Fatigue in individuals with COPD is common and has been referred to by these individuals as the worst or one of the worst symptoms experienced. Kinsman et al. (1983) found that over 58% of the individuals had experienced fatigue “almost always” or “always.” In a newer study conducted by Theander and Unosson (2004) comparing fatigue in individuals with COPD with a control group, 47.2% of the individuals with COPD reported experiencing fatigue every day during the previous month. Over half of these individuals (57.2%) experienced fatigue for more than six hours, and 44.4% of these individuals reported that fatigue was either their worst or one of their worst symptoms. Subjective fatigue is negatively related to functional performance in individuals with COPD (Breslin et al., 1998; Graydon & Ross, 1995; Graydon et al., 1995; Reishtein, 2005; Theander & Unosson). Theander and Unosson found that fatigue in individuals with COPD significantly impacted their cognitive, social, and psychosocial functioning. In a qualitative study conducted in Canada, participants with COPD described fatigue as a feeling of general tiredness that occurred every day and affected their social, physical and emotional functioning (Small & Lamb, 1999). In another qualitative study using a phenomenological approach, participants with COPD and cancer described fatigue as being exhausted and drained in energy which affected their daily activities, social and working life (Ream & Richardson, 1997). These participants’ fatigue created frustration and loss of control in their lives (Ream & Richardson, 1997). In a study conducted by Kapella, Larson, Patel, Covey, and Berry (2006), fatigue, dyspnea, airflow obstruction, and anxiety accounted for 36% of the variance in functional performance.

Fatigue is often related to dyspnea (Janson-Bjerklie et al., 1986; Kapella et al., 2006; Kinsman et al., 1983; Reishtein, 2005). Dyspnea was found to have a strong relationship with fatigue in two studies, one conducted by Kinsman et al. ($r = 0.76$), and the other study conducted

by Kapella et al. ($r = 0.74$). In another study, dyspnea was found to have a moderate relationship with fatigue ($r = 0.43$) (Reishtein). Janson-Bjerklie et al. found that dyspnea was related to fatigue to the extent that 45% of the subjects described their dyspnea as fatigue.

Fatigue is also related to other problems reported by individuals with COPD, such as depression, anxiety, sleep quality (Gift & Shepard, 1999; Kapella et al., 2006; Reishtein, 2005), and negative mood (Small & Graydon, 1992). Kapella et al. observed that dyspnea, depression, and sleep quality accounted for 42% of the variance in subjective fatigue. Similarly, Small and Graydon (1992) found that fatigue was related to negative mood, where fatigue explained 28% of the variance in negative mood. Reishtein observed a weak relationship between sleep quality and fatigue ($r = 0.19$). Gift and Shepard found that a moderate relationship existed between psychological factors and fatigue ($r = 0.59$).

A Canadian pilot study conducted by Woo (2000a) examined the relationships between dyspnea, physical activity, and fatigue in patients with COPD. Dyspnea, physical activity, and fatigue were found to be all significantly inter-related. Since this was a pilot study, results cannot be generalized because of its small sample size ($N = 15$) and use of convenience sampling. In addition, this study examined fatigue in only one dimension: intensity. In another Canadian study also conducted by Woo (2000b), the mediating effects of physical activity between dyspnea and fatigue in patients with COPD were examined. A larger sample size of 39 patients was obtained; however, a similar limitation is the use of convenience sampling. After controlling for age and FEV₁ (forced expiratory volume in one second), Woo (2000b) found that dyspnea, physical activity, and fatigue were all inter-related. Further analysis suggested that physical activity acted as a mediator between dyspnea and fatigue. This study examined fatigue in terms of the intensity dimension.

From the limited literature available which examines the multidimensionality of fatigue in individuals with COPD, Breukink et al. (1998) measured: FEV₁, vital capacity (VC), maximal inspiratory peak pressure (P_{imax}), symptom-limited bicycle exercise capacity (maximum workload), and maximal voluntary isometric muscle force of several muscles. These researchers found a negative relationship between two dimensions of the Multidimensional Fatigue Inventory (MFI): reduced activity and FEV₁ ($r = -0.62$), and motivation and FEV₁ ($r = -0.55$). No relationship was observed between any of the dimensions of fatigue and maximum workload. In addition, the physical fatigue dimension was related to the majority of the muscle forces

measured. Based on the results, the authors claimed that in individuals with COPD, the activity and physical dimensions of subjective fatigue were related to pulmonary function and skeletal muscle force. A limitation of this study was the small sample size ($N = 19$), where the generalizability of the findings from the study can be decreased.

In another study that examined the multidimensionality of fatigue in individuals with COPD, Breslin et al. (1998) also used the MFI. These researchers measured: pulmonary function, exercise tolerance, depression, and quality of life in individuals with COPD. The general fatigue dimension of the MFI was related to FEV₁ ($r = -0.32$), exercise tolerance ($r = -0.55$), depression ($r = 0.44$), and overall quality of life ($r = 0.75$). Depression was also related to another dimension of the MFI: mental fatigue. The physical dimension of the MFI was related to increased pulmonary impairment and reduced exercise tolerance. The cognitive dimension was not observed to be highly related to the physical dimension of quality of life. In addition, all five dimensions of fatigue in the MFI were found to be related to overall impairment in quality of life. This study conducted by Breslin et al. had a small sample size ($N = 41$) and used convenience sampling; however, the samples were drawn from two different countries (United States and Netherlands). The authors claimed that the dimensions of fatigue were related to pulmonary function, exercise tolerance, and quality of life.

A study conducted by Gift and Shepard (1999) examined fatigue in the following dimensions: frequency, intensity, and distress, which are outlined in the TOUS. Women and men both experienced a moderate level of fatigue and no significant differences were observed. However, there were differences in all three dimensions of fatigue between the two genders. Other symptoms frequently reported included dyspnea and cough. Both genders were similar in psychological symptoms with the exception of anxiety which was higher in women. The predictors of fatigue in both genders included dyspnea and physical symptoms, which predicted 42% of the variance.

2.6 Fatigue in Other Illnesses

Fatigue has been studied more extensively in cancer and other chronic illnesses such as heart failure, Human Immunodeficiency Virus (HIV), and rheumatoid arthritis. This related literature is explored briefly in this section. Krishnasamy (1997, 2000) explored the nature and impact of fatigue in advanced cancer in a qualitative study. This study found that the fatigue experienced by the participants was unpredictable, overwhelming, brought feelings of

helplessness and hopelessness. A study conducted by Blesch et al. (1991) examined fatigue and its correlates in individuals with breast and lung cancer. Fatigue was significantly related to level of pain and scores on the Profile of Mood States (POMS). A limitation of this study was its small sample size ($N = 77$) and use of convenience sampling, which limits the generalizability of the findings.

Friedman and King (1995) examined the amount of variance in fatigue accounted for by psychological factors and physical symptoms in older women with heart failure at two different time periods. Fatigue occurred frequently at both time periods. Physical symptoms contributed to the variance in fatigue at both time periods, whereas psychological factors did not. The physical symptoms which contributed uniquely to the variance in fatigue included: sleep difficulties, chest pain, weakness, and dyspnea.

In a study that examined fatigue in women with HIV, Lee, Portillo, and Miramontes (1999) found that morning fatigue was related to wake episodes during the night, napping, and perception of sleep disturbance during the past week. Furthermore, Lee et al. discovered that a predictor of the severity of fatigue experienced the next evening was the number of awakenings during the first night. Although Lee et al. used a larger sample size ($N = 100$), they used convenience sampling.

Belza, Henke, Yelin, Epstein, and Gilliss (1993) examined the prevalence of fatigue, and identified correlates of fatigue in a group of older adults with rheumatoid arthritis. The prevalence of fatigue was high, remained constant, and affected some ADLs. In addition, Belza et al. observed that pain rating, functional status, sleep quality, the female gender, co-morbidities, and duration of disease explained a significant amount of variance in fatigue. In another study comparing fatigue in healthy individuals and individuals with rheumatoid arthritis, Belza (1995) also examined the relationships between fatigue and variables including: pain, sleep, functional status, depressive symptoms, and disease activity. Fatigue was higher in individuals with rheumatoid arthritis compared to the healthy individuals. Fatigue was strongly related to poor sleep, functional disability, greater pain, more depressive symptoms, and lower hematocrit (Hct). The sample size in this study was not small ($N = 97$); however, convenience sampling was used.

2.7 Pulmonary Rehabilitation in Persons with COPD

Pulmonary rehabilitation should be encouraged in clinically stable COPD patients who although are receiving medications to help manage their COPD, remain dyspneic and limited in their exercise capacity (O'Donnell et al., 2008). The effects of pulmonary rehabilitation are beneficial, where patients experience improved exercise capacity, increased quality of life, decreased risk of hospitalizations after an acute exacerbation of COPD (O'Donnell et al., 2008), reduced dyspnea (Lacasse et al., 2004; O'Donnell et al., 2008), and reduced fatigue (Lacasse et al.).

2.8 Psychometric Evaluation of Instruments

There are valid and reliable instruments designed to measure various dimensions of fatigue, as well as the influencing factors that were examined in this study. Validity and reliability of instruments including the: Multidimensional Fatigue Inventory (MFI), MRC Dyspnea Scale, six-minute walk test (6MWT), Hospital Anxiety and Depression Scale (HADS), and Pittsburgh Sleep Quality Index (PSQI) are discussed in the following section.

2.8.1 Fatigue

The MFI was developed by Smets, Garssen, Bonke, and de Haes (1995). The MFI has been tested for its psychometric properties by the developers of the instrument in cancer patients, patients with chronic fatigue syndrome, psychology students, medical students, army recruits, and junior physicians. In another study, Smets, Barssen, Cull, and de Haes (1996) further evaluated the psychometric properties of the MFI in cancer patients. All authors found that the MFI had good internal consistency, with an average Cronbach's alpha of 0.84 in the first study (Smets et al., 1995), and a Cronbach's alpha between 0.79 and 0.93 (Smets et al., 1996) in the second study. The MFI had good construct validity where results showed significant differences between groups of subjects for all subscales (Smets et al., 1995). Significant correlations between the MFI and ADLs, anxiety, and depression scores, also demonstrated satisfactory construct validity (Smets et al., 1996). Convergent validity was satisfactory and results demonstrated correlation with a visual analogue scale (VAS) (Smets et al., 1995; Smets et al., 1996) ($r = 0.23 - 0.77$), and with the Rotterdam Symptom Checklist ($r = 0.54 - 0.83$) (Smets et al., 1996). The MFI is also available in over 10 languages (Smets et al., 1995). The MFI has been used in various clinical populations, including lung disorders, and in the healthy population (Smets et al., 1995).

Similar validity and reliability results for the MFI were found in one study by Hagelin, Wengstrom, Runesdotter, and Furst (2007), and in another study by Gentile, Delaroziere, Sambuc, and San Marco (2003). The psychometric properties of the Swedish version of the MFI was tested in four populations: palliative care patients, cancer patients, non-cancer outpatients, and hospital staff (Hagelin et al.), and the psychometric properties of the French version of the MFI was evaluated in thyroid patients and patients from a fatigue centre (Gentile et al.). Similar to Smets et al. (1995, 1996), Hagelin et al. and Gentile et al. also found that the MFI was a valid and reliable instrument for measuring fatigue. Few participants omitted items in the MFI (Gentile et al.; Hagelin et al.) which led Hagelin et al. to believe that the acceptability was high. Convergent validity was good as demonstrated from the high correlation between the scores of all the subscales in the MFI and the Category Ratio instrument (CR-10) ($r = 0.37 - 0.74$) (Hagelin et al.), and the high correlation between the MFI and a VAS (Gentile et al.). Cronbach's alpha for the MFI ranged between 0.67 and 0.94 (Hagelin et al.), and between 0.68 and 0.93 (Gentile et al.), showing good internal consistency. In addition, the MFI had good internal consistency as shown by the inter-item correlation coefficients ($r = 0.21 - 0.90$) (Hagelin et al.). In the participants who were followed one month after the start of the study, the reproducibility and sensitivity to change demonstrated satisfactory results (Gentile et al.).

2.8.2 Dyspnea

The MRC Dyspnea Scale was developed to measure the effect of breathlessness on performing daily activities (Fletcher, 1960). A study conducted by Bestall et al. (1999) examined the validity of the MRC Dyspnea scale in COPD patients. Various assessments were used to determine whether there were significant correlations between the grades obtained in the MRC Dyspnea Scale and these assessments. Significant correlations were found between the MRC Dyspnea Scale grades and the shuttle walking test, the St. George's Respiratory Questionnaire (SGRQ), the Chronic Respiratory Questionnaire (CRQ), and the Nottingham Extended Activities of Daily Living (EADL). Bestall et al. (1999) concluded that the MRC Dyspnea Scale was a valid and simple tool to use in COPD patients. High inter-rater reliability has been found in the MRC Dyspnea Scale where the Cohen's kappa value was 0.92 (Mahler & Wells, 1988). Various studies have been conducted to examine the concurrent validity of the MRC Dyspnea Scale and has been found to be satisfactory in individuals with respiratory conditions (Darbee & Ohtake, 2006). The grades on the MRC Dyspnea Scale correlated with other dyspnea measurement tools

such as the Oxygen Cost Diagram ($r = -0.53$) and the Baseline Dyspnea Index ($r = -0.70$) in asthma patients (Mahler & Wells), and the SGRQ ($r = 0.53 - 0.70$) in COPD patients (Hajiro, Nishimura, Tsukino, Ikeda & Oga, 2000). The MRC Dyspnea Scale grades correlated with PFTs (pulmonary function tests) such as forced vital capacity (FVC) ($r = -0.28$) (Guyatt, Townsend, Keller, Singer, & Nogradi, 1989) in COPD patients, and with the 6MWT ($r = -0.52$) (Mak, Bugler, Roberts, & Spiro, 1993). In addition, in patients with moderately severe COPD, the MRC Dyspnea Scale grades reduced after receiving six weeks of pulmonary rehabilitation, which was found to be both clinically and statistically significant (Lorenzi et al., 2004).

2.8.3 Activity Limitation

The 6MWT is a useful test for measuring functional exercise for daily physical activities (American Thoracic Society, 2002). Exploring the possibility of shortening the 12MWT to a 6MWT was performed by Butland, Pang, Gross, Woodcock and Geddes (1982). Various studies have examined the reliability and validity of the 6MWT not only in COPD patients, but also in pediatric patients, surgical patients, patients with heart failure, patients with pacemakers, and peripheral arterial disease patients (Solway, Brookes, Lacasse, & Thomas, 2001). Several studies have found the 6MWT to have satisfactory construct and concurrent validity. In COPD patients and patients with severe asthma, the 6MWT correlated with several lung diffusion tests and pulmonary function tests ($r = 0.48 - 0.63$) (Mak, Bugler, Roberts, & Spiro, 1993). In this study, the 6MWT also correlated with the MRC Dyspnea Scale ($r = -0.52$) (Mak et al.). Similarly, in a study conducted by Wijkstra et al. (1994) which studied adults with COPD, the 6MWT correlated with several lung diffusion tests and pulmonary function tests ($r = 0.50 - 0.62$). The 6MWT also correlated with the Borg scale ($r = -0.41$) (Wijkstra et al., 1994). A study conducted by Bernstein et al. (1994) which examined elderly men with moderate COPD, found that the distance walked in the 2MWT, 4MWT, 6MWT, and 12MWT correlated with maximal oxygen consumption ($r = 0.45, 0.48, 0.51, \text{ and } 0.49$, respectively). Bernstein et al. (1994) also found that the 2MWT, 4MWT, 6MWT, and 12MWT correlated with maximal carbon dioxide elimination ($r = 0.35, 0.36, 0.40, \text{ and } 0.38$, respectively). More reliability evaluation of the 6MWT can be found in studies examining other clinical populations.

2.8.4 Depression and Anxiety

The HADS was developed by Zigmond and Snaith (1983). The psychometric properties of the HADS have been evaluated in various clinical populations including psychiatric patients

(Bramley, Easton, Morley, & Snaith, 1988), cancer patients (Moorey et al., 1991), and patients with physical illnesses (Aylard, Gooding, & McKenna, 1987). The HADS has been found to have good internal consistency (Zigmond & Snaith) with a Cronbach's alpha of 0.93 for the anxiety subscale, and 0.90 for the depression subscale (Moorey et al., 1991). In addition, the HADS has been used in studies involving: general medicine outpatients (Soderstrom & Grimm, 2004), individuals with chronic illnesses (Payne, 1992), and individuals with cardiac conditions (Soderstrom & Grimm). Zigmond and Snaith reported the internal consistency of the two subscales with the item-to-subscale reliability ($r = 0.41 - 0.76$ for the anxiety items, and $r = 0.30 - 0.60$ for the depression items). The subscales and psychiatric ratings correlated ($r = 0.74$ for anxiety and 0.70 for depression) demonstrating that the subscales could be used as indicators of anxiety and depression. In a review of the psychometric properties available for the HADS by Herrmann (1997), the HADS is a reliable and valid instrument for measuring depression and anxiety in clinical populations. The HADS has been validated in various languages in different populations, and is generally well accepted by the subjects (Herrmann). In a new update on the validity of the HADS, a common conclusion from 747 studies was that "the HADS was found to perform well in assessing severity and caseness of anxiety disorders and depression in both somatic, and psychiatric and primary care patients and the general population" (Bjelland, Dahl, Haug & Neckelmann, 2002, p. 69).

2.8.5 Sleep Quality

The PSQI was developed by Buysse, Reynolds, Monk, Berman, and Kupfer (1989). Reliability and validity were evaluated for the PSQI by its developers in a study with different clinical populations including individuals with major depressive disorders, individuals diagnosed with either Disorder of Initiating and Maintaining Sleep (DIMS) or Disorder of Excessive Somnolence (DOES), and healthy controls (Buysse et al.). The subjects found the PSQI easy to understand and use. Cronbach's alpha for all seven components of the PSQI in this study was 0.83, demonstrating a high internal consistency. High test-retest reliability of the overall PSQI showed a correlation of 0.85. To assess validity, PSQI scores were compared between the healthy controls, the individuals with major depressive disorders, and the individuals with the sleep disorders. The PSQI scores in individuals with the major depressive disorders and the individuals with the sleep disorders were distinguishable from the healthy controls. In addition, concurrent validity was demonstrated through polysomnographic findings. The PSQI is available

in several different languages (Smyth, 2008). A study by Carpenter & Andrykowski (1998) examined the psychometric properties of the PSQI in four clinical populations including: bone marrow transplant patients, renal transplant patients, women with breast cancer, and women with benign breast problems. Good internal consistency was found across all groups of subjects, where the global Cronbach's alpha was 0.80. The global PSQI scores and component scores were correlated ($r = 0.42 - 0.83$). Construct validity was evaluated in terms of convergent and discriminant validity as demonstrated by the consistent correlations with both related and unrelated constructs across all groups of subjects.

2.9 Summary

There is no consensus on the definition of fatigue due to debate on the various dimensions of fatigue and its associated underlying mechanisms or influencing factors. Researchers in a few studies found that fatigue was either the most distressing or one of the most distressing symptoms experienced in COPD (Kinsman et al., 1983; Theander & Unosson, 2004). In addition, in various studies, subjective fatigue was found to be negatively related to functional performance in individuals with COPD (Breslin et al., 1998; Graydon & Ross, 1995; Graydon et al., 1995; Kapella et al., 2006; Ream & Richardson, 1997; Reishtein, 2005; Small & Lamb, 1999; Theander & Unosson). Fatigue is often related to dyspnea and other problems reported by individuals with COPD, such as depression, anxiety, and sleep quality (Gift & Shepard, 1999; Graydon & Ross; Janson-Bjerklie et al., 1986; Kapella et al.; Kinsman et al., 1983; Reishtein). Two Canadian studies, conducted by Woo (2000a; 2000b) found that fatigue was related to physical activity and dyspnea. These two studies conducted by Woo examined just one dimension of fatigue: intensity. Limited research has been conducted to examine different influencing factors of fatigue and the multidimensionality of fatigue in individuals with COPD. However, fatigue has been studied more extensively in other chronic illnesses. As explored in this review of the literature, there are several advantages to pulmonary rehabilitation. There are also valid and reliable instruments available to measure the different variables of interest that were examined in this study.

2.10 Gaps in the Research

Limited research has been conducted to examine various influencing factors of fatigue and the multidimensionality of fatigue in individuals with COPD. This study was different from the studies in the review of the literature which examined the multidimensionality of fatigue in

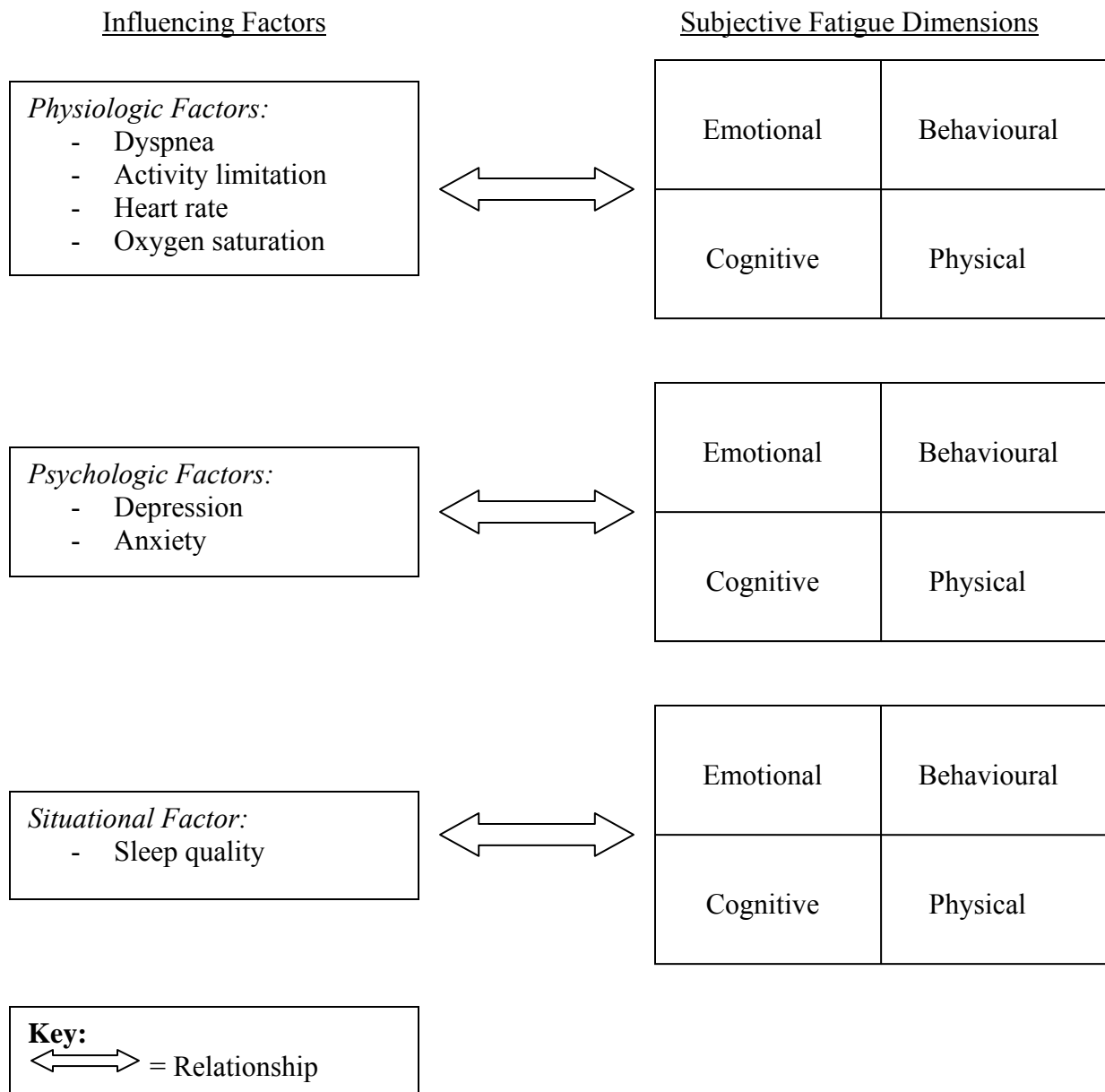
individuals with COPD, in that dyspnea, anxiety, sleep quality, heart rate, and oxygen saturation were studied. Most of the existing research on fatigue in COPD have focused on quality of life or functional performance, and only one dimension of fatigue: intensity. In addition, there are very few Canadian studies that have examined fatigue in individuals with COPD.

CHAPTER III

Conceptual Framework

The conceptual framework that was used to guide this study in examining the relationships among various dimensions of subjective fatigue and influencing factors of fatigue was modified from the Theory of Unpleasant Symptoms (TOUS), developed by Lenz, Pugh, Milligan, Gift, and Suppe in 1995, and later revised in 1997. The influencing factors of the symptom experience in this theory are categorized into three factors: physiologic, psychologic, and situational (Lenz et al., 1997). According to TOUS, physiologic factors include pathology, trauma, and individuals' level of energy (Lenz et al.). Psychologic factors include individuals' mental state or mood, affective reaction to illness, and the level of uncertainty about their symptoms experienced and the possible meaning (Lenz et al.). Situational factors include social and physical aspects of the environment that may affect the individuals' experience of the symptoms (Lenz et al.).

In this study, the symptom being examined according to this theory was subjective fatigue. A modified framework for the proposed study was developed by the researcher which conceptualized subjective fatigue in four dimensions: emotional, behavioural, cognitive and physical. The influencing factors of fatigue were the three factors conceptualized in TOUS that were examined, which included: physiologic, psychologic, and situational. Under the physiologic factors were: dyspnea, activity limitation, heart rate, and oxygen saturation. Within the psychologic factors were depression and anxiety, and under the situational factors was sleep quality. The relationships between each of these influencing factors with each of the subjective fatigue dimensions was examined in this study. A diagram of this modified conceptual framework is displayed in Figure 3.1.



Adapted from the Theory of Unpleasant Symptoms (Lenz, Pugh, Milligan, Gift & Suppe, 1997).

Figure 3.1. Conceptual Framework Displaying the Relationships among Various Dimensions of Subjective Fatigue and Influencing Factors of Fatigue

3.1 Definitions of Research Variables

The variables that were examined in this study, including the conceptual and operational definitions are discussed in the next section. More detailed discussion on the instruments that were used to measure the variables are discussed in the methods and procedures section.

3.1.1 Subjective Fatigue

Conceptual definition. Fatigue was defined as “a subjective, unpleasant symptom which incorporates total body feelings ranging from tiredness to exhaustion, creating an unrelenting overall condition which interferes with individuals’ ability to function to their normal capacity,” (Ream & Richardson, 1996, p. 527).

Operational definition. Subjective fatigue was measured using the MFI, which was distributed to the participants. The dimensions that were measured in the MFI included: emotional, behavioural, cognitive, and physical. The emotional dimension included the emotional effects of fatigue (Piper, 2003). The behavioural dimension was comprised of indicators of changes in physical performance, ADLs, or the amount of effort to perform physically (Piper, 2003). The cognitive dimension consisted of indicators of changes in thought or concentration (Piper, 2003). The physical dimension included the signs and symptoms of fatigue, and the intensity of the fatigue experienced (Piper, 2003). Piper (2003) noted that another term for the physical dimension is general fatigue.

3.1.2 Physiologic Factor – Dyspnea

Conceptual definition. Dyspnea was defined as difficult or laboured breathing (Gift & Pugh, 1993), or the symptom of shortness of breath (Scott, 2004). Dyspnea may arise during exercise or at rest in acute and chronic diseases (Scott).

Operational definition. Dyspnea was measured using the MRC Dyspnea Scale. The most recent grade obtained from the MRC Dyspnea Scale was found in the participants’ pulmonary rehabilitation health records and were recorded on a chart abstraction sheet by the researcher. The MRC Dyspnea Scale grades were recorded in the chart at various assessment time intervals which included: preliminary, three months, six months, and 12 months, in an interview format by the pulmonary rehabilitation staff.

3.1.3 Physiologic Factor – Activity Limitation

Conceptual definition. Activity limitation was defined as the participants’ ability to engage in activity.

Operational definition. Activity limitation was measured using the six-minute walk test (6MWT). The most recent distance participants had walked in the 6MWT were found in the participants' pulmonary rehabilitation health records. The distances from the 6MWT for participants were recorded on a chart abstraction sheet by the researcher. The distances were recorded in the health record at various assessment time intervals which included: preliminary, three months, six months, and 12 months, in an interview format by the pulmonary rehabilitation staff.

3.1.4 Physiologic Factor – Heart Rate

Conceptual definition. Heart rate was defined as the number of contractions of the heart muscle (heart beats) per unit of time.

Operational definition. Heart rate was measured by the number of heart beats per minute, which was measured by either the participant or the pulmonary rehabilitation staff, and recorded in his or her pulmonary rehabilitation health record.

3.1.5 Physiologic Factor – Oxygen Saturation

Conceptual definition. Oxygen saturation was defined as “the amount of oxygen bound to hemoglobin in the blood, expressed as a percentage of the maximal binding capacity” (O’Toole, 1997, p. 1443).

Operational definition. Oxygen saturation was measured with pulse oximetry, which was measured by either the participant or the pulmonary rehabilitation staff, and recorded in his or her pulmonary rehabilitation health record.

3.1.6 Psychologic Factor – Depression and Anxiety

Conceptual definitions. Depression was defined as feelings of sadness that were persistent and interfered with normal daily functioning (National Institute of Mental Health, 2008, ¶ 1). Anxiety was defined as excessive dread of situations that interfered with normal daily functioning (National Institute of Mental Health, 2008, ¶ 1).

Operational definitions. Depression and anxiety were measured using the Hospital Anxiety and Depression Scale (HADS), which was distributed to the participants.

3.1.7 Situational Factor – Sleep Quality

Conceptual definition. Sleep quality was defined subjectively by the participants as the quality of sleep experienced.

Operational definition. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), which was distributed to the participants.

3.1.8 Extraneous Variable – Smoking Status

Conceptual definition. Smoking status was defined by whether an individual smoked, did not smoke, or used to smoke in the past.

Operational definition. Data on smoking status was gathered from each participant's pulmonary rehabilitation health record and recorded on a chart abstraction sheet by the researcher. Smoking status was classified as: non-smoker, currently smoking, or ex-smoker. The data for smoking status was recorded in the health record during the preliminary assessment in an interview format by the pulmonary rehabilitation staff.

3.1.9 Extraneous Variable – Amount of Pulmonary Rehabilitation Received

Conceptual definition. The amount of pulmonary rehabilitation received was defined as the length of time a participant had attended pulmonary rehabilitation.

Operational definition. Data on the initial assessment date which were recorded on the preliminary assessment by the pulmonary rehabilitation staff, were gathered from each participant's pulmonary rehabilitation health record and recorded on a chart abstraction sheet by the researcher. The date of the first day a participant began attending pulmonary rehabilitation was recorded by day, month, and year.

3.1.10 Extraneous Variable – Age

Conceptual definition. Age was defined by the length of time in years a participant has existed.

Operational definition. Data on age was gathered from each participant's completed demographic form. Participants recorded the number of years from their date of birth.

3.1.11 Extraneous Variable – Sex

Conceptual definition. Sex was defined as how each participant referred to himself or herself as either male or female.

Operational definition. Data on sex was gathered from each participant's completed demographic form. Participants recorded how they referred to himself or herself as either male or female.

3.1.12 Extraneous Variable – Co-morbidities

Conceptual definition. Co-morbidities were defined as any co-existing disease states (O'Toole, 1997).

Operational definition. Data on co-morbidities, excluding the diagnosis of COPD, were gathered from each participant's pulmonary rehabilitation health record and recorded on a chart abstraction sheet by the researcher. Co-morbidities were recorded in the health record as medical history during the preliminary assessment in an interview format by the pulmonary rehabilitation staff. The number of co-morbidities was recorded.

3.1.13 Extraneous Variable – Supplemental Oxygen Use

Conceptual definition. Supplemental oxygen use was defined as receiving any form of supplemental oxygen.

Operational definition. Data on supplemental oxygen use was gathered from each participant's pulmonary rehabilitation health record and recorded on a chart abstraction sheet by the researcher. Supplemental oxygen use was classified as used supplemental oxygen, or did not use supplemental oxygen. Supplemental oxygen use was recorded in the health record during the preliminary assessment in an interview format by the pulmonary rehabilitation staff.

CHAPTER IV

Methods and Procedures

4.1 Research Design

Since limited research has been conducted to examine various influencing factors of fatigue and the multidimensionality of fatigue in individuals with COPD, a feasibility study was chosen. A feasibility study can help evaluate whether the selected instruments and other aspects of the methods and procedures used in the study were appropriate for studying fatigue in individuals receiving pulmonary rehabilitation. The reviewed literature that was conducted to examine influencing factors of subjective fatigue in individuals with COPD have used descriptive, cross-sectional designs.

4.2 Setting

This study was conducted in pulmonary rehabilitation facilities (Confederation Mall and the Field House locations) in the city of Saskatoon, Canada. The self-report questionnaires, which were distributed by the researcher, were completed by the participants on a one-to-one basis with the researcher during their pulmonary rehabilitation sessions.

4.3 Population and Sample

The target population consisted of individuals with COPD receiving pulmonary rehabilitation in Saskatoon. Inclusion criteria included participants who: (a) had a confirmed diagnosis of COPD by a physician, (b) attended pulmonary rehabilitation in Saskatoon, (c) resided in Saskatchewan, (d) were able to read, write, understand, and communicate in English, and (e) were adults who were 18 years of age and older.

Convenience sampling method was used because of its feasibility. It is, however, important to note that controlling for bias is difficult when using convenience sampling, and is considered a weak approach to sampling (Burns & Grove, 2005). Since limited research has been conducted in this area, convenience sampling was believed to be appropriate. Future studies can build on this study and utilize other sampling methods to reduce bias, such as random sampling.

A sample size between 36 and 62 participants was determined by a sample size calculation with a standard power of 80%, r between 0.45 and 0.35, respectively, and a two-tailed test with an alpha of 0.05 (Hulley et al., 2001). In another sample size calculation, a sample size between 48 and 82 participants was determined with a power of 90%, r between 0.45 and 0.35, respectively, and a two-tailed test with an alpha of 0.05 (Hulley et al., 2001). Correlational analysis was used to calculate these sample sizes, which were based on the MFI. These calculations were based on a study conducted by Breslin et al. (1998).

4.4 Ethical Considerations

Prior to the start of the study, a meeting with the Saskatoon Health Region's pulmonary rehabilitation coordinator and manager was arranged to discuss the details of the study. The research proposal was submitted for approval to the University of Saskatchewan Behavioural Research Ethics Board, and approval was received on October 9, 2008 (Appendix A). Application was then made to the Saskatoon Health Region's Ethics Board for operational approval, and approval was obtained on October 17, 2008 (Appendix B). During the process of participant recruitment, the researcher ensured that the participants understood the information contained in the brochure and consent form (Appendix C and D). Participants' names did not appear on any of the questionnaires, demographic forms (Appendix E), or chart abstraction sheets (Appendix F) except for the consent forms and the Request for Results from Research Study forms (Appendix G). Each participant had a unique identification number on all questionnaires, demographic form, and chart abstraction sheet, which helped the researcher keep track of the completed forms. The consent forms, Master List of Participants and Associating Unique Identification Numbers (Appendix H), and the Request for Results from Research Study forms were stored separately from other information collected, so that it was not possible to associate a name with any information. The data collected was entered into the computer with only the participants' unique identification numbers. Prior to using the MFI and PSQI, the researcher contacted the developers of the instruments to ask for permission to use their instrument. Written permission to use the MFI was received from Dr. Smets (Appendix I). Similarly, written permission to use the PSQI was received from Dr. Buysse (Appendix J). The HADS was purchased online from GL Assessment which holds the copyright for the instrument.

4.5 Instruments

4.5.1 Fatigue

The MFI was used to measure subjective fatigue (Appendix K). The MFI was distributed to the participants by the researcher during the pulmonary rehabilitation sessions. The MFI has a total of 20 items, where the five subscales, each with four items, measure various dimensions of fatigue including: general fatigue, physical fatigue, reduced activity, reduced motivation, and mental fatigue. Participants rate their fatigue experienced during the past few days. Each item is rated on a scale from 1 to 5. A value of one indicated ‘yes, that is true’ and a value of five indicated ‘no, that is not true.’ When scoring, some of the items need to be recoded in reverse according to the scoring instructions. A total score is calculated for each subscale by adding the scores of the items in each subscale. Scores can range between 4 and 20, where a higher score indicated more fatigue. Smets et al. (1995) noted that calculating an overall score of the 20 items was not recommended. The data collected from the MFI was ordinal-level data, and relate to the four dimensions of fatigue that were examined in this study: emotional, behavioural, cognitive, and physical.

As discussed in the review of the literature, the MFI has been found to be a valid and reliable instrument for measuring fatigue. The MFI has good internal consistency (Gentile, Delaroziere, Sambuc, & San Marco, 2003; Hagelin, Wendstrom, Runesdotter, & Furst, 2007; Smets et al., 1995). The MFI has also been found to have good construct validity and convergent validity (Gentile et al.; Hagelin et al.; Smets et al., 1995; Smets, Garssen, Cull, & de Haes, 1996). Two studies in the reviewed literature that used the MFI in examining subjective fatigue in patients with COPD were conducted by Breslin et al. (1998) and Breukink et al. (1998). Two more recent studies also used the MFI in individuals with lung conditions including cystic fibrosis (de Jong, van Aalderen, Kraan, Koeter, & van der Schans, 2001) and chronic lung disease (Oh, Kim, Lee, & Kim, 2004).

The MFI was chosen as the instrument to measure fatigue because it has been used in the COPD population as well as various other clinical populations in examining various dimensions of fatigue. Many other multidimensional fatigue scales are lengthy; therefore, the MFI’s shorter length was feasible for individuals with COPD who often experience fatigue, and may have difficulty in completing a lengthy questionnaire. In addition, as demonstrated by the

psychometric studies for the MFI, the instrument was accepted by the majority of the participants.

4.5.2 Dyspnea

The MRC Dyspnea Scale was used as a measure of dyspnea (Appendix F). The most recent grades from the MRC Dyspnea Scale were found in participants' pulmonary rehabilitation health records, and were recorded on a chart abstraction sheet by the researcher. Participants graded their dyspnea experienced with physical activity based on five descriptions on a scale between 1 and 5, and a higher score indicated more severe dyspnea (O'Donnell et al., 2008). The MRC Dyspnea Scale has been documented to be simple (Bestall et al., 1999; Fletcher, 1960), and standardized (Fletcher). The MRC Dyspnea Scale has been used in patients of various ages (de Jong et al., 1997), and in individuals who have various respiratory conditions including COPD (Darbee & Ohtake, 2006). The MRC Dyspnea Scale provides ordinal-level data.

As demonstrated in the review of the literature, the MRC Dyspnea Scale is a valid and reliable instrument to measure dyspnea in patients with respiratory conditions. The MRC Dyspnea Scale has been found to have good inter-rater reliability (Mahler & Wells, 1988), and good concurrent validity (de Jong et al., 1997; Guyatt et al., 1989; Hajiro et al., 2000; Lorenzi et al., 2004; Mahler & Wells). The MRC Dyspnea Scale was chosen as the method for measuring dyspnea because it was convenient and feasible.

4.5.3 Activity Limitation

The 6MWT was used to measure activity limitation (Appendix F). The most current distances from the 6MWT were obtained from participants' pulmonary rehabilitation health records, and were recorded in the chart abstraction sheet by the researcher. An individual walks quickly on a flat, hard surface for a six-minute period, and the total distance walked at the end of this period is measured (American Thoracic Society, 2002). The 6MWT has been used extensively in evaluating therapeutic interventions for pulmonary and cardiac disease and is repeated over time to measure change in distance (American Thoracic Society). It is still unclear as to what the best method is for measuring the change in an individual's total distance from the 6MWT (American Thoracic Society); however, the American Thoracic Society recommends that a change in distance be recorded as an absolute value until more research is available. Calculating the predicted distance using published studies from healthy individuals of a similar age group can help provide a reference for comparing the results, but there is great variability in

studies due to the use of different methods (Enright, 2003). Healthy subjects' distances obtained in the 6MWT have ranged between 400 and 700 metres (Enright). In one study, distances obtained in the 6MWT for 50 patients with mild to severe stable COPD was 437 ± 88.0 metres (Starobin et al., 2006). In a larger study, distances obtained in the 6MWT for 124 patients with moderate to severe COPD was 403.0 ± 81.6 metres (Carter et al., 2003). A low result is non-specific and if the total distance from the 6MWT has reduced from the previous 6MWT, further investigation is required. Although the 6MWT is non-specific, it is "easy to administer, better tolerated, and more reflective of activities of daily living than the other walk tests" (Solway et al., 2001, p. 268). The data collected from the 6MWT was ratio-level data.

From the review of the literature, several studies have found the 6MWT to have satisfactory construct and concurrent validity. The 6MWT was correlated with several lung diffusion tests and pulmonary function tests (Mak, Bugler, Roberts, & Spiro, 1993; Wijkstra et al., 1994), and the Borg scale (Wijksta et al., 1994).

The 6MWT was chosen as the method for measuring activity limitation because it was convenient and feasible. In addition, it has been found to reflect ADLs more accurately than other walk tests (Solway et al., 2001).

4.5.4 Depression and Anxiety

The Hospital Anxiety and Depression Scale (HADS) was used to measure anxiety and depression (Appendix L). The HADS was distributed to the participants by the researcher during the pulmonary rehabilitation sessions. The HADS measured how the participant felt during the past week. The scale is comprised of 14 items of which seven items measure depression and the remaining seven items measure anxiety. Items are rated on a scale between 0 and 3. The values, zero, one, two and three have various corresponding descriptors for the feelings described. These values, along with their corresponding descriptors, are reversed in some items. The values on individual items are added and scores can range between 0 and 21. A score between 8 and 10 in either the anxiety items or depression items indicated probable presence of clinical caseness. The data collected from the HADS was ordinal-level data.

As indicated in the review of the literature, the HADS has been found to be a valid and reliable instrument for measuring anxiety and depression. The HADS has good internal consistency (Zigmond & Snaith, 1983), with a Cronbach's alpha of 0.93 for the anxiety subscale, and 0.90 for the depression subscale (Moorey et al., 1991). In addition, good internal consistency

has been found from the item-to-subscale reliability coefficients (Zigmond & Snaith). One study in the reviewed literature, conducted by Krishnasamy (1997, 2000) used the HADS. The HADS was used to screen for psychiatric morbidity while examining fatigue in advanced cancer.

The HADS was chosen as the instrument to measure depression and anxiety in this study because it has been validated in the chronic illness population. In addition, the HADS is shorter in length and easier to complete when compared to other depression and anxiety instruments. As mentioned earlier, a shorter instrument will likely be easier and less demanding for the COPD participants in this study who could be affected by fatigue.

4.5.5. Sleep Quality

The PSQI was used to measure sleep quality (Appendix M). The PSQI was distributed to the participants by the researcher during the pulmonary rehabilitation sessions. The PSQI measures the participant's sleep quality during the past month. The scale is comprised of 19 items. There are five additional items that are assessed by the participant's bed partner. These five items are not used to determine the overall score. Since these five items are not used to determine the overall score, they were not distributed to the participants. The 19 items are divided into seven components: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each of these 19 items are rated on a scale between 0 and 3. A value of zero indicates no difficulty and a value of three indicates severe difficulty. The values on individual items are added and scores can range between 0 and 21. A higher score indicates worse sleep quality. The data collected from the PSQI was ordinal-level data. The PSQI has been documented to be easy to use and understand (Buysse et al., 1989).

As discussed in the review of the literature, the PSQI has been found to be a valid and reliable instrument for measuring sleep quality. The PSQI has high internal consistency (Carpenter & Andrykowski, 1998, Buysse et al., 1989). The PSQI has high test-retest reliability and concurrent validity (Buysse et al.), as well as good construct validity (Carpenter & Andrykowski). Two studies in the reviewed literature used the PSQI to study sleep quality in individuals with COPD (Kapella et al., 2006; Reishtein, 2005).

The PSQI was chosen as the instrument for measuring sleep quality because it was the most appropriate in assessing sleep quality. Other instruments, in the form of questionnaires, examine sleepiness at a given point in time which was not applicable to this study.

4.5.6 Heart Rate

The data on heart rate was gathered from each participant's pulmonary rehabilitation health record and recorded on a chart abstraction sheet (Appendix F) by the researcher. Heart rate was recorded as the number of heart beats per minute.

4.5.7 Oxygen Saturation

The data on oxygen saturation was gathered from each participant's pulmonary rehabilitation health record and recorded on a chart abstraction sheet (Appendix F) by the researcher. Oxygen saturation was recorded as a percentage of the maximal binding capacity.

4.5.8 Extraneous Variables

The extraneous variables including: smoking status, amount of pulmonary rehabilitation received, co-morbidities, and supplemental oxygen use were gathered from each participant's pulmonary rehabilitation health record and recorded on a chart abstraction sheet (Appendix F) by the researcher. Smoking status was recorded as either currently smokes, non-smoker, or ex-smoker. Amount of pulmonary rehabilitation received was determined by using the date of the first day a participant began attending pulmonary rehabilitation. This date was recorded by day, month, and year. Co-morbidities was recorded by the number of co-morbidities a participant had. Supplemental oxygen use was recorded as either uses supplemental oxygen, or does not use supplemental oxygen.

The remaining extraneous variables: age and gender, was obtained from the demographic form (Appendix E) which each participant completed. To determine age, each participant recorded the number of years from his or her date of birth. To determine sex, each participant recorded how he or she referred to himself or herself as either male or female.

4.6 Procedure

The researcher had a meeting with the coordinator and the manager of the Saskatoon Health Region's pulmonary rehabilitation program to discuss the details of the study before applying for ethical approval. Once ethical approval was received from the University of Saskatchewan Behavioural Ethics Board and operational approval was obtained from the Saskatoon Health Region, the pulmonary rehabilitation coordinator was made aware that participant recruitment would begin. Throughout the process of recruiting participants, the researcher was present during most of the pulmonary rehabilitation sessions at both locations for a period of two months. The coordinator and pulmonary rehabilitation staff briefly introduced the

study to the individuals during the sessions, distributed brochures, and directed interested individuals to the researcher. The researcher also distributed brochures to individuals, explained the study and answered questions. The researcher met with each interested participant individually, recorded the participant's name and assigned him or her a unique identification number on the Master List of Participants and Associating Unique Identification Numbers form, reviewed the consent form, ensured that two copies of the consent form were signed, and offered him or her the opportunity to receive the results from the study by completing the Request for Results From Research Study Form. Each participant was then given a demographic form and was asked to complete it. The researcher read the instructions in each questionnaire out loud to the participant, answered any questions he or she had, and the participants proceeded with completing the questionnaires. The MFI was completed first, followed by the HADS, and lastly the PSQI. Data on dyspnea, activity limitation, heart rate, oxygen saturation, smoking status, amount of pulmonary rehabilitation received, co-morbidities, current medications, PFTs, and supplemental oxygen use were collected from each participant's pulmonary rehabilitation health record, and recorded on a chart abstraction sheet.

A codebook was developed by the researcher for each variable in each instrument, the demographic form, and the chart abstraction sheet before data analysis was initiated to help manage data and facilitate data analysis. The researcher coded the data according to the codebook.

4.7 Data Analysis

The primary research questions addressed in this thesis were: (a) what proportion of the individuals with COPD receiving pulmonary rehabilitation experienced emotional, behavioural, cognitive, and physical dimensions of subjective fatigue, and (b) what are the relationships between each of the four dimensions of subjective fatigue and various symptoms (dyspnea, depression, anxiety, sleep quality, activity limitation, heart rate, and oxygen saturation) in these individuals? The secondary research questions addressed were: (a) how do men and women compare on the four dimensions of subjective fatigue, (b) how do individuals who use supplemental oxygen and those who do not use supplemental oxygen compare on the four dimensions of subjective fatigue, (c) how do ex-smokers, non-smokers, and those who currently smoke compare on the four dimensions of subjective fatigue, (d) how do the individuals' severity of dyspnea according to the MRC Dyspnea Scale grades compare on the four dimensions of

subjective fatigue, and (e) what are the relationships between the four dimensions of fatigue and age, the number of co-morbidities, and the amount of pulmonary rehabilitation received?

Data from the questionnaires and chart abstraction sheets were entered into SPSS 16.0, and recoded when required according to the questionnaires' scoring instructions. For the descriptive analysis, frequencies and percentages were calculated for most variables. For ordinal and ratio variables, measures of central tendencies and dispersion were determined.

T-tests or one-way ANOVAs (analysis of variance) were performed to examine significant differences between groups. For two sets of sample data, a *t*-test was used, and for three or more sets of sample data, a one-way ANOVA was used. For the ordinal and ratio variables, Spearman's rho correlation coefficients were calculated. All variables, with the exception of the amount of pulmonary rehabilitation received which was slightly leptokurtic, met acceptable levels of normality.

T-test for independent samples were calculated to determine whether significant differences existed in the means between men and women, and between having used and not having used supplemental oxygen for each of the MFI subscales. A one-way ANOVA was used to determine whether significant differences existed among the means of non-smokers, ex-smokers, and those who currently smoke, and among the different grades obtained in the MRC Dyspnea Scale for each of the MFI subscales. Spearman's rho correlation coefficients were calculated to explore whether significant relationships existed between each of the MFI subscales and dyspnea, anxiety, depression, activity limitation, sleep quality, heart rate, oxygen saturation, age, number of co-morbidities, and amount of pulmonary rehabilitation received. For all statistical tests, an alpha of 0.05 indicated statistical significance.

CHAPTER V

Results

5.1 Participation Rate

Forty-five participants were approached by the researcher or pulmonary rehabilitation staff during attendance at the pulmonary rehabilitation sessions between October 2008 and December 2008, and a total of 42 participants agreed to participate in the study (participation rate = 93.3%). Of these participants, 13 attended pulmonary rehabilitation at the Confederation Mall location, and 29 attended pulmonary rehabilitation at the Saskatoon Field House location. All 42 participants completed the questionnaires, and the researcher was able to assess all their health records at the location where they participated in pulmonary rehabilitation.

5.2 Characteristics of the Sample

The characteristics of the participants in the sample can be referred to in Tables 5.1 and 5.2. The sample was 17 (40.5%) male, and 25 (59.5%) female. The participants' ages ranged between 56 and 87 years, and the mean was 72.9 years ($SD = \pm 6.5$). Data on co-morbidities, smoking status, and supplemental oxygen were collected by the pulmonary rehabilitation staff during the preliminary assessment period when they met participants individually for the first time. The mean number of co-morbidities was 2.6 ($Mdn = 3$, $Md = 1$, $SD = \pm 1.4$) and 52.4% had three or more co-morbidities. There were 33 (78.6%) ex-smokers, 7 (16.7%) current smokers, and 2 (4.8%) non-smokers. There were 11 (26.2%) participants who used supplemental oxygen, and 31 (73.8%) who did not use supplemental oxygen. The mean number of months of pulmonary rehabilitation received was 25 ($R = 0 - 75$, $SD = \pm 26$). The most recent MRC Dyspnea Scale grades were obtained from 30 of the participants' health records. MRC Dyspnea Scale grades had been recorded within the last three months in 43.3% of the participants, within the last 3 to 6 months in 16.7% of the participants, within the last 6 to 12 months in 10.0% of the participants, and over 12 months ago in 30.0% of the participants. The mean MRC Dyspnea Scale grade was 2.6 ($Md = 3$, $R = 1 - 4$). The most recent 6MWT distances were obtained from 41 of the participants' health records. The mean distance was 356 metres ($SD = \pm 90$), and ranged

between 126 metres and 552 metres. The most recent oxygen saturation and heart rate for walking were collected from all participants' health records. The mean oxygen saturation was 92.6% ($SD = \pm 4.1$), and the mean heart rate reading was 102 beats per minute ($SD = \pm 14.4$). The most recent PFTs were available in 14 health records. The mean FEV₁ (% predicted) was 47.8 ($SD = \pm 16.3$), the mean FVC (% predicted) was 78.9 ($SD = \pm 18.1$), and the mean FEV₁/FVC was 0.68 ($SD = \pm 0.13$). The COPD medications which participants used were gathered from the most recent time of assessment. The number of participants and the medications they used were as follows: 22 (52.4%) used Salbutamol, 1 (2.4%) used Formoterol, 2 (4.8%) used Salmeterol, 9 (21.4%) used Ipratropium, 18 (42.9%) used Tiotropium, 4 (9.5%) used the Salbutamol and Ipratropium combination, 10 (23.8%) used the Fluticasone and Salmeterol combination, 6 (14.3%) used the Budesonide and Formoterol combination, 1 (2.4%) used Fluticasone, 1 (2.4%) used Budesonide, and 1 (2.4%) used Beclomethasone.

Table 5.1. Participants' Demographic Characteristics

Characteristics	<i>n</i>	<i>M</i>	<i>SD</i>	Frequency	Percent
Age	42	72.9 years	±6.5		
Sex	42				
Male				17	40.5
Female				25	59.5
Smoking status	42				
Ex-smokers				33	78.6
Current smokers				7	16.7
Non-smokers				2	4.8

n = number of participants

M = mean

SD = standard deviation

Table 5.2. Participants' Health Status and Pharmacologic Characteristics

Characteristics	<i>n</i>	<i>M</i>	<i>SD</i>	Frequency	Percent
MRC Dyspnea Scale	30	2.6			
Co-morbidities	42	2.6	±1.4		
Amount of pulmonary rehabilitation received	42	25 months	±26		
6MWT	41	356 metres	±90		
Oxygen saturation	42	92.6%	±4.1		
Heart rate	42	102 beats/minute	±14.4		
Pulmonary function tests	14				
FEV ₁ (% predicted)		47.8	±16.3		
FVC (% predicted)		78.9	±18.1		
FEV ₁ /FVC		0.68	±0.13		
Supplemental oxygen use	42				
Used supplemental oxygen				11	26.2
Did not use supplemental oxygen				31	73.8
Medications	42				
SABA				22	52.4
Salbutamol				22	52.4
LABA				3	7.2
Formoterol				1	2.4
Salmeterol				2	4.8
Anticholinergic				27	64.3
Ipratropium				9	21.4
Tiotropium				18	42.9
SABA and anticholinergic				4	9.5
Salbutamol and Ipratropium combination				4	9.5
LABA and corticosteroid				16	38.1
Fluticasone and Salmeterol combination				10	23.8
Budesonide and Formoterol combination				6	14.3
Corticosteroid				3	7.2
Fluticasone				1	2.4
Budesonide				1	2.4
Beclomethasone				1	2.4

n = number of participants

M = mean

SD = standard deviation

5.3 Questionnaires

The results of the scores obtained in the MFI, HADS, and PSQI are shown in Table 5.3.

5.3.1 MFI

The MFI has 20 items which measure all four dimensions of fatigue (physical, behavioural, cognitive, and emotional) from the conceptual framework which guided this study. Scores between 4 and 20 are possible for each of the MFI subscales, where higher scores indicate more fatigue. According to Piper (2003), the physical or sensory dimension, also known as general, physical, or somatic fatigue, includes signs and symptoms of fatigue and their intensities, which can be localized to a specific part of the body, or generalized over the whole body. Two MFI subscales, general fatigue and physical fatigue, measure the physical dimension of fatigue. The mean score was 11.1 ($SD = \pm 2.3$, $R = 6 - 17$) for general fatigue, and 13.5 ($SD = \pm 2.2$, $R = 8 - 18$) for physical fatigue. The behavioural dimension includes signs and symptoms that reflect changes in physical performance, ADLs, or the amount of effort needed to perform physically (Piper, 2003). The MFI subscale reduced activity, measures the behavioural dimension of fatigue. The mean score for reduced activity was 13.0 ($SD = \pm 2.3$, $R = 8 - 19$). The emotional, also known as affective or psychologic dimension, consists of emotional effects of fatigue which includes reduced motivation (Piper, 2003). The MFI subscale reduced motivation measures the emotional dimension of fatigue. The mean score for reduced motivation was 12.8 ($SD = \pm 2.3$, $R = 6 - 18$). Piper (2003) outlined that the cognitive or mental dimension includes indicators of changes in thought or concentration. The MFI subscale mental fatigue assesses the cognitive dimension of fatigue. The mean was score was 11.2 ($SD = \pm 1.8$, $R = 7 - 16$) for mental fatigue.

Participants' scores on the five MFI subscales from most fatigue to least fatigue were: physical fatigue, reduced activity, reduced motivation, mental fatigue, and general fatigue. A higher score on the MFI indicates more fatigue; however, the MFI does not have specific guidelines to differentiate the severity of fatigue. For the purpose of differentiating the severity of fatigue to help make the findings in this present study more meaningful, the researcher decided that a score between 4 and 9 indicated mild fatigue, a score between 10 and 14 indicated moderate fatigue, and a score between 15 and 20 indicated severe fatigue. Decisions on these score ranges were guided by percentiles and measures of central tendencies. The mean subscales scores at the 50th percentile and the overall mean score on all subscales were approximately 12.

Therefore, a mean of 12 formed the middle score for the moderate fatigue score range, and the mild and severe fatigue score ranges were approximately equally divided into the two remaining severity categories. The majority of the participants reported moderate levels of fatigue on all MFI subscales: general fatigue (69.0%), physical fatigue (61.9%), reduced activity (71.4%), reduced motivation (64.2%), and mental fatigue (81.0%). Most of the participants experienced moderate levels of fatigue for all dimensions including: fatigue affecting general functioning and physical sensations related to fatigue (physical dimension), reduced activity as a possible consequence of fatigue (behavioural dimension), reduced motivation (emotional dimension), and cognitive symptoms such as difficulty concentrating (cognitive dimension). The percentage of the sample that experienced mild, moderate, and severe levels of fatigue on the MFI subscales and associated fatigue dimensions are displayed in Table 5.4.

5.3.2 HADS

The HADS is comprised of two subscales, anxiety and depression. There are seven items in the anxiety subscale which assess anxiety, and seven items in the depression subscale which assess depression. A higher score indicates more anxiety or depression, and a score of eight or higher indicates probable clinical presence of anxiety or depression. Possible scores for each subscale range between 0 and 21. The mean score on the HADS anxiety subscale was 7.0 ($SD = \pm 3.6$, $R = 0 - 15$), and on the HADS depression subscale was 5.3 ($SD = \pm 2.9$, $R = 1 - 15$). For the anxiety and depression subscales, 42.9% and 21.4% of the participants, respectively, scored an eight or higher.

5.3.3 PSQI

The 19 items in the PSQI used in this study measured an individual's sleep quality by assessing seven components (sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction). Possible scores range between 0 and 21, where a higher score indicates greater sleep difficulty in all components. The mean score on the PSQI was 7.1 ($SD = \pm 4.1$, $R = 1 - 15$).

Table 5.3. Results from Questionnaires

Questionnaire	<i>n</i>	<i>R</i>	<i>M</i>	<i>SD</i>
MFI ^a	42			
General fatigue		6-17	11.1	±2.3
Physical fatigue		8-18	13.5	±2.2
Reduced activity		8-19	13.0	±2.3
Reduced motivation		6-18	12.8	±2.3
Mental fatigue		7-16	11.2	±1.8
HADS ^b	42			
Anxiety		0-15	7.0	±3.6
Depression		1-15	5.3	±2.9
PSQI ^c	42	1-15	7.1	±4.1

^a Scores can range between 4 and 20 for each subscale. A higher score indicates more fatigue.

^b Scores can range between 0 and 21 for each subscale. A score between 0 and 7 is normal. A score greater than or equal to 8 indicates probable presence of clinical anxiety or depression.

^c Scores can range between 0 and 21. A higher score indicates greater sleep difficulty in all components.

n = number of participants

R = range

M = mean

SD = standard deviation

Table 5.4. Comparison of Mild, Moderate, and Severe Fatigue Levels on the MFI Subscales and Associated Fatigue Dimensions

	Mild	Moderate	Severe
General Fatigue (Physical Dimension)	21.5%	69.0%	9.6%
Physical Fatigue (Physical Dimension)	4.8%	61.9%	33.4%
Reduced Activity (Behavioural Dimension)	4.8%	71.4%	23.9%
Reduced Motivation (Emotional Dimension)	11.9%	64.2%	23.8%
Mental Fatigue (Cognitive Dimension)	16.6%	81.0%	2.4%

5.4 Comparisons and Correlations

Comparison of men and women, the use of supplemental oxygen, smoking status, and MRC Dyspnea Scale grades on the MFI subscales are displayed in Tables 5.5 – 5.8. Correlations between the MFI subscales and age, number of co-morbidities and amount of pulmonary rehabilitation received can be referred to in Table 5.9. Correlations among the MFI subscales and associated fatigue dimensions, physiologic, psychologic, and situational influencing factors (dyspnea, depression, anxiety, sleep quality, activity limitation, heart rate, and oxygen saturation) are shown in Table 5.10.

Table 5.5. Comparison of Men and Women on the MFI Subscales

	Men			Women			<i>t</i> -test	<i>p</i> value (2-tailed)
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>		
General Fatigue	17	11.0	±2.2	25	11.2	±2.5	-0.32	0.75
Physical Fatigue	17	14.1	±2.0	25	13.2	±2.4	1.37	0.18
Reduced Activity	17	12.3	±2.3	25	13.4	±2.2	-1.53	0.13
Reduced Motivation	17	12.4	±3.0	25	13.1	± 2.4	-0.81	0.42
Mental Fatigue	17	11.2	±1.0	25	11.2	±2.2	0.07	0.94

n = number of participants

M = mean

SD = standard deviation

Table 5.6. Comparison of the Use of Supplemental Oxygen on the MFI Subscales

	Uses Supplemental Oxygen			Does Not Use Supplemental Oxygen			<i>t</i> -test	<i>p</i> value (2-tailed)
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>		
General Fatigue	11	11.4	±2.2	31	11.1	±2.4	0.36	0.72
Physical Fatigue	11	13.0	±1.9	31	13.7	±2.4	-0.94	0.35
Reduced Activity	11	14.0	±2.0	31	12.6	±2.3	1.72	0.09
Reduced Motivation	11	13.2	±2.1	31	12.7	±2.8	0.55	0.59
Mental Fatigue	11	10.9	±1.4	31	11.3	±1.9	-0.66	0.51

n = number of participants

M = mean

SD = standard deviation

Table 5.7. Comparison of Smoking Status with the MFI Subscales

	Non-Smokers			Current Smokers			Ex-Smokers			Total			<i>F</i> -test	<i>p</i> value
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>		
General Fatigue	2	11.0	±1.4	7	12.0	±1.5	33	11.0	±2.5	42	11.1	±2.3	0.55	0.58
Physical Fatigue	2	14.0	±2.8	7	13.4	±2.5	33	13.5	±2.2	42	13.5	±2.2	0.05	0.96
Reduced Activity	2	12.0	±1.4	7	12.6	±2.1	33	13.2	±2.4	42	13.0	±2.3	0.37	0.70
Reduced Motivation	2	10.0	±2.8	7	15.6	±2.4	33	13.0	±2.6	42	12.8	±2.6	1.32	0.28
Mental Fatigue	2	12.0	±0.0	7	11.4	±1.8	33	11.1	±1.8	42	11.2	±1.8	0.28	0.76

n = number of participants

M = mean

SD = standard deviation

Table 5.8. Comparison of MRC Dyspnea Scale Grades on the MFI Subscales

	1			2			3			4			Total			<i>F</i> -test	<i>p</i> value
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>		
General Fatigue	2	13.0	±1.4	10	10.9	±3.3	16	10.8	±1.3	2	11.0	±2.8	30	11.0	±2.2	0.58	0.64
Physical Fatigue	2	15.5	±3.5	10	13.6	±2.5	16	12.9	±1.9	2	12.0	±1.4	30	13.3	±2.2	1.07	0.38
Reduced Activity	2	13.0	±2.8	10	12.6	±3.0	16	12.9	±1.5	2	13.5	±2.1	30	12.9	±2.1	0.11	0.95
Reduced Motivation	2	14.0	±5.7	10	12.2	±3.2	16	12.4	±2.2	2	12.0	±0.0	30	12.4	±2.6	0.26	0.85
Mental Fatigue	2	10.5	±2.1	10	11.4	±2.7	16	11.0	±1.5	2	11.5	±0.7	30	11.1	±2.0	0.20	0.90

n = number of participants

M = mean

SD = standard deviation

Table 5.9. Correlations between the MFI Subscales and Age, Number of Co-morbidities and Amount of Pulmonary Rehabilitation Received

MFI Subscales	<i>n</i>	Age	Number of Co-morbidities	Amount of Pulmonary Rehabilitation Received
General Fatigue	42	-0.01	0.20	-0.02
Physical Fatigue	42	0.11	0.17	0.06
Reduced Activity	42	0.43**	0.16	0.08
Reduced Motivation	42	0.31*	0.12	0.22
Mental Fatigue	42	-0.09	0.05	-0.03

n = number of participants

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 5.10. Correlations among the MFI Subscales and Associated Fatigue Dimensions, Physiologic, Psychologic, and Situational Influencing Factors

MFI Subscales	Physiologic				Psychologic		Situational
	Dyspnea	Activity Limitation	Heart Rate	Oxygen Saturation	Depression	Anxiety	Sleep Quality
General Fatigue (Physical Dimension)	-0.11	-0.17	0.02	-0.10	0.00	0.23	0.04
Physical Fatigue (Physical Dimension)	-0.33	-0.11	-0.21	0.24	-0.22	-0.23	-0.19
Reduced Activity (Behavioural Dimension)	0.12	-0.25	-0.08	-0.11	-0.29	-0.28	-0.07
Reduced Motivation (Emotional Dimension)	-0.09	-0.07	0.09	-0.02	-0.20	-0.47**	-0.05
Mental Fatigue (Cognitive Dimension)	-0.04	0.11	-0.04	0.05	-0.30	-0.22	0.16

** Correlation is significant at the 0.01 level (2-tailed).

Men and women did not significantly differ in their MFI subscales scores. Those who used supplemental and those who did not use supplemental oxygen did not significantly differ in their MFI subscale scores. Ex-smokers, currently smokers, and non-smokers did not significantly differ in their MFI subscales scores. There were no significant differences in the MFI subscales scores among the different MRC Dyspnea Scale grades. Age positively correlated with two of the MFI subscales, reduced activity [$\rho = 0.43, p < 0.01$] and reduced motivation [$\rho = 0.31, p < 0.05$], but did not correlate with the remaining MFI subscales scores. The number of co-morbidities and the amount of pulmonary rehabilitation received did not correlate with the MFI subscales scores.

The MRC Dyspnea Scale grades, HADS depression subscale scores, PSQI sleep quality scores, 6MWT distances, heart rate, and oxygen saturation readings did not correlate with any of the MFI subscales scores. The HADS anxiety subscale negatively correlated with reduced motivation [$\rho = -0.47, p < 0.01$], but did not correlate with the remaining MFI subscales scores.

CHAPTER VI

Discussion

Fatigue is a common and distressing symptom in individuals with COPD (Kinsmen et al., 1983, Theander & Unosson, 2004). It has a significant negative impact on quality of life, including physical, psychological, social, and cognitive functioning (Theander & Unosson). Pulmonary rehabilitation is strongly encouraged in individuals with COPD to help improve their quality of life (O'Donnell et al., 2008) among other benefits such as reducing fatigue (Lacasse et al., 2004).

The following summarizes the results and provides answers to the primary and secondary research questions.

6.1 Primary Research Questions

- 1. What proportion of the individuals with COPD receiving pulmonary rehabilitation experienced emotional, behavioural, cognitive, and physical dimensions of subjective fatigue? The majority of the participants experienced moderate levels of subjective fatigue in all four dimensions. Moderate to severe levels of physical fatigue were experienced in 95.3% of the participants.
- 2. What are the relationships between each of the four dimensions of subjective fatigue and various symptoms (dyspnea, depression, anxiety, sleep quality, activity limitation, heart rate, and oxygen saturation) in these individuals? The only significant finding was a negative relationship between anxiety and emotional fatigue (reduced motivation). There were no significant relationships between any of the fatigue dimensions and the other influencing factors: sleep quality, activity limitation, dyspnea, oxygen saturation, heart rate, and depression.

6.2 Secondary Research Questions

- 1. How do men and women compare on the four dimensions of subjective fatigue? Men and women did not significantly differ in the four dimensions of subjective fatigue.

- 2. How do individuals who use supplemental oxygen and those who do not use supplemental oxygen compare on the four dimensions of subjective fatigue? Those who used supplemental oxygen and those who did not use supplemental oxygen did not significantly differ in the four dimensions of subjective fatigue.
- 3. How do ex-smokers, non-smokers, and those who currently smoke compare on the four dimensions of subjective fatigue? Ex-smokers, non-smokers, and those who currently smoke did not significantly differ in the four dimensions of subjective fatigue.
- 4. How do the individuals' severity of dyspnea according to the MRC Dyspnea Scale grades compare on the four dimensions of subjective fatigue? There were no significant differences in the four dimensions of subjective fatigue among the different MRC Dyspnea Scale grades.
- 5. What are the relationships between the four dimensions of fatigue and age, the number of co-morbidities, and the amount of pulmonary rehabilitation received? There was a significant positive relationship between age and two dimensions: emotional fatigue (reduced motivation) and behavioural fatigue (reduced activity). There were no significant relationships between the four dimensions of fatigue and the number of co-morbidities and the amount of pulmonary rehabilitation received.

6.3 Participation Rate

The participation rate in this study was high, indicating that participants in the pulmonary rehabilitation program showed great interest in this study. Participants found the questionnaires easy and quick to complete. Participants typically completed the questionnaires in 10 to 15 minutes.

6.4 Severity of COPD

Based on the pulmonary function tests of 14 participants that were available in the health records, a mean FEV₁/FVC of less than 0.7 confirmed a diagnosis of COPD, and a mean FEV₁ of 47.8% of the predicted value for the participants' age, size and sex, indicated that they had severe COPD (O'Donnell et al., 2008).

6.5 Sex

More women (59.5%) than men (40.5%) participated in this study. The gender distribution was different than the population from which the sample was drawn. According to the information provided by the pulmonary rehabilitation coordinator, there are slightly more

men (54.3%) than women (45.7%) with COPD in the pulmonary rehabilitation program. Similar to this present study, more women than men participated in a few COPD studies (Janson-Bjerklie et al., 1986; Woo, 2000a; Woo, 2000b). However, more men than women participated in 11 COPD studies (Breslin et al., 1998; Breukink et al., 1998; Carter et al., 2006; Dowson et al., 2001; Gift & Shepard, 1999; Kapella et al., 2006; Kinsmen et al., 1983; Oh et al., 2004; Reishtein, 2005; Small & Graydon, 1992; Starobin et al., 2006). Some possible explanations as to why more women than men participated in this study include gender differences in health beliefs and health seeking behaviour. For example, women may be more aware and distressed by their symptoms, and are more willing to seek health care services. In addition, it may be more socially acceptable for women to report symptoms than for men to do so.

There were no significant differences between men and women in this study for any of the MFI subscales, which demonstrated that men and women did not significantly differ in the various dimensions of fatigue they experienced. This finding was also similar to other COPD studies (Gift & Shepard, 1999; Kapella et al., 2006; Oh et al., 2004). Although the results from this present study indicate that there were no differences between men and women in the fatigue they experienced, symptoms such as dyspnea, anxiety, and depression have been reported to be higher in women than in men (Gift & Shepard, 1999), which may affect the overall fatigue levels experienced.

6.6 Age

Information to estimate the mean age of the COPD population in the pulmonary rehabilitation program was provided by the pulmonary rehabilitation coordinator. The estimated mean age of the individuals in this population was 66 years, and when compared to the participants in this present study with a mean age of 72.9 years, the participants in this study were slightly older. In addition, the participants were slightly older in this present study than several COPD studies where the reported means ranged between 62 and 69.9 years (Breslin et al., 1998; Breukink et al., 1998; Carter et al., 2006; Dowson et al., 2001; Gift & Shepard, 1999; Janson-Bjerklie et al., 1986; Kapella et al., 2006; Kinsmen et al., 1983; Oh et al., 2004; Reishtein, 2005; Small & Graydon, 1992; Starobin et al., 2006; Woo, 2000a; Woo, 2000b). With older participants in the study, a positive relationship between age and fatigue was anticipated. As individuals get older, they may experience more fatigue because of their decrease in physical strength associated with aging.

There was a significant positive relationship between age and two of the MFI subscales, reduced activity and reduced motivation. The reduced activity and reduced motivation subscales measure the behavioural and emotional dimensions of fatigue, respectively; therefore, there was a significant positive relationship between age and behavioural fatigue, and between age and emotional fatigue. One possible explanation for this finding was that with increasing age and the natural process of aging, participants were not physically as strong as when they were younger, and needed to exert more effort to perform physically. This decrease in physical strength may have negatively impacted their ability to carry out ADLs. A reduction in the participants' motivation to start activities may have been a result of the decline in physical strength that comes with increasing age. Previous studies found that age was not significantly related to the amount of fatigue experienced (Reishtein, 2005; Woo, 2000b). These studies examined the amount of fatigue experienced, and did not examine different dimensions of fatigue.

6.7 Fatigue

The results from this present study indicate that the majority of participants experienced moderate levels of general fatigue (69.0%), physical fatigue (61.9%), reduced activity (71.4%), reduced motivation (64.2%), and mental fatigue (81.0%) based on the MFI subscales. This meant that most of the participants experienced moderate levels of fatigue for all dimensions (physical, behavioural, emotional, and cognitive). In addition, moderate to severe levels of physical fatigue were experienced in 95.3% of the participants. The means in the MFI subscales ranged between 11.1 and 13.5, which were expected based on several other studies which used the MFI with individuals who had moderate to severe COPD. The means on the MFI subscales in these studies ranged between 10.5 and 13.0 (Oh et al., 2004), between 9.8 and 14.5 (Breslin et al., 1998), and between 9.7 and 14.6 (Breukink et al., 1998).

Although a common conceptualization of the physical fatigue dimension includes general fatigue according to Piper (2003), the results in this study suggested that physical and general dimensions of fatigue were separate in these participants because the scores were highest on the physical fatigue subscale, and lowest on the general fatigue subscale. The physical sensations of the fatigue they experienced were not only more severe, but perhaps also different from the fatigue they experienced which affected their overall functioning. It may be possible that the participants' physical sensations of the fatigue they experienced may not have affected how they perceived their general functioning. The conceptual framework used in this study worked well

for conceptualizing emotional, behavioural and cognitive fatigue dimension. However, the conceptual framework which included the common conceptualization of general fatigue as part of physical fatigue, did not work well in conceptualizing the physical dimension because the results from this study suggested a distinction between the physical and general fatigue dimensions.

Similar results where physical fatigue was also highest, followed by reduced activity was noted by Breslin et al. (1998) in pulmonary rehabilitation participants, and by Oh et al. (2004). Participants scored lowest in general fatigue in this present study, which was different from three other COPD studies where mental fatigue was lowest (Breslin et al., 1998; Breukink et al., 1998, Oh et al., 2004). In one cancer study, mental fatigue was also lowest, but general fatigue was highest (Smets et al., 1996). In other COPD studies which used other fatigue instruments, results showed that subjects experienced moderate to high levels of fatigue (Gift & Shepard, 1999; Kapella et al., 2006; Woo, 2000a; Woo, 2000b). The moderate amounts of fatigue experienced by the participants in this present study and in the study conducted by Breslin et al. (1998) on individuals with COPD attending pulmonary rehabilitation may suggest that many individuals attending pulmonary rehabilitation experience moderate amounts of fatigue. Whether or not pulmonary rehabilitation is effective in reducing the fatigue was not examined in this study; however, it would be worth examining in future studies.

6.8 Physiologic Factors

Moderate amounts of dyspnea were reported in 53.3% of the participants, where a mode of three was calculated from the MRC Dyspnea Scale grades. Similar to this present study, one previous work using the MRC Dyspnea Scale found that pulmonary rehabilitation participants with COPD experienced moderate to severe dyspnea (Bestall et al., 1999). Relatively high amounts of dyspnea were reported by outpatient participants with COPD in two other studies; however, a different instrument was used to measure dyspnea (Woo 2000a, Woo, 2000b).

It was anticipated that a positive relationship between dyspnea and fatigue would be found in this study from a pathophysiological aspect. The dyspnea experienced by the participants in this present study may be a result of decreased pulmonary function. The decreased pulmonary function may be due to changes in the structures of the lung and impaired gas exchange, which is associated with the disease trajectory of COPD. The decrease in pulmonary

function may lead to poor oxygenation of muscles needed for physical performance, which may impact the fatigue levels experienced by individuals with COPD.

There were no significant relationships between dyspnea and any of the dimensions of fatigue based on the available MRC Dyspnea Scale grades for 30 participants. This may be explained by the variability in time frame in which dyspnea was assessed, the use of the most recent scores available, and from not having the participants' dyspnea and fatigue measured concurrently.

When the MRC Dyspnea Scale grades were grouped according to when the participants' dyspnea were assessed (within the last three months, within the last 3 to 6 months, within the last 6 to 12 months, and over 12 months ago) to determine if there were any significant relationships with fatigue, there were only significant negative relationships between the scores at the 3 to 6 months interval and both the general fatigue ($\rho = -0.92, p < 0.05$) and physical fatigue ($\rho = -0.92, p < 0.05$) MFI subscales. No other significant relationships were found. The MRC Dyspnea Scale grades were grouped in this manner because the participants are assessed when they start pulmonary rehabilitation, as well as after 3, 6, and 12 months. Although the results showed that there was a significant relationship between dyspnea and fatigue, this finding is unfortunately not very helpful in terms of generalizability because the significance of this relationship was calculated based on five of the participants' MRC Dyspnea Scale grades. However, when the MRC Dyspnea Scale grades were dichotomized into two groups (within the last six months and over six months ago) to increase the number of participants' scores in each group, there were no significant relationships between dyspnea and fatigue. Findings from this present study contrasted with previous studies where a significant relationship between dyspnea and fatigue was found (Gift & Shepard, 1999; Janson-Bjerklie et al., 1986; Kapella et al., 2006; Kinsman et al., 1983; Reishtein, 2005; Woo, 2000a; Woo, 2000b). Furthermore, one study used the MFI and the results showed a significant relationship between dyspnea and all the MFI subscales (Oh et al., 2004). Oh et al. used a different instrument to measure dyspnea (Baseline Dyspnea Index), but dyspnea and fatigue were measured concurrently.

With a mean distance of 356 metres on the 6MWT, the participants in this present study had a higher activity tolerance than subjects in another study with mild COPD (Woo, 2000a), which included 22 subjects. The opposite was found in three studies where participants with

severe COPD (Carter et al., 2003; Starobin et al., 2006), and mild COPD (Woo, 2000b) had a higher activity tolerance than the subjects in this present study.

There were no significant relationships between activity limitation and any of the dimensions of fatigue based on the 6MWT distances available for 41 participants. The lack of significant relationships between activity limitation and the fatigue dimensions may have been attributed to the various assessment time intervals at which the 6MWT was conducted among the participants, and the use of the most recent 6MWT distance available in this study. In addition, the 6MWT was conducted by various staff at the pulmonary rehabilitation program, which may have affected its reliability.

There have been inconsistent findings on the relationship between activity limitation and fatigue. There was a significant relationship between the 6MWT and fatigue in three COPD studies, indicating that activity limitation was related to fatigue (Breslin et al., 1998; Woo, 2000a; Woo, 2000b). In another study which did not use the 6MWT but used the MFI, there were no significant relationships between any of the MFI subscales and measures of activity limitation (Breukink et al., 1998). Very few studies have examined the relationship between the 6MWT and various dimensions of fatigue in individuals with COPD. One such study conducted by Breslin et al. (1998) found significant relationships between three of the MFI subscales and the 6MWT.

There were no significant relationships between heart rate or oxygen saturation and any of the dimensions of fatigue. Heart rate and oxygen saturation were included in this present study because the information was readily available, and to the researcher's knowledge, these two variables have not been studied in the context of fatigue in COPD. Participants often recorded their readings after engaging in physical activity during their pulmonary rehabilitation session. It is important to note that the participants' fatigue was measured at a time that was convenient for them during their pulmonary rehabilitation session. As a result, some of the participants' fatigue was measured before they engaged in physical activity, and some was measured after physical activity. Since heart rate and oxygen saturation were not measured at the same time with fatigue, this may be a possible explanation for the lack of significant relationships.

6.9 Psychologic Factors

On the HADS anxiety subscale, 42.9% of the participants scored an eight or higher, indicating a probable presence of clinical anxiety. Compared to anxiety, fewer participants

scored an eight or higher on the HADS depression subscale, indicating a probable presence of clinical depression in 21.4% of the participants. It has been found that in individuals with COPD, there is a significant relationship between anxiety and an increased risk of re-hospitalization after an acute exacerbation (Gudmundsson et al., 2005). Several studies have found that pulmonary rehabilitation impacted anxiety and depression in individuals with COPD (Guell et al., 2006; Kayahan, Karapolat, Atyntoprak, Atasever, & Ozturk, 2006; Paz-Diaz, Montes de Oca, Lopez, & Celli, 2007; Withers, Rudkin, & White, 1999). In this sample, with nearly 43% of the participants having probable presence of clinical anxiety and a prevalence rate that was nearly twice as high as depression, it is even more imperative that they continue with pulmonary rehabilitation to not only reduce anxiety, but also decrease the risks of re-hospitalizations after an acute exacerbation of COPD (O'Donnell et al., 2008). The participants receive an educational component in addition to the monitored exercise component in the pulmonary rehabilitation program. One educational session is focused on coping with COPD. Participants receive education on suggested techniques to help them cope physically, mentally, socially, and spiritually, which potentially impacts the management of anxiety and depression. The pulmonary rehabilitation program is focused mainly on physical techniques such as stretching exercises, walking, and breathing techniques, which are incorporated in the exercise component of the program. However, the high levels of anxiety experienced by nearly half of the participants may suggest that incorporating additional techniques into the program such as mental, social and spiritual components, can be more effective in managing anxiety and depression. Higher levels of anxiety were also found in two other studies which used the HADS on subjects with severe COPD (Bestall et al., 1999; Dowson et al., 2001).

There was a significant negative relationship between anxiety and reduced motivation, but no significant relationships between depression and any of the MFI subscales. When participants experienced higher levels of anxiety, their scores suggested that they had greater motivation. Anxiety is an emotion, and emotions are felt experiences which form the basis of motivation (Ninan & Dunlop, 2006). Motivation is a readiness to react (Ninan & Dunlop), act in a purposeful manner... get past hurdles... and exists as energy, a wanting, drive, activity” (Sussman, Nezami, Pokhrel & Ames, 2007, p. 10). Often, individuals with COPD become anxious due to dyspnea (Grant & Moore, 2007), where fear may be associated with episodes of breathlessness which were experiences felt in the past. According to the self-regulation models

of motivation, one is motivated to maintain system balance or an optimal state (Sussman, Nezami, Pokhrel & Ames). An awareness of a lack of system balance will motivate one to exert effort to restore balance. This model can be applied to this study which can explain this significant relationship. As the participants became increasingly anxious, perhaps due to the fear of dyspnea associated with activity, they became more motivated to restore emotional balance in the body. This may have led to a decrease in anxiety, a decrease in emotional distress, and a decrease in the amount of emotional fatigue experienced.

In two COPD studies which used the MFI and other instruments to measure anxiety and depression, significant positive relationships between all MFI subscales and mood, which included anxiety and depression, were noted by Oh et al. (2004); however, Breslin et al. (1998) found that the relationships were only significant between the general and mental fatigue subscales and depression. Other fatigue, anxiety and depression instruments were used in several other COPD studies where findings indicated that fatigue was significantly and positively related to negative mood (Small & Graydon, 1992), anxiety and depression (Kapella et al., 2006), and depression only (Gift & Shepard, 1999). In a cancer study, Smets et al. (1996) found a significant positive relationship between all MFI subscales and the HADS anxiety and depression subscales. The lack of a significant relationship between depression and fatigue in this present study may have been from the small sample size used. The sample size calculation was based on the MFI, and not the HADS; therefore, there may have been insufficient power to detect a significant relationship.

6.10 Situational Factors

A mean of 7.1 on the PSQI indicated that most participants in this study experienced some sleep difficulties in the areas of sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, or daytime dysfunction. Higher PSQI scores indicate greater sleep difficulty or worse sleep quality; however, it does not differentiate the severity of sleep difficulty to help interpret the participants' quality of sleep. In order to differentiate the quality of sleep to help make the findings in this present study more meaningful, the researcher decided that a score between 0 and 6 indicated mild sleep difficulty, a score between 7 and 13 indicated moderate sleep difficulty, and a score between 14 and 21 indicated severe sleep difficulty. Decisions on these score ranges were guided by the frequency distribution of the participants' scores. In addition, these ranges were approximately equally

divided into the three severity of sleep difficulty categories. According to these score ranges, 52.3% of the participants experienced mild sleep difficulty, 38.1% experienced moderate sleep difficulty, and 9.6% indicated severe sleep difficulty. Participants in the present study had slightly better sleep quality than those in a study by Reishtein (2005) who had a mean of 8.69.

There were no significant relationships between sleep quality and any of the dimensions of fatigue. The lack of significant relationships may be attributed to the longer one-month assessment time interval of sleep disturbances when compared to the shorter assessment time intervals for the MFI and HADS, the longer one-month recall of sleep disturbances required in the PSQI, and the use of a small sample size. The sample size calculation was based on the MFI, and not the PSQI; therefore, there may have been insufficient power to detect a significant relationship. There have been conflicting findings on the relationship between sleep quality and fatigue. Significant relationships between sleep quality and fatigue were noted by Kapella et al. (2006) and Oh et al. (2004), but not in another study conducted by Reishtein (2005). While all these studies used the PSQI, a single item measuring sleep quality was used by Oh et al. The lack of a significant relationship between fatigue and sleep quality has also been found in other clinical populations. Lee et al. (1999) found that sleep disturbance was a poor predictor of fatigue in women with HIV.

6.11 Other Findings

There were no significant differences among those who used supplemental oxygen and those who did not use supplemental oxygen; among ex-smokers, current smokers, and non-smokers; and among the different MRC Dyspnea Scale grades on the four dimensions of subjective fatigue. In addition, the number of co-morbidities and the amount of pulmonary rehabilitation received were both not significantly related to any of the fatigue dimensions. In one study conducted on the general population, there was a significant relationship between certain co-morbidities and fatigue in the general population (Loge et al., 1998). Although data on the specific co-morbidities were not collected, perhaps some of co-morbidities which the participants had in this present study may not have affected the amount of fatigue they experienced. If more specific data on the participants' co-morbidities were collected and categorized into various types, the significance of the relationship may have changed. The lack of a significant relationship between the amount of pulmonary rehabilitation received and fatigue was unexpected. This may have been due to some of the participants not attending pulmonary

rehabilitation regularly, which had been brought up by the coordinator of the program. The irregular attendance suggests the need for a longitudinal assessment.

6.12 Recommendations for Future Studies

Some recommendations for future studies include: examining other physiologic, psychologic and situational factors to determine their relationships with various dimensions of fatigue, recruiting more individuals from pulmonary rehabilitation programs since there has been limited research conducted with this particular group, examining whether pulmonary rehabilitation is effective in reducing fatigue levels, conducting longitudinal studies, conducting more validation studies for the use of the HADS in the COPD population, and including healthy older individuals for comparison studies.

6.13 Implications for Nursing Practice

Fatigue is prevalent in the COPD population, and should be assessed, monitored, and managed by nurses. The MFI is a practical instrument to use for assessing fatigue in pulmonary rehabilitation, which can easily be incorporated into the preliminary assessment, and can later be assessed and monitored by incorporating it into the periodic assessments. However, a single-dimensional instrument, such as a VAS may be more practical to use in a clinical setting to screen for the presence and severity of fatigue first, because it is quicker to complete than the MFI. The MFI could then be used to provide a more detailed assessment if needed. For research use, it would be more appropriate to use the MFI than single-dimensional instruments due to its comprehensiveness in assessing fatigue. Dyspnea is often assessed in individuals with COPD. Although fatigue is a very common and distressing symptom in individuals with COPD, it is poorly assessed and monitored in the clinical setting. Nurses and allied healthcare providers who work with clients with COPD not only in pulmonary rehabilitation, but also in the community and acute care settings could use both the VAS and MFI to assess for and monitor their clients' fatigue. Until the complexity of fatigue in COPD is better understood through more research, and more effective fatigue management strategies can then be developed, nurses and allied healthcare providers in the clinical setting can help stress the importance of fatigue in COPD by assessing and monitoring it.

6.14 Strengths

This present study was one of the few studies that have examined different dimensions of fatigue in the COPD and pulmonary rehabilitation populations. Other strengths of this study

included: (a) the high participation rate, and (b) the use of a multidimensional fatigue instrument which is more comprehensive in assessing fatigue than single-dimensional instruments.

6.15 Limitations

Some limitations of this present study included: (a) the uncontrolled extraneous variables, (b) the convenience sampling method, (c) not having a control group for comparison, (d) the possibility of social desirability bias, (e) the missing data, (f) the possibility of an inadequate sample size and insufficient statistical power for finding a significant relationship between anxiety, depression, and sleep quality for the four dimensions of fatigue, and (g) the increased possibility of making a type I error. The uncontrolled extraneous variables including: age, gender, co-morbidities, smoking status, supplemental oxygen use, and amount of pulmonary of rehabilitation received may affect internal validity. The non-probability convenience sampling method used does not assure that every individual with COPD in the COPD population has an equal chance of being included in the sample, which limits the generalizability of the findings. Therefore, one should be cautioned in generalizing the findings from this study to other individuals with COPD. Only individuals with COPD who attended pulmonary rehabilitation were included in the study. Others with COPD who are affected by the distressing effects of fatigue were excluded. Since self-report questionnaires were used in this study, participants may have responded in a manner that is favoured by society and not respond accurately to reflect their situation. The missing data on the MRC Dyspnea Scale grades may have affected the significance of the relationships between dyspnea and the different dimensions of fatigue. The missing data on pulmonary function tests affected the accurateness in the description of the participants' characteristics. The sample size calculation was based on the MFI, and not on the HADS or PSQI. The sample size may have been too small for examining anxiety, depression, and sleep quality; therefore, there may have been insufficient statistical power to detect a significant relationship between these influencing factors and the four dimensions of fatigue. By running multiple separate comparison and correlational models for each variable, there is an increased possibility of making a type I error.

6.16 Other Considerations

Complete and current data for all 42 participants for the MRC Dyspnea Scale and the PFTs would have been helpful. The data for the PFTs would have been helpful to describe the participant characteristics more accurately. If this study were to be repeated, assessing activity

limitation, followed by measuring heart rate and oxygen saturation, dyspnea, and fatigue would be completed at one time by the researcher. Depression, anxiety, and sleep quality would then be measured by the researcher immediately or shortly afterwards at another time depending on the participants' preference. Following this order of assessment can help reduce the variability in the assessment times, and increase the reliability of the 6MWT. More stringent data collection methods for assessing the participants' attendance would be helpful in examining the amount of pulmonary rehabilitation received more accurately, and more specific data on the types of comorbidities would be collected.

The MFI and PSQI were appropriate instruments to use with this population because many participants found that they were easy and quick to complete. The MFI measured various dimensions of fatigue, and the PSQI measured various sleep disturbances in a short period of time and commitment on the participants' part. The researcher found some difficulty interpreting the scores in both instruments because of the lack of specific guidelines to help understand the ranges of scores and its associated meaning. The MFI and PSQI may be more useful on a comparative basis to help measure changes over time for fatigue and sleep quality. The HADS has not been used extensively in the COPD population. More validation studies are needed to determine whether the HADS is an appropriate instrument to measure anxiety and depression in the COPD population. The conceptual framework used in this present study worked well in conceptualizing the relationships between the influencing factors and three of the four fatigue dimensions (emotional, behavioural, and cognitive). Guided by the results of the study, the general fatigue dimension should not be conceptualized together with the physical fatigue dimension. Therefore, the new conceptual framework would include five dimensions of subjective fatigue (emotional, behavioural, cognitive, physical, and general).

6.17 Conclusion

Fatigue is a complex and multidimensional sensation which is common in individuals with COPD. Its distressing effects are reported to negatively affect these individuals' functioning in terms of their quality of life. Fatigue in COPD has not been a well researched area when compared to other chronic illnesses such as cancer. However, from the research that has examined fatigue in COPD, most have focused on a single dimension: the intensity or severity of the fatigue experienced. Limited research has been conducted to examine the various dimensions of fatigue in the COPD population, and some factors that may be related to the fatigue

experienced. The results of this feasibility study suggested that: (a) most of the participants (61.9 - 81.0%) experienced moderate levels of subjective fatigue in all four dimensions (emotional, behavioural, cognitive, and physical), (b) moderate to severe levels of physical fatigue were experienced in 95.3% of the participants, (c) the only significant relationship was between anxiety and emotional fatigue; all other relationships were statistically insignificant, (d) there were no significant differences between sex, supplemental oxygen use, smoking status, and severity of dyspnea based on the MRC Dyspnea Scale grades on the four dimensions of subjective fatigue, and (e) many of the participants had probable presence of clinical anxiety (42.9%), where the prevalence of anxiety was nearly twice as high as depression (21.4%). The findings from this study will help healthcare professionals increase their understanding of fatigue in individuals with COPD who attend pulmonary rehabilitation, and work towards developing effective interventions in reducing the distressing effects of fatigue to help improve the quality of life in these individuals.

References

- Aaronson, L. S., Teel, C. S., Cassmeyer, V., Neuberger, G. B., Pallikkathayil, L., Pierce, J., et al. (1999). Defining and measuring fatigue. *The Journal of Nursing Scholarship*, 31(1), 45-50.
- American Thoracic Society. (2002). ATS statement: Guidelines for the six-minute walk test. *American Journal of Respiratory and Critical Care Medicine*, 166, 111-117.
- Ang, D. C., & Calabrese, L. H. (1999). A common-sense approach to chronic fatigue in primary care. *Cleveland Clinical Journal of Medicine*, 66(6), 343-352.
- Aylard, P. R., Gooding, J. H., McKenna, P. J., & Snaith, R. P. (1987). A validation study of three anxiety and depression self-assessment scales. *Journal of Psychosomatic Research*, 31(2), 261-268.
- Bakshi, R., Miletich, R. S., Henschel, K., Shaikh, Z. A., Janardhan, V., Wasay, M., et al. (1999). Fatigue in multiple sclerosis: Cross sectional correlation with brain MRI findings in 71 patients. *Neurology*, 53, 1151-1153.
- Belza, B. L. (1995). Comparison of self-reported fatigue in rheumatoid arthritis and controls. *The Journal of Rheumatology*, 22, 639-643.
- Belza, B. L., Henke, C. J., Yelin, E. H., Epstein, W. V., & Gilliss, C. L. (1993). Correlates of fatigue in older adults with rheumatoid arthritis. *Nursing Research*, 42(2), 93-99.
- Bernstein, M. L., Despars, J. A., Singh, N. P., Avalos, K., Stansbury, D. W., & Light, R. W. (1994). Reanalysis of the 12-minute walk in patients with chronic obstructive pulmonary disease. *Chest*, 105, 163-167.
- Bestall, J. C., Paul, E. A., Garrod, R., Garnham, R., Jones, P. W., & Wedzicha, J. A. (1999). Usefulness of the Medical Research Council (MRC) dyspnoea scale as a measure of disability in patients with chronic obstructive pulmonary disease. *Thorax*, 54, 581-586.
- Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale; an updated review. *Journal of Psychiatric Research*, 52, 69-77.
- Blesch, K. S., Paice, J. A., Wickham, R., Harte, N., Schnoor, D. K., Purl, S., et al. (1991). Correlates of fatigue in people with breast or lung cancer. *Oncology Nursing Forum*, 18(1), 81-87.

- Bramley, P. N., Easton, A. M. E., Morley, S., & Snaith, R. P. (1988). The differentiation of anxiety and depression by rating scales. *Acta Psychiatrica Scandinavica*, 77, 133-138.
- Breitbart, W., McDonald, M. V., Rosenfeld, B., Monkman, N. D., & Passik, S. (1998). Fatigue in ambulatory AIDS patients. *Journal of Pain and Symptom Management*, 15(3), 159-167.
- Breslin, E., van der Schans, C., Breukink, S., Meek, P., Mercer, K., Volz, W., et al. (1998). Perception of fatigue and quality of life in patients with COPD. *Chest*, 114, 958-964.
- Breukink, S. O., Strijbos, J. H., Koorn, M., Koeter, G. H., Breslin, E. H., & van der Schans, C. P. (1998). Relationship between subjective fatigue and physiological variables in patients with chronic obstructive pulmonary disease. *Respiratory Medicine*, 92, 676-682.
- Burns, N., & Grove, S. (2005). *The practice of nursing research: Conduct, critique, and utilization* (5th ed.). St. Louis, MO: Elsevier Saunders.
- Burns, S. M. (1991). Preventing diaphragm fatigue in the ventilated patient. *Dimensions in Critical Care Nursing*, 10(1), 13-20.
- Butland, R. J. A., Pang, J., Gross, E. R., Woodcock, A. A., & Geddes, D. M. (1982). Two-, six-, and 12-minute walking tests in respiratory disease. *British Medical Journal*, 284, 1607-1608.
- Buysse, D. J., Reynolds, C. F., III, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193-213.
- Canadian Lung Association. *COPD*. Retrieved June 1, 2008 from http://www.lung.ca/diseases/maladies/copd-mpoc/what-quoi/index_e.php
- Carpenter, J. S., & Andrykowski, M. A. (1998). Psychometric evaluation of the Pittsburgh Sleep Quality Index. *Journal of Psychosomatic Research*, 45(1), 5-13.
- Carter, R., Holiday, D. B., Nwasuruba, C., Stocks, J., Grothues, C., & Tiep, B. (2003). 6-minute walk work for assessment of functional capacity in patients with COPD. *Chest*, 123, 1408-1415.
- Cimprich, B., & Ronis, D. L. (2001). Attention and symptom distress in women with and without breast cancer. *Nursing Research*, 50(2), 86-94.
- Colombo, B., Boneschi, F. M., Rossi, P., Rovaris, M., Maderna, L., Filippi, M., et al. (2000). MRI and motor evoked potential findings in nondisabled multiple sclerosis patients with and without symptoms of fatigue. *Journal of Neurology*, 247, 506-509.

- Curt, G. A. (2000a). The impact of fatigue on patients with cancer: Overview of fatigue 1 and 2. *The Oncologist*, 5 (Suppl 2), 9-12.
- Curt, G. A. (2000b). The impact of fatigue on quality of life in oncology patients. *Seminars in Hematology*, 37, (4 Suppl 6), 14-17.
- Darbee, J. C., & Ohtake, P. J. (2006). Outcome measures in cardiopulmonary physical therapy: Medical Research Council (MRC) dyspnea scale. *Cardiopulmonary Physical Therapy Journal*, 17(1), 29-37.
- de Jong, W., van Aalderen, W. M. C., Kraan, J., Koeter, G.H., & van der Schans, C. P. (2001). Inspiratory muscle training in patients with cystic fibrosis. *Respiratory Medicine*, 95(1), 31-36.
- de Jong, W., van der Schans, C. P., Mannes, G. P. M., van Aalderen, W. M. C., Grevink, R. G., & Koeter, G. H. (1997). Relationship between dyspnoea, pulmonary function and exercise capacity in patients with cystic fibrosis. *Respiratory Medicine*, 91, 41-46.
- Dowson, C., Laing, R., Barraclough, R., Town, I., Mulder, R., Norris, K., et al. (2001). The use of the Hospital Anxiety and Depression Scale (HADS) in patients with chronic obstructive pulmonary disease: A pilot study. *New Zealand Medical Journal*, 114, 447-449.
- Dunbar, S. B., Kimble, L. P., Jenkins, L. S., Hawthorne, M., Dudley, W., Slemmons, M., et al. (1999). Association of mood disturbance and arrhythmic events in patients after cardioverter defibrillator implantation. *Journal of Depression and Anxiety*, 9(4), 163-168.
- Enright, P. L. (2003). The six-minute walk test. *Respiratory Care*, 48(8), 783-785.
- Epstein, K. R. (1995). The chronically fatigued patient. *Medical Clinics of North America*, 79(2), 315-327.
- Fletcher, C. M. (1960). Standardized questionnaire on respiratory symptoms: A statement prepared and approved by the Medical Research Council's Committee on the Aetiology of Chronic Bronchitis. *British Medical Journal*, 2, 1665.
- Friedman, M. M., & King, K. B. (1995). Correlates of fatigue in older women with heart failure. *Heart & Lung*, 24, 512-518.
- Gentile, S., Delaroziere, J. C., Favre, F., Sambuc, R., & San Marco, J. L. (2003). Validation of the French 'multidimensional fatigue inventory' (MFI 20). *European Journal of Cancer Care*, 12, 58-64.

- Gift, A. G., & Pugh, L. C. (1993). Dyspnea and fatigue. *Nursing Clinics of North America*, 28(2), 373-384.
- Gift, A. G., & Shepard, C. E. (1999). Fatigue and other symptoms in patients with chronic obstructive pulmonary disease: Do women and men differ? *Journal of Obstetric, Gynecologic and Neonatal Nursing*, 28, 201-208.
- Gillis, A., & Jackson, W. (2002). *Research for nurses: Methods and interpretation*. Philadelphia: F. A. Davis Company.
- Glaus, A. (1993). Assessment of fatigue in cancer and no-cancer patients. *Journal of Supportive Care Cancer*, 1, 305-315.
- Glaus, A., Crow, R., & Hammond, S. (1996). A qualitative study to explore the concept of fatigue/tiredness in cancer patients and healthy individuals. *Journal of Supportive Care Cancer*, 4, 82-86.
- Groopman, J. E. (1998). Fatigue in cancer and HIV/AIDS. *Oncology*, 12(3), 335-346.
- Grant, A., & Moore, L. (2007). Pulmonary rehabilitation. In L. Blackler, C. Jones & Mooney, C. (Eds.), *Managing chronic obstructive pulmonary disease* (pp. 85-111). West Sussex, England: John Wiley & Sons, Ltd.
- Graydon, J. E., & Ross, E. (1995). Influence of symptoms, lung function, mood, and social support on level of functioning of patients with COPD. *Research in Nursing & Health*, 18, 525-533.
- Graydon, J. E., Ross, E., Webster, P. M., Goldstein, R. S., & Avendano, M. (1995). Predictors of functioning of patients with chronic obstructive pulmonary disease. *Heart & Lung*, 24, 369-375.
- Gudmundsson, G., Gislason, T., Janson, C., Lindberg, E., Hallin, R., Ulrik, C. S., et al. (2005). Risk factors for rehospitalisation in COPD: Role of health status, anxiety and depression. *European Respiratory Journal*, 26, 414-419.
- Guell, R., Resqueti, V., Sangenis, M., Morante, F., Martorell, B., Casan, P. et al. (2006). Impact of pulmonary rehabilitation on psychosocial morbidity in patients with severe COPD. *Chest*, 129, 899-904.
- Guyatt, G. H., Townsend, M., Keller, J., Singer, J., & Nogradi, S. (1989). Measuring functional status in chronic lung disease: Conclusions from a randomized control trial. *Respiratory Medicine*, 83, 293-297.

- Hagelin, C. L., Wengstrom, Y., Runesdotter, S., & Furst, C. J. (2007). The psychometric properties of the Swedish multidimensional fatigue inventory MFI-20 in four different populations. *Acta Oncologica, 46*(1), 97-104.
- Hajiro, T., Nishimura, K., Tsukino, M., Ikeda, A., & Oga, T. (2000). Stages of disease severity and factors that affect the health status of patients with chronic obstructive pulmonary disease. *Respiratory Medicine, 94*, 841-846.
- Herrmann, C. (1997). International experiences with the Hospital Anxiety and Depression Scale – a review of validation data and clinical results. *Journal of Psychosomatic Research, 42*, 17-41.
- Hulley, S. B., Cummings, S. R., Brownder, W. S., Grady, D., Hearst, N., & Newman, T. B. (2001). *Designing clinical research: An epidemiologic approach* (2nd ed.). Philadelphia: Lippincott Williams & Wilkins.
- Irvine, D., Vincent, L., Graydon, J. E., Bubela, H., & Thompson, L. (1994). The prevalence and correlates of fatigue in patients receiving treatment with chemotherapy and radiotherapy: A comparison with the fatigue experienced by healthy individuals. *Cancer Nursing, 17*(5), 367-378.
- Irvine, J., Basinski, A., Baker, B., Jandciu, S., Paquette, M., Cairns, J., et al. (1999). Depression and risk of sudden cardiac death after acute myocardial infarction. Testing for the confounding effects of fatigue. *Psychosomatic Medicine, 61*(6), 729-737.
- Janson-Bjerklie, S., Carrieri, V. K., & Hudes, M. (1986). The sensations of pulmonary dyspnea. *Nursing Research, 35*(3), 154-159.
- Kapella, M. C., Larson, J. L., Patel, M. K., Covey, M. K., & Berry, J. K. (2006). Subjective fatigue, influencing variables, and consequences in chronic obstructive pulmonary disease. *Nursing Research, 55*(1), 10-17.
- Kayahan, B., Karapolat, H., Atyntoprak, E., Atasever, A., & Ozturk, O. (2006). Psychological outcomes of an outpatient pulmonary rehabilitation program in patients with chronic obstructive pulmonary disease. *Respiratory Medicine, 100*, 1050-1057.
- Kinsman, R. A., Fernandez, E., Schocket, M., Dirks, J. F., & Covino, N. A. (1983). Multidimensional analysis of the symptoms of chronic bronchitis and emphysema. *Journal of Behavioral Medicine, 6*(4), 339-357.

- Knobel, H., Loge, J. H., Lund, M. B., Forfang, K., Nome, O., & Kaasa, S. (2001). Late medical complications and fatigue in Hodgkin's Disease survivors. *Journal of Clinical Oncology*, *19*(13), 3226-3233.
- Krishnasamy, M. (1997). Exploring the nature and impact of fatigue in advanced cancer. *International Journal of Palliative Nursing*, *3*(3), 126-131.
- Krishnasamy, M. (2000). Fatigue in advanced cancer – meaning before measurement? *International Journal of Nursing Studies*, *37*, 401-414.
- Lacasse, Y., Maltais, F., & Goldstein, R. S. (2004). Pulmonary rehabilitation: An integral part of the long-term management of COPD. *Swiss Medical Weekly*, *134*, 601-605.
- Lee, E. H. (1999). Construct validity of the Revised Piper Fatigue Scale in Korean women with breast cancer. *Journal of the Korean Academy of Nursing*, *29*, 485-493.
- Lee, E. H. (2001). Fatigue and hope: Relationships to psychosocial adjustment in Korean women with breast cancer. *Applied Nursing Research*, *14*(2), 87-93.
- Lee, K. A., Hicks, G., & Nino-Murcia, G. (1991). Validity and reliability of a scale to assess fatigue. *Psychiatry Research*, *36*, 291-298.
- Lee, K. A., Portillo, C. J., & Miramontes, H. (1999). The fatigue experience for women with human immunodeficiency virus. *Journal of Obstetric, Gynecologic and Neonatal Nursing*, *28*, 193-200.
- Lenz, E. R., Pugh, L. C., Milligan, R., Gift, A., & Suppe, F. (1997). The middle-range theory of unpleasant symptoms: An update. *Advances in Nursing Science*, *19*(3), 14-27.
- Loge, J. H., Ekeberg, O., & Kaasa, S. (1998). Fatigue in the general Norwegian population: Normative data and associations. *Journal of Psychosomatic Research*, *45*, 53-65.
- Lorenzi, C. M., Cilione, C., Rizzardi, R., Furino, V., Bellantone, T., Lugli, D., et al. (2004). Occupational therapy and pulmonary rehabilitation of disabled COPD patients. *Respiration*, *71*, 246-251.
- Mahler, D. A., & Wells, C. K. (1988). Evaluation of clinical methods for rating dyspnea. *Chest*, *93*, 580-586.
- Mak, V. H., Bugler, J. R., Roberts, C. M., & Spiro, S. G. (1993). Effect of arterial oxygen desaturation on six minute walk distance, perceived effort, and perceived breathlessness in patients with airflow limitation. *Thorax*, *48*, 33-38.

- McCann, K., & Boore, J. R. P. (2000). Fatigue in persons with renal failure who require maintenance haemodialysis. *Journal of Advance Nursing*, 32(5), 1132-1142.
- Mendoza, T. R., Wang, X. S., Cleeland, C. S., Morrissey, M., Johnson, B. A., Wendt, J. K., et al. (1999). The rapid assessment of fatigue severity in cancer patients: Use of the Brief Fatigue Inventory, 85(5), 1186-1196.
- Moorey, S., Greer, S., Watson, M., Gorman, C., Rowden, L., Tunmore, R., Robertson, B., & Bliss, J. (1991). The factor structure and factor stability of the Hospital Anxiety and Depression Scale in patients with cancer. *British Journal of Psychiatry*, 158, 255-259.
- Nardini, S. (1995). Respiratory muscle function and COPD. *Monaldi Archives for Chest Disease*, 50, 325-336.
- National Institute of Mental Health. *Anxiety disorders*. Retrieved June 1, 2008 from <http://www.nimh.nih.gov/health/topics/anxiety-disorders/index.shtml>
- National Institute of Mental Health. *Depression*. Retrieved June 1, 2008 from <http://www.nimh.nih.gov/health/publications/depression/complete-publication.shtml>
- Ninan, P. T., & Dunlop, B. W. (2006). *Contemporary diagnosis and management of anxiety disorders*. Newtown, PA: Handbooks in Health Care Co.
- O'Donnell, D. E., Hernandez, P., Kaplan, A., Aaron, S., Bourbeau, J., Marciniuk, D., et al. (2008). Canadian Thoracic Society recommendations for management of chronic obstructive pulmonary disease – 2008 update – highlights for primary care. *Canadian Respiratory Journal*, 15(suppl B), 1A-8A.
- O'Toole, M. T. (Ed). (1997). *Miller-Keane encyclopedia & dictionary of medicine, nursing & allied health*. Philadelphia: W. B. Saunders Company.
- Oh, E. G, Kim, C. J., Lee, W. H., & Kim, S. S. (2004). Correlates of fatigue in Koreans with chronic lung disease. *Heart & Lung*, 33(1), 13-20.
- Payne, S. A. (1992). A study of quality of life in cancer patients receiving palliative chemotherapy. *Social Science & Medicine*, 35(12), 1505-1509.
- Paz-Diaz, H., Montes de Oca, M., Lopez, J. M., & Celli, B. R. (2007). Pulmonary rehabilitation improves depression, anxiety, dyspnea and health status in patients with COPD. *American Journal of Physical Medicine & Rehabilitation*, 86, 30-36.
- Pickard-Holley, S. (1991). Fatigue in cancer patients: A descriptive study. *Cancer Nursing*, 14, 13-19.

- Piper, B. F. (2003). Fatigue. In V. Carrieri-Kohlman, A. M. Lindsey, & C. M. West (Eds.), *Pathophysiological phenomena in nursing* (3rd ed.) (pp. 209-234). St. Louis, MO: Saunders.
- Piper, B. F. (2004). Measuring fatigue. In M. Frank-Stromborg, & Olsen, S. J. (Eds.), *Instruments for clinical health-care research* (3rd ed.) (pp. 538-569). Sudbury, MA: Jones and Barlett Publishers.
- Piper, B. F., Lindsey, A. M., & Dodd, M. J. (1987). Fatigue mechanisms in cancerpatients: Developing nursing theory. *Oncology Nursing Forum*, 14(6), 17-23.
- Potempa, K. M. (1993). Chronic fatigue. *Annual Review of Nursing Research*, 11, 57-76.
- Press, A. N., Williams, P. D., & Wingate, A. (1999). Defining and measuring fatigue. *Journal of Nursing Scholarship*, 31(1), 45-50.
- Ream, E., & Richardson, A. (1996). Fatigue: A concept analysis. *International Journal of Nursing Studies*, 33(5), 519-529.
- Ream, E., & Richardson, A. (1997). Fatigue in patients with cancer and chronic obstructive airways disease: A phenomenological enquiry. *International Journal of Nursing Studies*, 34(1), 44-53.
- Reishtein, J. L. (2005). Relationship between symptoms and functional performance in COPD. *Research in Nursing & Health*, 28, 39-47.
- Scott, M. L. (2004). Measuring dyspnea. In M. Frank-Stromborg, & Olsen, S. J. (Eds.), *Instruments for clinical health-care research* (3rd ed.) (pp. 523-534). Sudbury, MA: Jones and Barlett Publishers.
- Sliwa, J. A. (2000). Neuromuscular rehabilitation and electrodiagnosis: 1. Central neurologic disorders. *Archives of Physical Medicine and Rehabilitation*, 81, S3-S112.
- Small, S. P., & Graydon, J. E. (1992). Perceived uncertainty, physical symptoms, and negative mood in hospitalized patients with chronic obstructive pulmonary disease. *Heart & Lung*, 21, 568-574.
- Small, S., & Lamb, M. (1999). Fatigue in chronic illness: The experience of individuals with chronic obstructive pulmonary disease and with asthma. *Journal of Advanced Nursing*, 30(2), 469-478.

- Smets, E. M. A., Garssen, B., Bonke, B., & de Haes, J. C. J. M. (1995). The Multidimensional Fatigue Inventory (MFI); psychometric qualities of an instrument to assess fatigue. *Journal of Psychomatic Research, 39*(5), 315-325.
- Smets, E. M. A., Garssen, B., Cull, A., & de Haes, J. C. J. M. (1996). Application of the multidimensional fatigue inventory (MFI-20) in cancer patients receiving radiotherapy. *British Journal of Cancer, 73*, 241-245.
- Smyth, C. A. (2008). Evaluating sleep quality in older adults. *American Journal of Nursing, 108*(5), 42-50.
- Soderstrom, M. S., & Grimm, P. M. (2004). Measuring fatigue. In M. Frank-Stromborg, & Olsen, S. J. (Eds.), *Instruments for clinical health-care research* (3rd ed.) (pp. 362-375). Sudbury, MA: Jones and Barlett Publishers.
- Solway, S., Brooks, D., Lacasse, Y., & Thomas, S. (2001). A qualitative systematic overview of the measurement properties of functional walk tests used in the cardiorespiratory domain. *Chest, 119*, 256-270.
- Starobin, D., Kramer, M. R., Yarmolovsky, A., Bendayan, D., Rosenberg, I., Sulkes, J., et al. (2006). *The Israel Medical Association Journal, 8*, 460-463.
- Sussman, S., Nezami, E., Pokhrel, P., & Ames, S. L. (2007). Motivation in health behaviour research and practice. In P. W. O'Neal (Ed.), *Motivation of health behavior* (pp. 5-14). New York: Nova Science Publishers, Inc.
- Tench, C. M., McCurdie, I., White, P. D., & D'Cruz, D. P. (2000). The prevalence and associations of fatigue in systemic lupus erythematosus. *Rheumatology, 39*, 1249-1254.
- Theander, K., & Unosson, M. (2004). Fatigue in patients with chronic obstructive pulmonary disease. *Journal of Advanced Nursing, 45*(2), 172-177.
- Wijkstra, P. J., TenVergert, E. M., van der Mark, T. W., Postma, D. S., Van Altena, R., Kraan, J., et al. (1994). Relation of lung function, maximal inspiratory pressure, dyspnoea, and quality of life with exercise capacity in patients with chronic obstructive pulmonary disease. *Thorax, 49*, 468-472.
- Winningham, M. L., Nail, L. M., Burke, M. B., Brophy, L., Cimprich, B., Jones, J. S., et al. (1994). Fatigue and the cancer experience: The state of the knowledge. *Oncology Nursing Forum, 21*(1), 23-36.

- Withers, N. J., Rudkin, S. T., & White, R. J. (1999). Anxiety and depression in severe chronic obstructive pulmonary disease: The effects of pulmonary rehabilitation. *Journal of Cardiopulmonary Rehabilitation, 19*(6), 362-365. Retrieved February 15, 2009, from Ovid Medline database.
- Woo, K. (2000a). A pilot study to examine the relationships of dyspnoea, physical activity and fatigue in patients with chronic obstructive pulmonary disease. *Journal of Clinical Nursing, 9*, 526-533.
- Woo, K. (2000b). Physical activity as a mediator between dyspnea and fatigue in patients with chronic obstructive pulmonary disease. *Canadian Journal of Nursing Research, 32*(3), 85-98.
- Zigmond, A. S., & Snaith, R. P. The Hospital Anxiety and Depression Scale. (1983). *Acta Psychiatrica Scandinavica, 67*, 361-370.

Appendix A: Ethics Certificate of Approval



UNIVERSITY OF
SASKATCHEWAN

Behavioural Research Ethics Board (Beh-REB)

Certificate of Approval

PRINCIPAL INVESTIGATOR
Donna Goodridge

DEPARTMENT
Nursing

BEH#
08-215

INSTITUTION(S) WHERE RESEARCH WILL BE CONDUCTED
University of Saskatchewan
Saskatoon SK

SUB-INVESTIGATOR(S)
Donna Rennie, Darcy D. Marciniuk

STUDENT RESEARCHERS
Cindy Wong

SPONSOR
SASKATCHEWAN HEALTH RESEARCH FOUNDATION (SHRF)

TITLE
Assessment of Fatigue in Patients with COPD Participating in a Pulmonary Rehabilitation Program: A Feasibility Study

ORIGINAL REVIEW DATE	APPROVAL ON	APPROVAL OF:	EXPIRY DATE
15-Sep-2008	09-Oct-2008	Ethics Application Consent Protocol	08-Oct-2009

Full Board Meeting

Date of Full Board Meeting:

Delegated Review

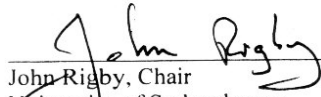
CERTIFICATION

The University of Saskatchewan Behavioural Research Ethics Board has reviewed the above-named research project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

ONGOING REVIEW REQUIREMENTS


In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: http://www.usask.ca/research/ethics_review/


John Rigby, Chair
University of Saskatchewan
Behavioural Research Ethics Board

Please send all correspondence to:

Ethics Office
University of Saskatchewan
Room 302 Kirk Hall, 117 Science Place
Saskatoon SK S7N 5C8
Telephone: (306) 966-2975 Fax: (306) 966-2069

Appendix B: Letter of Operational Approval

	<p>Research Services Unit Strategic Health Information & Planning Services (SHIPS) Joanne Franko, Manager Suite 300 Saskatoon Square 410 22nd St E Saskatoon, SK S7K 5T6 Phone: 306.655.3356 Fax: 306.655.3373</p>
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DATE: October 17, 2008

TO: Dr. Donna Goodridge, Associate Professor
College of Nursing
University of Saskatchewan

FROM: Joanne Franko
Manager, Research Services Unit

RE: **RESEARCH PROJECT ETHICS COMMITTEE (EC)#:** B2008-215
PROJECT NAME: assessment of Fatigue in patients with COPD Participating in a
Pulmonary Rehabilitation Program: A Feasibility Study
PROTOCOL #: N/A

Saskatoon Health Region is pleased to provide you with operational approval of the above-mentioned research project.

Please advise me when the data collection phase of the research project is completed. I would also appreciate receiving a summary of the results for this research project. As well, any publications or presentations that result from this research should include a statement acknowledging the assistance of Saskatoon Health Region.

I would like to wish you every success with your project. If you have any questions, please contact our office at 655-3351.

Yours truly,



Laurel Ducek, Director, SHIPS for
Joanne Franko, M.Sc.
Manager, Research Services Unit

cc: Rick Stene, Manager, Exercise Cardiology, RUH
Trent Litzenger, Coordinator, Pulmonary Rehab Program, RUH

Contact the researcher

- Contact the researcher to learn more about this study or if you would like to participate in this study

Researcher's contact information:

Cindy Wong, BSN, RN
Graduate Student
College of Nursing
University of Saskatchewan
Phone: (306) 262 - 6882
E-mail: cjw920@mail.usask.ca

You may also contact the research supervisor

Research supervisor's contact information:

Dr. Donna Goodridge, PhD, RN
Associate Professor
College of Nursing
University of Saskatchewan
Phone: (306) 966 - 1478
E-mail:
donna.goodridge@usask.ca

Help to improve our knowledge about fatigue in COPD



"Improving our knowledge about fatigue in COPD, one step at a time."

* This study has been approved by the University of Saskatchewan Behavioural Research Ethics Board and by the Saskatoon Health Region

If you have any questions about your right in participating in research studies, please contact the Ethics Office at (306) 966 - 2084. If you call from out of town, you may call collect.

Image on the front page taken from <http://ideaseller.typepad.com/photos/uncategorized/exhausted.jpg>

Image on the last page taken from <http://www.lincare.com/news/2003fall/climbing%20stairs.JPG>

Do you often feel fatigued or tired?



Fatigue affects the daily lives of people with COPD

? Did you know that fatigue is common in people who have COPD, yet little is known about it?

Learn more about how you can be part of this interesting research study!

What is fatigue?

- Fatigue is tiredness or lack of energy

What we know about fatigue in people who have COPD

- Fatigue is common in people with COPD
- Fatigue greatly affects many parts of their lives in a negative way, such as quality of life

What we don't know

- We don't understand fatigue very well in people who have COPD
- We don't have a good understanding of what factors can affect fatigue in people who have COPD

Want to help us better understand fatigue?

- Participate in this research study

- The purpose of this study is to find out how some factors may be affecting fatigue in people who have COPD. The main factors that will be studied are: fatigue, shortness of breath, how far a person with COPD can walk in the 6-minute walk test, depression, anxiety, sleep quality, how fast the heart beats in a person with COPD, and the amount of oxygen in the blood of a person with COPD. How these factors relate to fatigue will also be studied.

- This study can eventually help reduce fatigue in people who have COPD

What will I be asked to do in this study?

- You will be asked to answer questions on 4 forms. The first 3 forms will take about 5 - 10 minutes each to complete. These forms are about fatigue, depression and anxiety, and sleep quality. The last form is very short and will help the researcher understand more about the people in this study.

- The researcher will meet with you and guide you through these questions

What information will the researcher gather?

- The forms you completed (your name will not appear on any of the forms)
- Some information from your health record (with your consent)
- This information includes: smoking status, other medical conditions you may have, if you use an oxygen tank, medications, lung function tests, how fast your heart beats, the amount of oxygen in your blood, how short of breath you get when you are doing physical exercise, how far you walked in the 6-minute walk test, and the amount of pulmonary rehabilitation you have received
- Collecting this information will help to find out if these factors can also affect fatigue

Want to participate in this study or want to learn more?

Turn to the back of this brochure!



Appendix D:
Consent Form for Participation in Research Study

Unique Identification Number: _____

You are invited to participate in a research study called, Assessment of Fatigue in Patients with Chronic Obstructive Pulmonary Disease (COPD) Participating in a Pulmonary Rehabilitation Program: A Feasibility Study. Please read this form carefully, and feel free to ask questions you might have.

Researcher: Cindy Wong, B.S.N., R.N.; College of Nursing, University of Saskatchewan.
Phone number: (306) 262-6882; E-mail: cjw920@mail.usask.ca

Purpose and Procedure: The purpose of this study is to find out how some factors may be affecting fatigue in people with COPD. The main factors that will be studied are: fatigue, shortness of breath, how far a person with COPD can walk in the 6-minute walk test, depression, anxiety, sleep quality, how fast the heart beats in a person with COPD, and the amount of oxygen in the blood of a person with COPD. How these factors relate to fatigue will also be studied.

I will be giving you four forms to fill out which has questions on them. The first three forms will take about 5-10 minutes each to complete. The forms are about fatigue, depression and anxiety, and sleep quality. The last form is very short and collects information about your age and gender. Collecting this information will help me understand more about the individuals in this study. I will be guiding you through these questions to make sure that you understand them, and answer any questions you may have. In each form, I will be reading the questions out loud and displaying the question on a sheet of paper in large writing. We will continue this process until all the forms are complete.

Some information will be obtained from your health record (with your consent). This information includes: your lung function tests, the distance you walked in your 6-minute walk test, how short of breath you get when you are doing physical activity, how fast your heart beats, the amount of oxygen in your blood, the medications you are taking, your smoking status, the amount of pulmonary rehabilitation you have received, other medical conditions you may have, and if you use an oxygen tank. Collecting this important information from your health record will help me study whether these factors can affect fatigue in people with COPD. The information collected in this study will be reported in a group format for a thesis, possible publications (such as research articles), and possible presentations at conferences.

- I **give consent** for the researcher to access my health record.
- I **do not give consent** for the researcher to access my health record.

After the study is finished, you may receive the study's results. This can be done by writing your mailing address on a form I can give you.

Possible benefits: Participating in this study can help people involved in healthcare better understand the complex nature of fatigue, and what factors maybe affecting fatigue in people who have COPD. This study can eventually help reduce fatigue in people who have COPD. But, these benefits are not necessarily guaranteed.

Unique Identification Number: _____

Potential Risk: One possible discomfort to participating in this study is feeling fatigued or tired from completing the questionnaires. Please take your time in completing these questionnaires, but if you are feeling tired, please let me know and you are more than welcome to take breaks.

Storage of Data: All information will be stored in secured locations at the College of Nursing, University of Saskatchewan for five years. When the information is no longer required, it will be appropriately destroyed. Only the research team will be able to look at the information.

Confidentiality: Your name will not appear on any of the questionnaires or the demographic form. Please **do not put your name or any other identification** on any of these questionnaires or the demographic form. Instead, only a unique identification number will be used on the questionnaires and demographic form to help me keep track of the completed questionnaires and demographic form. I will be the only person who is aware of your identity. The master list of all the participants' names and unique identification numbers, the form you fill out if you would like to receive the study results, and the consent form will be stored separately from the rest of the data collected so that it will not be possible to associate a name with any information.

Right to Withdraw: Your participation will help to better understand the complex nature of fatigue, and what factors maybe affecting fatigue in people who have COPD. But, your participation is entirely your choice, and you can answer only those questions that you are comfortable with. There is no guarantee that you will personally benefit from your involvement, but you may be more aware of the amount of fatigue you experience. The information you share will be held in strict confidence and discussed only with the research team. You may withdraw your participation in the study for any reason, at any time, without penalty of any sort. Withdrawing your participation in the study will not affect your medical care or access to health care services. Should you choose to withdraw your participation in the study, the information you shared will be deleted from the research project and destroyed, at your request.

Questions: If you have any questions concerning the research project, please feel free to ask at any point. You are also free to contact me by phone or e-mail, as provided above if you have other questions. You may also contact the researcher supervisor, Dr. Donna Goodridge by phone at (306) 966-1478 or e-mail at donna.goodridge@usask.ca. This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board on October 9th, 2008, and by the Saskatoon Health Region on October 17th, 2008. If you have any questions about your rights as a participant, please contact the Ethics Office at (306) 966-2084. Out of town participants may call collect.

Consent to Participate: I have read and understood the description provided above. I have been provided with an opportunity to ask questions and my questions have been answered. I consent to participate in the research project, understanding that I may withdraw my consent at any time. A copy of this Consent Form has been given to me for my records.

Signature of Participant

Date

Signature of Researcher

Date

Appendix E: Demographic Form

Date: _____

Unique Identification Number: _____

Instructions: This form is designed to help the researcher understand more about the individuals in this study. Please answer each question by **placing an X in the most appropriate box or filling in the blank**. Please do not put your name, or any other identification on this form.

Age: _____ (in years)

Sex: Male Female

Thank you for taking the time to complete this form.

Appendix G: Request for Results From the Research Study

I would like to receive a copy of the results from the research study called, Assessment of Fatigue in Patients with Chronic Obstructive Pulmonary Disease (COPD) Participating in a Pulmonary Rehabilitation: A Feasibility Study.

Name:

Mailing Address:






City:

Province:

Postal Code:

Appendix I: Permission to Use MFI E-mail

Date: Wed, 06 Aug 2008 15:42:59 +0200
From: "E.M.A. Smets" <e.m.smets@amc.uva.nl> **Block Address**
Subject: **Re: Master Student Inquiring about the MFI**
To: "Cindy Wong" <cjw920@mail.usask.ca>

 Reply  Reply All  Forward  Print  Delete

Dear Cindy,
Please consider this as my formal permission for you to use the MFI.
There are no requirements on your part. For your information, please
find attached the questionnaire, scoring instructions and a
bibliography.
Good luck and kind regards,
Ellen

E.M.A. Smets PhD
Medical Psychology J3-220
Academic Medical Center, University of Amsterdam
P.O. box 22660
1100 DD Amsterdam
The Netherlands
tel: +31-(0)20-5664768
www.amc.nl/MedPsych

----- Original Message -----
From: Cindy Wong <cjw920@mail.usask.ca>
Date: Friday, July 11, 2008 7:42 pm
Subject: Re: Master Student Inquiring about the MFI
To: "E.M.A. Smets" <e.m.smets@amc.uva.nl>

> Dear Dr. Smets,
>
> I contacted a few months ago about the possibility of using the MFI
> in
> my thesis. I would like to use the MFI in my thesis and I have
> discussed this with my thesis committee members. Would it be possible
>
> if I could use the MFI, and if so, will you require anything on my
> part?
>
> Thank you
>
> Cindy

Appendix J: Permission to Use PSQI E-mail

Date: Mon, 14 Jul 2008 13:34:12 -0400
From: "Buysse, Daniel" <BuysseDJ@upmc.edu> **Block Address**
Subject: **RE: Masters Student Inquiring About the PSQI**
To: "Cindy Wong" <cjw920@mail.usask.ca>

 Reply  Reply All  Forward  Print  Delete

Cindy-

You have permission to use the PSQI in your thesis work. You can get further information by looking under the "Instruments" tab at www.sleep.pitt.edu. Good luck with your research.

Sincerely,

Daniel J. Buysse, M.D.
Professor of Psychiatry
University of Pittsburgh School of Medicine
E-1127 WPIC
3811 O'Hara St.
Pittsburgh, PA 15213
T: (412) 246-6413
F: (412) 246-5300
buyssej@upmc.edu

-----Original Message-----

From: Cindy Wong [<mailto:cjw920@mail.usask.ca>]
Sent: Monday, July 14, 2008 12:57 PM
To: Buysse, Daniel
Subject: Masters Student Inquiring About the PSQI

Dear Dr. Buysse,

My name is Cindy and I am a Master in Nursing student currently working on my thesis at the University of Saskatchewan, in Canada. My research involves examining relationships between various influencing factors (sleep quality is a factor I will be looking at) and the different dimensions of fatigue in chronic obstructive pulmonary disease patients. I would like to use the PSQI in my thesis and I have discussed this with my thesis committee members. Would it be possible if I could use the PSQI, and if so, will you require anything on my part and are there procedures to follow?

Thank you

Cindy

 Reply  Reply All  Forward  Print  Delete

Copyright © University of Saskatchewan 2003-2007

Appendix K: MFI

Date: _____

Unique Identification Number: _____

MFI® MULTIDIMENSIONAL FATIGUE INVENTORY

© E. Smets, B.Garssen, B. Bonke.

Instructions:

By means of the following statements we would like to get an idea of how you have been feeling **lately**.

There is, for example, the statement:

"I FEEL RELAXED"

If you think that this is **entirely true**, that indeed you have been feeling relaxed lately, please, place an **X** in the extreme left box; like this:

yes, that is true 1 2 3 4 5 **no, that is not true**

The more you **disagree** with the statement, the more you can place an **X** in the direction of "no, that is not true". Please do not miss out a statement and place only one **X** in a box for each statement.

1	I feel fit.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
2	Physically, I feel only able to do a little.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
3	I feel very active.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
4	I feel like doing all sorts of nice things.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
5	I feel tired.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
6	I think I do a lot in a day.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true

Unique Identification Number: _____

7	When I am doing something, I can keep my thoughts on it.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
8	Physically I can take on a lot.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
9	I dread having to do things.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
10	I think I do very little in a day.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
11	I can concentrate well.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
12	I am rested.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
13	It takes a lot of effort to concentrate on things.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
14	Physically I feel I am in a bad condition.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
15	I have a lot of plans.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
16	I tire easily.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
17	I get little done.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
18	I don't feel like doing anything.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
19	My thoughts easily wander.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true
20	Physically I feel I am in an excellent condition.	yes, that is true	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	no, that is not true

87

Thank you very much for your cooperation

* A copy of this instrument was produced for the purpose of the thesis. Additional copies and use of this instrument would need to be sought or purchased appropriately.

Permission to use the MFI was given by Dr. Smets

Smets, E. M. A., Garssen, B., Bonke, B., & de Haes, J. C. J. M. (1995). The Multidimensional Fatigue Inventory (MFI); psychometric qualities of an instrument to assess fatigue. *Journal of Psychomatic Research, 39*(5), 315-325.

Appendix L: HADS

(* Copy shown, originals were purchased from GL Assessment)

Date: _____

Unique Identification Number: _____

Hospital Anxiety and Depression Scale (HADS)



Name: _____ Date: _____

Clinicians are aware that emotions play an important part in most illnesses. If your clinician knows about these feelings he or she will be able to help you more.

This questionnaire is designed to help your clinician to know how you feel. Read each item below and **underline the reply** which comes closest to how you have been feeling in the past week. Ignore the numbers printed at the edge of the questionnaire.

Don't take too long over your replies, your immediate reaction to each item will probably be more accurate than a long, thought-out response.

FOLD HERE

FOLD HERE

	A	D			A	D
	3		I feel tense or 'wound up'	I feel as if I am slowed down		3
	2		Most of the time	Nearly all the time		2
	1		A lot of the time	Very often		1
	0		From time to time, occasionally	Sometimes		0
			Not at all	Not at all		
		0	I still enjoy the things I used to enjoy	I get a sort of frightened feeling like 'butterflies' in the stomach	0	
		1	Definitely as much	Not at all	1	
		2	Not quite so much	Occasionally	2	
		3	Only a little	Quite often	3	
			Hardly at all	Very often		
	3		I get a sort of frightened feeling as if something awful is about to happen	I have lost interest in my appearance		3
	2		Very definitely and quite badly	Definitely		2
	1		Yes, but not too badly	I don't take as much care as I should		1
	0		A little, but it doesn't worry me	I may not take quite as much care		0
			Not at all	I take just as much care as ever		
		0	I can laugh and see the funny side of things	I feel restless as if I have to be on the move	3	
		1	As much as I always could	Very much indeed	2	
		2	Not quite so much now	Quite a lot	1	
		3	Definitely not so much now	Not very much	0	
			Not at all	Not at all		
	3		Worrying thoughts go through my mind	I look forward with enjoyment to things		0
	2		A great deal of the time	As much as I ever did		1
	1		A lot of the time	Rather less than I used to		2
	0		Not too often	Definitely less than I used to		3
			Very little	Hardly at all		
		3	I feel cheerful	I get sudden feelings of panic	3	
		2	Never	Very often indeed	2	
		1	Not often	Quite often	1	
		0	Sometimes	Not very often	0	
			Most of the time	Not at all		
	0		I can sit at ease and feel relaxed	I can enjoy a good book or radio or television programme	0	
	1		Definitely	Often	1	
	2		Usually	Sometimes	2	
	3		Not often	Not often	3	
			Not at all	Very seldom		

Now check that you have answered all the questions

<p><small>This form is printed in green. Any other colour is an unauthorized photocopy.</small></p> <p><small>HADS copyright © R.P. Snaith and A.S. Zigmond, 1983, 1992, 1994.</small></p> <p><small>Record form items originally published in <i>Acta Psychiatrica Scandinavica</i> 67, 361-70, copyright © Munksgaard International Publishers Ltd, Copenhagen, 1983.</small></p> <p><small>This edition first published in 1994 by nferNelson Publishing Company Ltd.</small></p> <p><small>414 Chiswick High Road, London W4 5TF</small></p> <p><small>GL Assessment is part of Granada Learning Limited</small></p> <p><small>Printed in Great Britain</small></p>	<p>TOTAL</p>	<table border="1" style="margin: auto;"> <tr> <td style="width: 10px; height: 15px;"></td> <td style="width: 10px; height: 15px;"></td> </tr> </table>		
<p><small>Code 0090002511</small></p>		<p><small>9(1.08)</small></p>		

*A copy of this instrument was produced for the purpose of the thesis. Additional copies and use of this instrument would need to be sought or purchased appropriately.

Appendix M: PSQI

Date: _____

Unique Identification Number: _____

PITTSBURGH SLEEP QUALITY INDEX

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month.

Please answer all questions.

1. During the past month, what time have you usually gone to bed at night?

BED TIME _____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

NUMBER OF MINUTES _____

3. During the past month, what time have you usually gotten up in the morning?

GETTING UP TIME _____

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

HOURS OF SLEEP PER NIGHT _____

For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you . . .

a) Cannot get to sleep within 30 minutes

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-----------------------------------	-------------------------------	------------------------------	------------------------------------

b) Wake up in the middle of the night or early morning

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-----------------------------------	-------------------------------	------------------------------	------------------------------------

c) Have to get up to use the bathroom

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-----------------------------------	-------------------------------	------------------------------	------------------------------------

d) Cannot breathe comfortably

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-----------------------------------	-------------------------------	------------------------------	------------------------------------

e) Cough or snore loudly

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-----------------------------------	-------------------------------	------------------------------	------------------------------------

f) Feel too cold

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____
-----------------------------------	-------------------------------	------------------------------	------------------------------------

Unique Identification Number: _____

g) Feel too hot

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

h) Had bad dreams

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

i) Have pain

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

j) Other reason(s), please describe _____

How often during the past month have you had trouble sleeping because of this?

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

6. During the past month, how would you rate your sleep quality overall?

Very good _____

Fairly good _____

Fairly bad _____

Very bad _____

7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

Unique Identification Number: _____

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all _____

Only a very slight problem _____

Somewhat of a problem _____

A very big problem _____

*A copy of this instrument was produced for the purpose of the thesis. Additional copies and use of this instrument would need to be sought or purchased appropriately.

Permission to use the PSQI was given by Dr. Buysse

Buysse, D. J., Reynolds, C. F., III, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193-213