Evaluation of a Tai Chi Qigong Program in Promoting Physiological and Psychosocial Health Statuses in Chronic Obstructive Pulmonary Disease Clients

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PREFACE

ABSTRACT

Background: Incidences of chronic obstructive pulmonary disease (COPD), currently the fourth leading cause of death, continue to increase worldwide. People with COPD may experience a decline in their physical ability, which in turn influences their quality of life. In addition, these physical and psychosocial limitations can increase their need for support from family and friends. Existing medications are mainly used to decrease symptoms, rather than to modify lung functions and improve psychosocial functions. Ideally, clients need to develop skills in disease management in order to improve their health and functional status. COPD clients need to be physically active to reduce the impact of the lung damage, as well as to maintain fitness and reduce disability. Tai chi Qigong (TCQ), a traditional Chinese health-promoting exercise, is believed to be beneficial to the respiratory system. During practice, Tai chi displays a better training effect because of its higher intensity, whereas Qigong enhances breathing efficiency. This study attempts to evaluate the effectiveness of a TCQ program in improving physiological and psychosocial functions in COPD clients.

Method: In this single-blind, randomized controlled trial, 206 COPD clients were recruited from five general outpatient clinics. Subjects were randomly assigned into one of the three groups: TCQ, exercise, or control. Subjects in the TCQ group received a TCQ program consisting of two 60-minute sessions each week for three months. Subjects in the exercise group were taught to practice breathing techniques in combination with walking as an exercise. Subjects in the control group received their usual care. All subjects continued their prescribed medical treatment. Data collections were performed at baseline, six weeks, three months, and six months. The primary outcomes were measured by spirometry, six-minute walk test (6MWT), St.

George's respiratory questionnaire (SGRQ), and multidimensional scale of perceived social support (MSPSS) questionnaire. Repeated-measures analyses of covariance were used to examine the differences of outcome measures within groups and between the independent samples.

Results: No significant difference was found in demographic data except in gender (p =.021) as fewer females were in the TCQ group. Confounding effect of gender was controlled as covariate for data analysis. Improvements were seen in lung functions, forced vital capacity (F (5.56, 561.10) = 6.334, P < .001), and forced expiratory volume in one second (F (4.72, 476.61) = 6.356, P < .001) in the TCQ group. No significant changes in lung functions were found in the exercise group, whereas deterioration was observed in the control group. Improvement was also noted in the 6MWT (F (5.25, 530.19) = 7.871, P < .001) of the TCQ group. No significant differences in 6MWT were found in either the exercise group or the control group. For the health-related quality of life assessed by SGRQ, findings revealed significant group and time interactions, with TCQ group showing greater improvement (F (6, 400) = 3.510, P = .002) across the six-month study period compared to the exercise and control groups. For MSPSS, significant improvement in perceived social support from friends was observed in the TCQ group (F (4.68, 472.47) = 2.338, P = .045). No significant changes were found in the other two groups.

Conclusion: TCQ improved lung function, activity tolerance, and health-related quality of life, as well as perceived social support from friends in COPD clients. This should be included as part of the chronic care model for COPD management.

摘要

慢性阻塞性肺病（COPD）是全球疾病第四號殺手，它將會在世界各地繼續增加。它不但對患者做成很大的負擔，對社會亦做成一定的負擔。當慢性阻塞性肺病病情進展及惡化時，患者可能會體驗到他們的體能下降，從而影響他們的生活質量。此外，這些身體和心理的限制會令患者對家人及朋友的支持需求增加。現有的藥物，主要用於減少症狀，而不是修改和改善肺功能和心理功能。最理想的目標是令患者學習技能去管理自己的疾病，以改善他們的健康和功能上的狀態。重要的是要保持慢性阻塞性肺病患者活躍於日常活動，以減慢肺功能衰退的影響，並保持體能和減少疾病做成的殘障。太極氣功是中國傳統的促進健康的運動，它被認為是有利於呼吸系統的一種運動。太極是一種很好的體能訓練，因為其包含較高的運動強度，而氣功則有助提高呼吸效率的鍛煉。本研究的目的是測定太極氣功對促進慢性阻塞性肺病患者的生理、心理及社交健康的成效。

此項研究是以隨機抽樣的方法，從 5 間普通科門診診所，徵聘了 206 名慢性阻塞性肺病的患者。研究對象被隨機分為三組之一，即太極氣功組，運動組和對照組。太極氣功組參加一個太極氣功班，其中包括每週兩次 60 分鐘的太極氣功訓練班，為期 3 個月。運動組接受教導練習呼吸技巧，配合步行作為一種運動鍛煉。對照組繼續維持他們的日常活動。所有參與者繼續其常規的醫療護理。數據收集是在基線，6 週，3 個月和 6 個月進行。主要研究是測試肺功能，六分鐘步行試驗，聖喬治呼吸問卷（SGRQ），多角度領悟社會支持（MSPSS）。數據是以重複測量的方差分析法進行分析。

在參與者當中，除了在性別（P =. 021）中，較少女性在太極氣功組外，我們發現無顯著差異的人口數據。於是在數據分析時，性別的干擾效應被控制。研究結果顯示，肺功能的主要改進出現在太極氣功組，FVC（F(5.56，561.10) = 6.334，P < 0.001）及 FEV1（F(4.72，476.61) = 6.356，P < 0.001）。運動組的肺功能無顯著變化，而觀察對照組則顯示肺功能出現退化。研究還指出太極氣功組在 6 分鐘步行距離測試（6MWT）有顯著進步（F(5.25，530.19) = 7.871，P < 0.001）。但發現無論是在運動組或對照組，在 6 分鐘行走距離都無顯著差異。至於健康相關的生活品質評估 SGRQ，在橫跨 6 個月的研究期間，相對運動組和對照組，結果顯示太極氣功組表現出更大的改善（F(6，400) = 3.510，P = 0.002）。對於 MSPSS，朋友的支持度在太極氣功組有顯著改善（F(4.68，472.47)= 2.338，P = .045）。其他兩組則無顯著變化。

研究結論顯示太極氣功能夠改善慢性阻塞性肺病患者的肺功能，活動耐力，健康相關生活品質以及增進社交朋友的支持。故醫療體制應包括太極氣功作為慢性阻塞性肺病護理模式的一部分。

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LSIT OF ABBREVIATIONS

Abbreviations:

η^2 : Effect size

6MWT: Six-minute walk test

ATS: American Thoracic Society

BRTCQ: Breathing Regulating Tai chi Qigong

COPD: Chronic obstructive pulmonary disease

FEV_1: Forced expiratory volume in 1 second

FVC: Forced vital capacity

ITT: Intention-to-treat

MSPSS-C: Multidimensional scale of perceived social support–Chinese

SaO_2: Oxygen saturation

SGRQ-HKC-St George's respiratory questionnaire–Hong Kong Chinese

TCQ: Tai chi Qigong

CHAPTER 1
INTRODUCTION

Chronic Obstructive Pulmonary Disease

Definition

Chronic obstructive pulmonary disease (COPD) is a slow progressive disease characterized by chronic lung airflow limitations that are not fully reversible (World Health Organization [WHO], 2006, p. 14). COPD sufferers usually present the symptoms of coughing, wheezing, sputum production, and breathlessness (Hong Kong Lung Foundation, 2010). According to WHO, the definition of COPD is as follows: "COPD is a lung ailment that is characterized by a persistent blockage of airflow from the lungs. It is an under-diagnosed, life-threatening lung disease that interferes with normal breathing and is not fully reversible" (WHO, 2009).

COPD includes the conditions of chronic bronchitis and emphysema, which are now included in the COPD diagnosis (WHO, 2009). Smoking is the major risk factor of COPD. Nearly 90% of COPD cases are related to smoking or exposure to passive cigarette smoke (Department of Health, Hong Kong [HKDH], 2010; Hong Kong Lung Foundation, 2010).

Diagnosis

As suggested by the American Thoracic Society (ATS, 2004), the diagnosis of COPD should be considered in any patient presenting symptoms of cough, dyspnoea, or history of exposure to risk factors, such as cigarette smoke, noxious particles or gases. The diagnosis is based on spirometry, a measure of airflow and lung volumes during a forced expiatory maneuver from full inspiration. Airflow limitation is confirmed by a low post-bronchodilator forced expiratory volume in one second

(FEV_1), with a ratio of FEV_1 to forced vital capacity (FVC) below 70% (FEV_1/FVC < 70%) that is not fully reversible (ATS, 2004; Hansel & Barnes, 2004). Non reversible lung function is that an increase in the post-bronchodilator FEV_1 is not greater than 200ml and is not increased more than 15% over the pre-bronchodilator FEV_1 (Pearson, Alderslade, & Allen, 1997).

Assessment of Severity: Staging

Spirometry has been proven useful in assessing the severity of COPD (Ferguson, Enright, Buist, & Higgins, 2000), using a staging system to predict health status and mortality (ATS, 2004). Spirometric general classification is based on FEV_1 percentage of predicted normal values. The predicted normal value is based on the individual's sex, height, and age. The classification of the severity of COPD is shown in Table 1.1, which uses the FEV_1 percentage predicted normal value at the cutoff of < 80, 50, and 30 (ATS, 2004).

Table 1.1 Spirometric classification of COPD based on post-bronchodilator FEV1 percent predicted value according to the ATS guideline (2004).

Severity	FEV1/FVC	FEV1 % predicted
Mild COPD	< 0.7	> 80
Moderate COPD	< 0.7	50-80
Severe COPD	< 0.7	30-50
Very severe COPD	< 0.7	<30

FEV1: forced expiratory volume in one second
FVC: forced vital capacity

Background and Significance

COPD is one of the world's most common chronic diseases, has a rising trend in morbidity and mortality, and incurs heavy utilization of healthcare resources. Based on the 2009 data of WHO, COPD ranks as the fourth leading cause of death worldwide. In terms of morbidity, COPD ranks thirteenth. WHO estimates the disease will become the fifth commonest disease and the third killer globally by 2030 (WHO, 2009).

Up to 80 million people around the world today have moderate to severe COPD. Epidemiological statistics show more than three million people died of COPD in 2005, and that COPD accounts for 5% of all deaths worldwide (WHO, 2009). Moreover, the total annual cost of COPD to the National Health Services in UK accounts for more than GBP800 million in direct healthcare costs only, with a further cost of lost days of work due to COPD-related impairment at GBP 2.7 million per year (Department of Health, United Kingdom, 2005). In the United States, COPD accounted for 126,129 deaths in 2003. The total annual cost of COPD was USD32 billion in 2002. Hospitalizations for acute exacerbation are major contributors to the cost (COPD Foundation, United States, 2009).

According to WHO estimates on the prevalence of COPD in 12 Asian countries, the total number of moderate to severe COPD cases is 56.6 million, with an overall prevalence rate of 6.3%. In China, chronic respiratory diseases are the second leading cause of death. According to WHO estimates, in China, over 50% men smoke, whereas smoking rates among women are lower (WHO, 2007). Although COPD had been more common in men previously, with the increased cigarette smoking among

women in high-income countries and the higher risk of exposure to indoor air pollution in low-income countries, such as from biomass fuel used for cooking and heating, COPD currently affects men and women nearly equally (WHO, 2009).

COPD is a major public health problem in subjects over 40 years of age, and this problem will continue to be a challenge. Until recently, most of the information available on COPD prevalence came from high-income countries. Even in these countries, data greatly underestimate the total burden of COPD because the disease is usually not diagnosed until it is clinically apparent and moderately advanced (WHO, 2007). With increased longevity, many people suffer from COPD later in life. People with COPD in Hong Kong also face the same COPD-related problems and levels of disability as sufferers in other nations.

Risk Factors of COPD

Cigarette smoking is the major risk factor for COPD. Nearly 90% of COPD cases are related to smoking or exposure to passive cigarette smoke (HKDH, 2010). A recent study (Lokke, Lange, Scharling, Fabricius, & Vestbo, 2006) found that the absolute risk of developing COPD among 8045 subjects over a period of 25 years is at least 25% among the habitual smokers. The study also found that the risk for development of COPD is higher than the estimated 15% quoted in most of the previous studies with shorter study span (Lindberg et al., 2005; Vestbo & Lange, 2002).

Exposure to noxious particles or gases is another main risk factor for COPD. Occupational dust and chemicals (vapors, irritants, and fumes) also contribute to the development of COPD in exposed individuals. A study found that subjects with

biological dust exposure are associated with increased risk of COPD with an odds ratio of 2.70 (Matheson et al., 2005). Apart from occupational exposure, indoor pollution secondary to the use of solid fuels, such as wood, crop residue, and coal, was also a risk factor for the development of COPD (Lin, Murray, Cohen, Colijn, & Ezzati, 2008). The study estimated that more than 70% of Chinese households use solid fuels for cooking and heating. This risk factor appeared to be of particular importance to women living in developing countries who are responsible for cooking at home.

Apart from inhalation exposure, the genetic factor was found to be another risk factor to develop COPD. Nonsmokers with no apparent occupational or biomass fuel exposure have also been found to develop COPD (Behrendt, 2005; Celli, Halbert, Nordyke, & Schau, 2005). Thus, factors other than exposure to cigarette smoking (either active or passive), occupational, or biomass fuel exposure, as described above, may also play a role in the development of COPD.

Pathophysiology of COPD

The chronic airflow limitation characteristic of COPD is caused by narrowing of the airways, which reduces the rate of airflowing to and from the alveoli (Calverley & Koulouris, 2005). Decreased maximal expiratory flow and impaired gas exchange are fundamental to the pathophysiology of COPD. The effects of static airway obstruction are exacerbated by the loss of lung recoil due to destruction of the lung parenchyma (Halpin, 2003). Loss of lung recoil leads to the airways collapse earlier in expiration, increasing the amount of air trapped in the lungs and again increasing the residual volume, which causes airflow limitation and hyperinflation. In theory,

airflow could be increased by breathing more forcefully, increasing the pressure in the chest during expiration. However, this increases the work involved in breathing. In addition, inflammation with the resulting mucosal swelling and inflammatory exudates inside the airways further increases the severity of the disease. Mucous hyper-secretion also contributes to airflow limitation observed in COPD clients (Barnes, Shapiro, & Pauwels, 2003). A previous study suggested mucous hypersecretion was associated with an accelerated decline in lung function (Vestbo, Prescott, & Lange, 1996).

Exacerbations of COPD

Exacerbations are a common cause of morbidity and mortality in COPD clients. Acute exacerbation of COPD is defined by the National Institute for Clinical Excellence (2004, p. 30) as follows:

> Sustained worsening of the patients' symptoms from usual stable state, and beyond normal day-to-day variations and is acute in onset. Commonly reported symptoms are (i) worsening breathlessness, (ii) cough, (iii) increased sputum production and (iv) change in sputum colour. The change in symptoms often necessitates a change in medication.

Exacerbations are an important determinant of adverse health status (Halpin, 2003). Many exacerbations are related to infections, both viral and bacterial; however, inhalation of air pollutants and change in the weather may also be important (Wedzicha, 2001).

Incidence and Prevalence in Hong Kong

According to the statistics of the Hong Kong Hospital Authority (HA, 2009), COPD ranks as the fifth leading cause of death in Hong Kong, and accounted for more than 4% of emergency admissions in 2003. The prevalence of COPD among elderly Chinese (age $\geq$ 70 years) living in Hong Kong is estimated to be 9% (Hong Kong Lung Foundation, 2010). The early symptoms of COPD are usually nonspecific; the disease may have already become moderate or even severe when diagnosed. The number of inpatients with COPD was 33,755 in 2005, and 2,103 people died of COPD in 2008, corresponding to 5% of all deaths in HK (HA, 2009). It results not only a burden to COPD clients but also a large economic burden to the society.

Previous studies have shown that pulmonary function and quality of life (QOL) among patients with COPD are adversely affected by frequent exacerbations (Andenaes, Moum, Kalfoss, & Wahl, 2006; Koff, Jones, Cashman, Voelkel, & Vandiveier, 2009). Treatment of COPD includes cessation of smoking, drug therapy, surgery, exercise, and counseling. Intervention may help to alleviate the symptoms, slow down the deterioration of lung functions, and improve patient QOL (HKDH, 2010). COPD clients are always advised to keep themselves physically active in order to reduce the impact of the lung damage (Halpin, 2003; WHO, 2002a). Regular exercise within limitations imposed by shortness of breath can maintain fitness and reduce disability in functional health.

The Research Problem

Because of the disease progression, the lung functions of COPD clients may continue to deteriorate and experience shortness of breath. This would limit the daily activities of clients and lower their QOL (DH, 2003). Manifestations may include fatigue, weakness, activity intolerance, and dyspnoea. As the disease worsens, these signs and symptoms become more pronounced, and the ability of clients to perform daily activities is affected. Clients may become increasingly dependent on others to perform activities, may stop participating in activities, and finally isolate themselves (Chan, 2004). The time span between acute exacerbations of the disease may decrease, and exacerbations may become more difficult to reverse. Acute respiratory disorders superimposed on the chronic problems are life-threatening and can cause further pathologic changes in the respiratory system. The impact of the disease on both physical and emotional aspects of life may lead to disability and an impaired emotional state (Pauwels, Buist, Calverley, Jenkins, & Hurd, 2001), which would in turn influence the QOL of these clients. Previous studies have suggested that COPD clients have significant impaired QOL (Gore, Brophy, & Greenstone, 2000; Stavem, Lossius, Kvien, & Guldvog, 2000). Moreover, these physical and psychosocial limitations can increase the need of clients for support from family and friends. If clients with COPD are better supported and cared for, these negative psychosocial consequences might be prevented or decreased (Kara & Mirici, 2004). Hence, social support may contribute to a sense of acceptance that would affect overall functioning (Marino, Sirey, Raue, & Alexopoulos, 2008).

Because of the burden of COPD to clients and the society, measures to minimize suffering need to be implemented (Hansel & Barnes, 2004). Existing medications for

COPD are mainly used to decrease symptoms and complications, rather than to modify lung functions (Pauwels et al., 1999; Vestbo et al., 1999). Respiratory rehabilitation and physical exercise improve exercise capacity and health-related QOL (Puhan, Schunemann, Frey, Scharplatz, & Bachmann, 2005). Studies have shown the effectiveness of community-based pulmonary rehabilitation programs (PRPs) in reducing exacerbations and hospital admissions while reducing symptoms and improving exercise tolerance and QOL in clients with COPD (ATS, 1999a; MacNee & Calverley, 2003; Global initiative for Chronic Obstructive Lung Disease [GOLD], 2009; Guell et al., 2000). However, outpatient PRPs are still not widely available; and where available, may be inaccessible to clients due to location or scheduling difficulties. Closely supervised home programs are effective; however, they are expensive (Strijbos, Postma, van Altena, Gimeno, & Koete, 1996; Wijkstra et al. 1994). Unsupervised home programs have shown little effect on lung functions (MacNee & Calverley, 2003; Roberts, Thompson, & White, 2001). Therefore, COPD clients need to develop the skills in disease management in order to improve their health and functional status.

With existing evidence supporting the benefits of exercise to people with COPD, Rochford (2003) claimed that, as an activity, Tai chi Qigong (TCQ) helps to minimize breathlessness with its graceful movements. Qigong, in combination with Tai Chi, may also have benefits on the lung functions (Sum & Li, 1999). As the health benefits of TCQ, particularly to COPD clients, have been rarely studied in healthcare research, the study described in this thesis aims to bridge the present knowledge gap and provide empirical evidence on the physiological and psychosocial effects of TCQ.

Summary

Clients with COPD experience a wild variation in their level of disability (Bestall et al., 1999). COPD clients are always recommended to perform regular exercises that are suitable and beneficial to them; thus, TCQ may be an alternative exercise for COPD clients. Understanding the benefits of TCQ in promoting the physiological and psychosocial health of COPD clients is of great value in guiding the prescription of an effective intervention to address the health needs of COPD clients. TCQ has characteristics that are particularly suitable for older people with chronic illnesses. In addition, its easy application in a clinical setting has particular relevance to the current situation because healthcare resources, in terms of both manpower and funding, are tight. With a mounting demand for care of COPD clients in Hong Kong, this study is timely; its findings should provide important implications for advancing the quality of care delivered by health professionals.

CHAPTER 2

LITERATURE REVIEW

COPD is a distressing disease. As COPD is a progressive disease, people with COPD suffer from deteriorating physical capacity and avoidance of social functions, which in turn affect their QOL. However, there is no effective way to cure this disease. Current medications and treatments for COPD clients are mainly for reducing symptoms and preventing complications, rather than for improving physiological and psychosocial functions. Aiding this population to develop disease management skills is therefore necessary to promote their physical health, as well as their psychosocial health.

This literature review chapter first examines the physiological issues pertaining to COPD clients. It then highlights the psychosocial issues of these clients. The review then explores the effectiveness of various interventions in existing pulmonary rehabilitation programs (PRP) that have been conducted for promoting the physiological and psychosocial health of the COPD clients. Based on prior research, TCQ has been identified as a possible way of promoting the physiological and psychosocial health of people with chronic illnesses. Finally, this review concludes by providing a thorough analysis on the findings of previous studies on the physiological and psychosocial effects of TCQ.

Physiological Issues among Clients with COPD

People with COPD often have symptoms of cough, overproduction of sputum, and dyspnoea, with increasing frequency of acute exacerbations. Because of the chronic and progressive nature of the disease, most of the lung function impairments are

permanent and cannot be reversed by bronchodilators (ATS, 2004; Man et al., 2004). At the early stage of the disease, clients with mild COPD may have minimal symptoms, such as occasional morning cough, recurrent respiratory infection, or shortness of breath during strenuous exertion. As the disease progresses, coughing and sputum production may increase, leading to breathlessness or wheezing during moderate physical exertion. At the late stage, clients often experience acute exacerbations with progressive chronic breathlessness or respiratory-related complications (Chan, 2004).

Lung Functions

As stated previously, lung functions of COPD clients decline gradually with time. The annual decline in FEV_1 has been the standard way of assessing the progression of COPD (Burrows & Earle, 1969). From a randomized controlled trial (RCT) that assessed the rate of change in FEV_1 over a five-year period in COPD clients (Anthonisen et al., 1994), the result showed that the usual care group (n = 1984) had an annual decline of 56.2 ml, the smoking intervention group (n = 1962) had an annual decline of 52.3 ml, and the inhaled bronchodilator group (n = 1961) had an annual decline of 52.7 ml. Another study (Calverley, Burge, Spencer, Anderson, & Jones, 2003) evaluated the bronchodilator reversibility in COPD clients. The results of this study showed that the mean rate of decline in FEV_1 in placebo-treated COPD clients (n = 375) was 53 ml per year. From a review by Decrame et al. (2005), the annual decline in FEV_1 in normal subjects was found to be 20–30 ml, and an average decline of 60 ml per year was found in clients with COPD. A recent study by Keddissi et al. (2007) showed that the mean annual decline in FEV_1 was 85 ml in the control group (n = 203) of COPD subjects, whereas there was a slower annual

decline of 5 ml in FEV_1 in the intervention group (n = 215) using statin. Overall, COPD clients had an annual decline in FEV_1 from 53 to 85 ml if no specific intervention was given.

Exercise Capacity

Decrease in exercise capacity is another marker for disease progression of COPD. As a result of the symptoms mentioned above, people with COPD face increasingly severe respiratory symptoms across time. These symptoms increasingly limit their participation in various activities of daily living (ADL). At the early stage of the disease, COPD clients may experience difficulty in stair climbing and doing outdoor activities. As the disease progresses, they may experience problems doing activities requiring minimal physical exertion, such as dressing, feeding, and grooming themselves. At the late stage, they may experience significant breathlessness, even when at rest. As a result, over time, people with COPD experience a decline in their physical ability and may feel they have lost control over activities that once seemed to be basic and easy. They may then gradually lose confidence in their abilities to perform ADL. In addition, they may often experience a sense of fear related to frequent exacerbation and respiratory infection. This fear may further hinder them from participating in various daily activities (Chan, 2004).

The decline in exercise tolerance has been assessed in previous studies. A total of 198 COPD clients were studied over two years using the six-minute walking distance (6MWD) test to assess the exercise capacity (Pinto-Plata, Cote, Cabral, Taylor, & Celli, 2004). The result of this study showed that in subjects who died within two years, the mean decline in 6MWD was 40 meters per year compared with a decline

of 21 meters per year in those who survived. Another study by Riera et al. (2001) investigated effects of muscle training in clients with COPD. They evaluated the exercise performance by the distance walked in the shuttle walking test. The test was halted when subjects were unable to continue because of dyspnea or leg fatigue. The result of this study showed decreased walking distance by 58 meters in control group after six months, whereas the treatment group showed increased walking distance by 93 meters after six months. These results indicate that COPD clients show deterioration in their exercise capacity gradually if no specific intervention is provided.

Dyspnoea

Dyspnoea is defined as "a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity" (ATS, 1999b, p. 322). Dyspnoea is extremely distressing for the COPD clients. The symptom of dyspnoea is the most alarming symptom of COPD, and is one of the most common and significant complaints from clients with the disease. The sensation of dyspnoea is a sensory experience that is perceived, interpreted, and rated individually. Dyspnoea is usually progressive and, over time, becomes persistent. At the onset, it occurs during exercise, such as climbing up stairs or walking uphill. However, as the disease progresses, dyspnoea is elicited even during minimal exertion or at rest (ATS, 2004; Celli, 2007). As a result, COPD clients may have a significant decreased QOL.

Level of dyspnoea can be measured both objectively and subjectively by clients. The Modified Medical Research Council scale is a commonly used instrument that objectively grades the level of functional dyspnoea (Celli, 2007). By measuring

dyspnoea level of COPD clients, the scale predicts QOL and survival, independent of the degree of physiological airflow limitation. The evaluation of functional dyspnoea may also help to evaluate the effect of therapy (Celli, 2007). Dyspnoea with activities can also be objectively evaluated with the use of scales such as the visual analogue scale or the modified Borg dyspnoea scale (Borg, 1982). These scales are simple and can provide information for regarding the level of dyspnoea perceived by the clients before and after an activity. These scales have been very useful in evaluating the beneficial effect of therapy using in cardiopulmonary exercise testing or timed walked distance (Celli, 2007).

Fatigue

Fatigue is defined as a subjective feeling of tiredness, weakness, or lack of energy (Radbruch et al., 2008). Fatigue is a common symptom that affects clients of various chronic illnesses, particularly COPD. The work of breathing may significantly increase the incidence of fatigue in COPD clients (Cantley, 2001) because of the additional effort required for COPD clients to breathe. In the late stage, COPD clients have usually become weak and frail, with a significant degree of muscle wasting, which is likely to affect the working efficiency of their respiratory muscles. COPD clients are also likely to use accessory muscles to assist with their breathing, requiring a greater consumption of oxygen (Barnett, 2006). Various studies have revealed a strong correlation between fatigue, dyspnoea, and physical activity (Small & Lamb, 1999; K. Woo, 2000). This eventually leads to frustration, increased dependence, and social isolation (Barnett, 2006). This can have a profound effect on their QOL, causing decreased ability to perform ADL independently. Increased fatigue resulting in declining ADL performance in COPD clients has been correlated

with increased social isolation, depression, and negative mood in COPD clients (Larson, Kapella, Wirtz, Covey, & Berry, 1998; Leidy & Haase, 1996; Small & Graydon, 1992). Current interventions to assist COPD clients experiencing fatigue have been incorporated in PRP, including energy conservation methods, pacing of activities, and breathing control exercises to help alleviate symptoms.

Exacerbation of COPD

Acute exacerbation of COPD is characterized by acute onset of increased dyspnoea, increased cough and sputum, and may require medical intervention (GOLD, 2009). Exacerbations are significant events for clients with COPD. As the severity of COPD progresses, the number of exacerbations usually increases. Thus, exacerbations become more common with increasing severity of COPD (Bellamy & Booker, 2005). These events are distressing, disruptive, and affect the QOL and daily activities of clients (Barnett, 2006). Acute symptom exacerbation is the most frequent cause of emergency hospital admission in this population (A. Lee et al., 2001).

COPD incurs a significant burden on the healthcare resources, with a high rate of mortality and morbidly, as discussed in Chapter 1. Recurrent exacerbation is associated with harmful health effects and poor outcome. Local data have shown that COPD clients have an average of 2.2 episodes of readmissions to hospital for acute exacerbation within one year following last hospital discharge (F.W. Ko et al. 2005). Previous studies have shown that pulmonary functions and QOL are adversely affected by frequent exacerbations (Andenaes et al., 2006; Koff et al., 2009). The symptoms and lung functions of a client may take several weeks to recover to the

baseline values after an episode of exacerbation (Seemungal, Donaldson, Bhowmik, Jeffries, & Wedzicha, 2000).

Hospital Admission

In the literature, differences in the incidence of readmissions are demonstrated by different hospitalization episode time intervals. Studies using a 30-day interval include two studies in Hong Kong medical elderly that revealed 18% to 25% readmission rates (C.F. Ko, Yu, & Ko, 1996; Kwok et al., 1999). Another study using a 60-day interval post-hospital discharge reported a 27% readmission rate, with 24% of unexpected readmissions reported as due to chronic illness (Dai, Wu, & Weng, 2002; Holloway & Pokorny, 1994).

Evidence of repeated COPD readmission is higher than general readmission rates. A study in Western Norway reported the frequency of rehospitalization for COPD was 3.5 per 1,000 residents in two inhabited medical districts (Eagan, Gulsvik, Morkve, & Skaug, 1999). One Asian research study by Lau, Yam, and Pogon (2001) using retrospective data in Hong Kong reported over 50% of COPD clients were readmitted at least once within a year following discharge.

Psychosocial Issues among Clients with COPD

The term psychosocial involves both psychological and social aspects (Csaszar, Ganju, Mirnics, & Varga, 2009). According to Y.K. Lee (2006, p. 21),

> Psychological health implies having the qualities of a positive attitude, happiness, not worrying, having an active mind and creativity. Social health implies maintaining active social contacts, receiving and giving support to family

and friends, and keeping meaningful involvement in community and cultural activities.

Based on the previous analysis, living with COPD is not a pleasant experience and is potentially associated with a number of psychosocial challenges. The most commonly identified challenges are poor QOL and poor perceived social support. The importance of fostering these two aspects among the clients with COPD is highlighted in this study.

Health-related QOL

QOL is a broad concept; thus, there are variations in its definition. In general, QOL refers to a global evaluation of an individual's concept of satisfaction with life (Szalai, 1980). It represents the perception of an individual's own reaction to the different perspectives of his or her life, including health status, life aspiration and expectation, social relationships, spirituality, economic status, vocational function and activities, and pleasant or stressful events (Bowling, 2001; Feinstein, 1997). In the health and illness dimensions, it is referred to as health-related QOL (HRQL). This focus narrows the QOL to dimensions that are more relevant to the health and illness. HRQL focuses on the impact of the illness on the person's overall well being; it is recognized as an important outcome indicator for clinical intervention (Yu, 2004).

HRQL has been defined as "the functional effect of an illness and its treatment on a patient, as perceived by the patient" (Ferry, 1999, p. S15). The perception of personal health is vital in order for a client to understand how he or she is functioning at

home, school, or work. It generally refers to the perception of an individual of his or her own physical and psychosocial functioning in relation to his or her own health status. Because COPD is a progressive disease accompanied by chronic dyspnoea, the QOL of COPD clients may suffer. HRQL is an important measure of the impact of chronic health conditions and the effects of their symptoms on the QOL of the individual (Guyatt, Feeny, & Patrick, 1993; Thompson & Rodbuck, 2001). It reflects the perception by the individual of the overall effect of a specific health condition. HRQL is regarded as the major criterion for evaluating health interventions for chronic illnesses that can only be managed, not cured, and alteration in HRQL is likely to remain feasible (Sarvimaki & Stenbock-Hult, 2000). Moreover, it measures the healthcare management experience of the individual and can provide more information than from the health status alone (Thompson & Roebuck, 2001). Because one of the purpose of intervention is to enhance HRQL for the COPD clients, maintaining their HRQL is the ultimate goal of primary care.

Social Support

Social support has been defined as "a multidimensional construct that includes size of social network, frequency of contact with members in the social network, instrumental support, emotional support, quality of social support and reciprocal helping of others" (Chou, 2000, p. 299). Social support refers to the existence or availability of people on whom an individual can rely (Sarason, Levine, Bashman, & Sarason, 1983). Social support also refers to the degree of the interpersonal relationships that serves particular functions in the life of an individual (Sherbourne & Stewart, 1991). Social support has been claimed as having a direct effect on health (House, 1981) and as being able to buffer the pathologic effect of stress associated

with illness (Cohen & Syme, 1985). Social support has a crucial role in promoting adaptation to chronic illness and enhancing recovery outcomes (Yates, 1995), and plays a key role in maintaining the psychological integrity of chronically ill patients (Yu, 2004). For Chinese people in particular, social support is found to have a significant positive impact on physical, functional, and affective health (Lou & Chi, 2001). Social support network defines the availability or existence of social relationship, which is a necessary precondition for social support. Social support satisfaction delineates the degree to which expectations on social support are met and fulfilled (Y.K. Lee, 2006). As stated by Cheng, Lee, Chan, Leung, and Lee (2009), "the key aspect of social networks is the systematic variation among support elements across individuals" (p. 713). They pointed out that a wide network of family, friends, and neighbors provide more robust support functions because of the various roles that different network members play in times of need.

People with COPD experience a lack of control over daily activities, as well as recreational and social activities, because of progressive decline of physical functions. As a result, they also experience psychosocial problems, such as depression, social isolation, loneliness, helplessness, and hopelessness. These psychosocial and physical limitations can increase clients' need for holistic care, including attention to the person's environment and receiving support from family and friends. If these clients are better supported and cared for, these negative psychosocial effects might be prevented or at least decreased (Kara & Mirici, 2004). A recent cross-sectional study (Marino et al., 2008) examined 156 COPD subjects to evaluate the impact of social support on their overall functioning. The result showed that subjective social support improved adherence to treatment regimen and QOL.

An earlier cross-sectional study (McCathie, Spencer, & Tate, 2002) assessing 92 males showed that higher levels of positive social support lower levels of depression and anxiety. From their study, Kara and Mirici (2004) concluded that family members and friends were significant providers of social support for both clients and the spouses of clients. As social support has a significant positive impact on HRQL both in Western (Kara & Mirici, 2004; Marino et al., 2008; McCathie et al., 2002) and Asian cultures (Cheng et al., 2009; Taylor-Piliae, Haskell, Waters, & Proelicher, 2006), promotion in this aspect among COPD clients can ultimately contribute to the enhancement of their HRQL. Therefore, interventions should include efforts to strengthen social networks to improve the overall functioning of COPD clients.

Common Interventions for Promoting Functional Health in COPD Clients

Figure 2.1 shows the clinical course of COPD, which affects the physiological and psychosocial health in this group of population. Various interventions have been considered and implemented in an attempt to promote the physiological and psychosocial health of the clients with COPD. Among the previous efforts to deal with the prominent issues of clients living with COPD to promote their functional well being, pulmonary rehabilitation program (PRP) has been the core management for COPD clients. PRP is a structured, individualized program of exercise, physiotherapy, and education for clients with COPD. PRP does not alter the course of disease or have any impact on mortality (Freeman & Price, 2007); however, it may improve exercise capacity, physical functioning, QOL, and the client's perception of control over their disease (Hodgkin, Conners, & Bell, 1993; Lacasse et al. 1996).

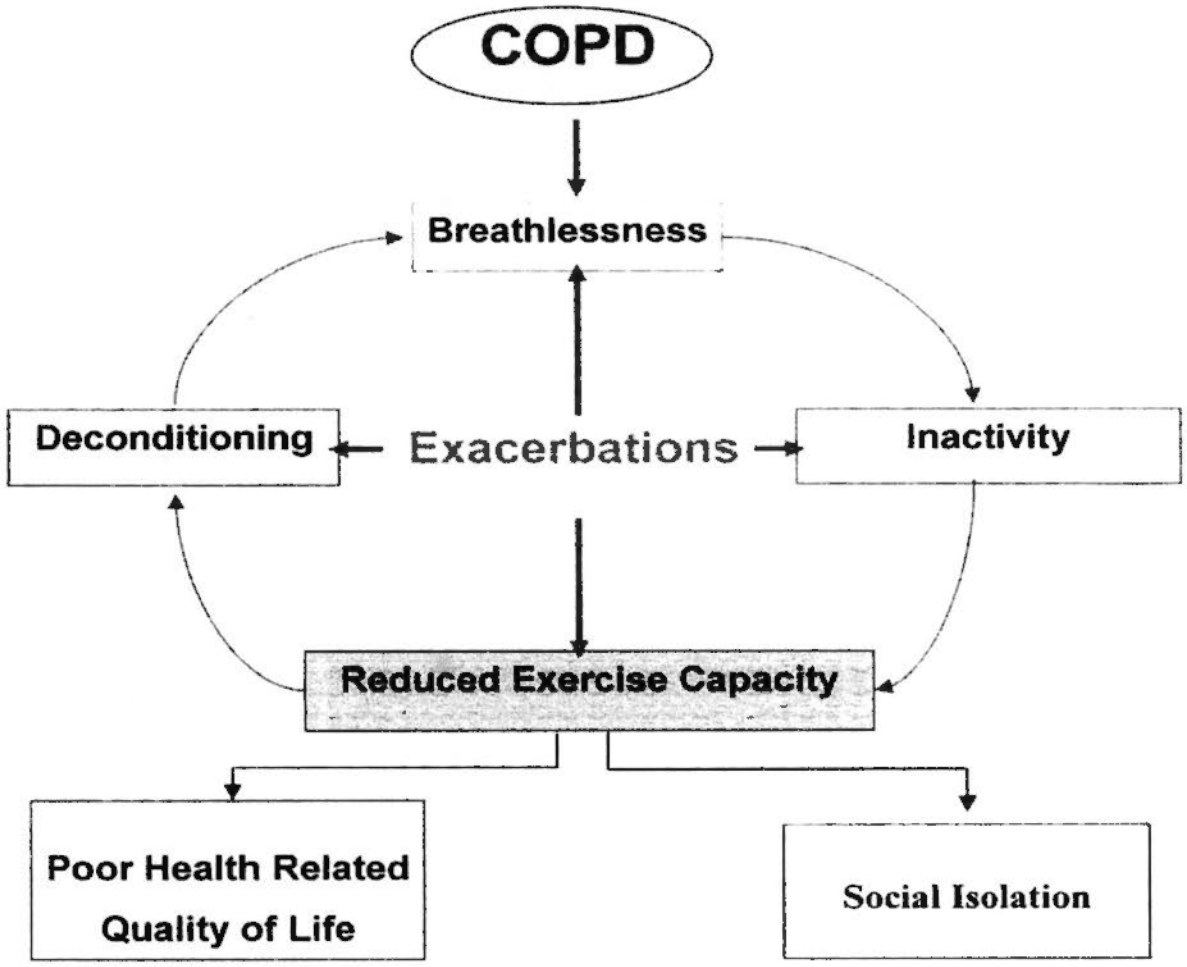


Figure 2.1 Clinical Course of COPD

Pulmonary Rehabilitation program (PRP)

PRP is defined as "a multidisciplinary program of care for clients with chronic respiratory impairment that is tailored and designed to optimize each individual's physical and social performance and autonomy" (Bellamy & Booker, 2005, p. 166). It involves a spectrum of therapeutic strategies, including exercise training, self-management education, nutritional intervention, psychosocial support, and promotion of long-term adherence (ZuWallack, 2007). Rehabilitation aims to restore the individual to the best physical, mental, and emotional state possible. There is evidence that pulmonary rehabilitation is effective in reducing breathlessness and in improving exercise tolerance and improving QOL (Bellamy & Booker, 2005). Hospital-based PRPs consist of three main components: (1) exercise training, (2) education regarding the disease and its management, and (3) psychosocial support.

Exercise Training

Exercise is defined as a planned, structured, and repetitive bodily movement conducted to improve or maintain one or more components of physical fitness (National Institutes of Health Consensus Development Panel, 1996). Endurance and strength training of the upper and lower extremities are essential components of comprehensive pulmonary rehabilitation. Exercise training reduces dyspnoea (Fernal & Daniels, 1984; Gigliotti et al., 2003), increases muscle endurance (Clark, Cochrane, Mackay, & Paton, 2000; Simpson, Killian, McCartney, Stubbing, & Jones, 1992), increases exercise tolerance (Guell et al., 2000), and improves clients' ability to perform particular tasks associated with daily living. Most hospital-based programs utilize a stationary cycle ergometer, motorized treadmill, stair-climbing, or walking on a flat surface. Although exercise is physically oriented, it has long been

valued for its psychosocial benefit to people with chronic illness, and has been found to be particularly effective in enhancing QOL (Griffthis et al., 2000; Wedzicha et al. 1998).

Education and Advice

Education is an integral component of PRP, particularly in providing information to the client and the family on respiratory disease and its treatment, and in helping to develop coping skills. Both of COPD clients and their caregivers are encouraged to attend the education sessions. PRP education includes basic information about COPD, its management, and the strategies to cope with the disease. Advice is also given about the drug treatment of COPD, healthy eating, sputum clearance techniques, breathing control, and others. It encourages the active participation of clients in healthcare, and promotes adherence and self-management skills (ZuWallack, 2007).

Psychosocial Support

Psychosocial problems in COPD clients, including anxiety, depression, poor coping skills and decreased feelings of self-efficacy, contribute to the morbidity of COPD (Kaplan, Ries, Prewitt, & Eakin, 1994). Dyspnoea on exertion, in addition to the fear, anxiety, and panic engendered, lead to avoidance of activity in COPD clients. Exercise avoidance results in deconditioning, which increases disability. Avoidance of exercise and fear of dyspnoea lead to a general loss of confidence, social isolation, and increased dependence (Bellamy & Booker, 2005). Intervention in PRP provides both COPD clients and their caregivers with social contact. Participation of family members or friends in pulmonary rehabilitation support groups is encouraged.

Informal discussions of symptoms frequently present in chronic lung disease and common concerns may provide emotional support to clients and their families (ZuWallack, 2007).

Promotion of Long-term Adherence

PRP has impressive positive short-term effects in exercise capacity, dyspnoea relief, and HRQL. The effects are always significant; however, these effects usually diminish after the programs end, and the results cannot sustain a long-term effect, especially in physiological functions (Ketelaars, Abu-Saad, Schlosser, & Wouters, 1997; Strijbos et al., 1996). ZuWallack (2007) also pointed out that long-term effectiveness tends to wane with time. The maintenance of improvement after PRP requires follow-up and aftercare of COPD clients. However, it would be expensive to provide continued support to clients in hospital setting. One approach to promote long-term adherence is to actively incorporate the principles of PRP into the home setting.

Supervised home-based PRP has shown improvement in QOL in COPD clients, but only minor improvement in exercise capacity and no improvement in lung functions (Wijkstra et al., 1994). A similar result by Puente-Maestu et al. (2003) showed that unsupervised home programs could not maintain physiological improvements in exercise tolerance; however, QOL could be maintained at 13 months. A study by Strijbos et al. (1996) compared a three-month hospital-based and home-based PRPs. The result showed that hospital-based group increased exercise tolerance at 3 months, but deteriorated at 12 and 18 months respectively. For the home-based program, an ongoing gradual improvement was observed throughout the complete

follow-up period at 18 months, which might be because the home-based group spent more time performing the unsupervised exercises compared to those of from the hospital-based group. However, no valid measures of HRQL were used in their study. Participants were asked to classify their situation as better, equal, or worse compared with the first visit.

A large number of studies have shown that PRP is beneficial in managing COPD. Benefits include increased exercise capacity, reduced dyspnoea, improved HRQL, and reduced hospital admissions (MacNee, & Calverley, 2003; Puhan et al., 2005; Roberts et al., 2001). If exercise training is maintained, these benefits can be sustained. PRP is beneficial to inpatients, outpatients, and those treated at home. Among all these programs, the outpatient setting is the least expensive (MacNee & Calverley, 2003). However, these programs are still not widely available, and where they are, not all clients are able to attend. Closely supervised home programs may be effective; however, these tend to be expensive. Unsupervised home programs have shown little effect on physiological functions, and the long-term effects cannot be sustained (Hernandez, et al., 2000; Ketelaars et al., 1997; Roberts et al., 2001). Therefore, highlighting the benefits of exercise and to maintain their exercise regularly in clients with COPD is important.

Breathing and Walking Exercises

Among the PRP, breathing and exercise training are the core of the programs. For a hospital-based program, treadmill and cycling are the most commonly used methods. For a home program, walking is usually adopted for exercise training. The following

section will discuss a comparison of the effectiveness of breathing and walking exercises with TCQ.

Breathing Exercise

People with COPD extensively use accessory breathing muscles, which greatly increases the work of breathing. Hyperinflation of the lungs causes the diaphragms to flatten, and the accessory muscles of respiration are used to aid respiration. The inefficient respiratory movements caused by hyperinflation also lead to increased dyspnoea on exertion (Bellamy & Booker, 2005). The narrowing of the small airways results in increased resistance to airflow in COPD clients. Airway collapse is exacerbated by forced exhalation, and air is trapped in the lungs. A common goal of breathing exercise is to teach clients to relax the accessory muscles used in breathing. The purposes of pursed-lip breathing (PLB) and diaphragmatic breathing (DB) are to reduce the work of breathing, improve ventilation, and provide some relief from dyspnoea.

PLB involves breathing in through the nose and breathing out through the mouth. The expiratory time is double the inspiratory time. PLB is used for prolonging exhalation in COPD clients. It helps to maintain air pressure in the small airways, preventing the airways from collapsing (Bellamy & Booker, 2005). PLB is a simple technique that can be used with all activities. From a recent RCT by Neild, Hoo, Roper, and Santiago (2007), PLB provides sustained improvement in exertional dyspnoea and physical function. Tiep (2007) pointed out that the greatest benefit of PLB occurs during exercise, when the limitation by hyperinflation is most obvious. PLB can slow exhalatory flow during exertion and enable alveolar emptying, thereby

creating mechanical advantage for the subsequent inhalation. A recent crossover study (Faager, Stahle, & Larsen, 2008) demonstrated that PLB increases walking endurance and reduces oxygen desaturation during walking; however, no significant differences in dyspnoea levels were reported.

DB involves breathing in assisted by contracting the diaphragm and breathing out slowly while the diaphragm is relaxed. DB consists of having the client comfortably seated, with one hand placed over the abdomen. The client is instructed to expand the abdomen outward during inspiration, and contract the abdomen inward during expiration. The client is reminded to keep the upper chest relatively motion-free to minimize the use of accessory muscles (Cahalin, Braga, Matsuo, & Hernandez, 2002). This maneuver increases lung capacity by lowering the diaphragm, allowing air to reach the bottom of the lungs. The reduced respiratory rate leads to increased tidal volume, potentially improving gas exchange in the alveoli, thereby improving blood gases (Tiep, Burns, Kao, Madison, & Herrera, 1986). The review of Cahalin et al. (2002) concluded that DB improves respiratory rate, arterial blood gases, and tidal volume. However, their review also found that DB increases inspiratory muscle effort and dyspnoea. They suggested that if worsening dyspnoea and fatigue occurs during or after DB, DB should be terminated. Nevertheless, methods of instruction in DB were inconsistent and poorly described in the literature, thereby reducing the reliability of the study results. Another study by Vitacca, Clini, Bianchi, and Ambrosino (1998) showed that DB improved blood gases and minute ventilation in severe COPD clients; however, DB also increased both inspiratory muscle effort and dyspnoea.

Nonetheless, the effectiveness of breathing exercises, including PLB and DB, is still being questioned (Jones, Dean, & Chow, 2003). Further study on the use of these two breathing techniques is recommended.

Walking Exercise

Walking is the most popular aerobic activity in the United States. Walking exercise is effective for improving fitness through aerobic development, muscular improvement, stress management, and weight control. In addition, the risk of injury is significantly less with walking than with other forms of exercise (J.D. Hawkins & S.M. Hawkins, 2001). Walking is an appropriate exercise for people of all ages, and can be done anytime and anywhere. According to J.D. Hawkins and S.M. Hawkins (2001), walking enables the lungs to fill and empty more fully, thereby increasing the amount of gas exchange in the lungs and improving the ease and efficiency of this exchange.

People with severe COPD often exhibit intolerable dyspnoea during walking, a light form of exercise that involves both upper and lower extremities (Palange et al., 2000). A RCT that investigated a supervised walking and arm exercise program in a 12-week home-based program showed improvements in exercise tolerance, QOL, and dyspnoea in COPD clients (n = 23) (Boxall, Barclay, Sayers, & Caplan, 2005). Another study by Puente-Maestu et al. (2000) compared the effects of supervised versus self-monitored training programs in COPD clients. The self-monitored walking exercise group (n = 20), although having less-intense training, showed increased submaximal exercise endurance in eight weeks. Studies have indicated that physical benefits of walking exercise are related to consistent adherence and regular exercise (Donesky-Curenco, Janson, Neuhaus, Neilands, & Carrieri-Kohlman, 2007).

Studies have also shown that regular walking is associated with slower decline in overall HRQL and walking self-efficacy, as well as less progression of dyspnoea during ADL (Heppner, Morgan, Kaplan, & Ries, 2006). Future research in testing interventions to improve exercise adherence in clients with COPD is suggested.

Social Gathering

A number of studies have attempted to improve QOL by adding pleasant activities or thoughtful opportunities for social gatherings, aiming to promote psychosocial well being of people with chronic illness. Studies have also indicated when exercise is performed in a group, the social reinforcement from participation can have social benefits to counter social isolation and create friendships (Y.K. Lee, 2006). Being part of the group creates an informal platform where participants are free to discuss feelings and share experiences. Through participating in group exercise, emotional and social support can be built up among the participants, especially among those who share similar backgrounds, such as the COPD sufferers.

Implications

Owing to the extensive evidence on the physiological and psychosocial benefit of exercise, group exercise can be considered as a possible means to promote the physical and psychosocial health of COPD clients. With a reduced physical ability, people with COPD may not be able to carry out high-intensity exercises. Despite the fact that much of the evidence pertaining to the psychological benefit of exercise is based on conventional physical exercise such as walking, jogging, swimming, and cycling, the roles of other complementary and alternative modes of exercise also deserve attention (Y.K. Lee, 2006). Among the different types of exercise practiced

in the community, TCQ can achieve this purpose because it has a number of potential advantages for promoting health among people with chronic illnesses.

TCQ is a form of gentle exercise suitable for older adults and relatively frail people because it can be mastered without much exertion (Gallagber, 2003; Lan, Chou, Chen, Lai, & Wong, 2004). Such advantage implies that TCQ participants may be less susceptible to attrition than with other rehabilitation programs (Gallagber, 2003). These known characteristics of TCQ also match with the background of COPD clients who may not have good physical status (Lan et al., 2004). TCQ is safe because it does not carry any side effects, unlike in the case of pharmacological measures. Moreover, TCQ has a long history and is well known among the Chinese population. It may be perceived as more culturally appropriate for the Chinese elderly people than other forms of conventional exercise. As TCQ is usually practiced in a group, this may also facilitate social interaction among the participants (Y.K. Lee, 2006).

From the perspective of those who manage rehabilitation programs, running a TCQ program does not impose a heavy economic load. Only a TCQ instructor is needed, and no other special equipment or clothing is required. Staff costing is at a reasonably low level. In addition, TCQ is a self-learned skill and is easily accessible in the community; once it is learned, people can perform it conveniently at any time and any place without the need for supervision. The important part is careful planning and coordination, which are necessary for successful implementation. From a social perspective, given the ever-rising costs in the healthcare system, adopting a low-cost behavioral modality to promote health and prevent illnesses is particularly

attractive (Y.K. Lee, 2006). Finally, running a TCQ program for the COPD clients in the community encourages mobilization of existing community resources. Such an arrangement can facilitate the community to keep in contact with the people with COPD.

Overview of Qigong and Tai Chi

Qigong is an ancient Chinese system of gentle self-healing exercises that include healing postures, movements, sounds, breathing techniques, and meditation. It originated in China and has a history of more than 5000 years. The practice of Qigong is designed to cultivate functional integrity and enhance the life vital energy called *Qi*. All the traditional Chinese medicine (TCM) practice is based on the concept of *Qi*. Tai chi is a martial art that originated in China in the 13th century. It can be viewed as a therapeutic exercise based on Chinese medicine. Tai chi practice also involves the recognition, development, and use of *Qi*.

Theoretical Basis of Qi

According to the TCM theory, *Qi* is the fundamental energy that sustains life. All things in the universe, including the human body, are believed to be composed of *Qi*. This vital energy flows in the body along channels called meridians and collaterals, which connect all the organ systems and tissues. In this philosophy, all phenomena are the results of changes and movements in the flow of *Qi*. When *Qi* is abundant, flowing freely, and in balance, a person usually enjoys good health and longevity. However, when *Qi* becomes deficient or excessive, stagnant or blocked in different parts of the body, or unable to ward off pathogenic factors, a pattern of imbalance occurs, which can lead to physical, mental, or emotional problem. Imbalances in *Qi* can occur because of improper diet, overstrain, stress, lack of physical exercise, traumatic injury, toxins, the six environmental factors (wind, cold, summer heat, dampness, dryness, and fire), or the seven emotional factors (anger, worry, sadness, grief, fear, fright, and joy) (Londorf & Winn, 2000). Thus, the balance of physical, mental, and emotional well being affects *Qi* in our bodies. For instance, worry and

sorrow disturb the *Qi* in the spleen. Anger affects the *Qi* in the liver. Excessive joy harms the *Qi* of the heart. Fear and shock interfere the *Qi* in the kidney (McCaffrey & Fowler, 2003). When the body's natural ability to cope with change and challenges is overcome by any of these factors, its equilibrium is lost and disease can occur (Londorf & Winn, 2000).

Qi is stored in energy centers known as *tantiens*. There are three *tantiens*: the lower *tantien* at the navel, the middle *tantien* at the solar plexus, and the upper *tantien* at the imaginary third eye on the forehead. Taoist teachings state that the cultivation of the lower *tantien* is the foundation of all Taoist practices (McCaffrey & Fowler, 2003). The deep breathing exercise of TCQ helps to sink *Qi* in the lower *tantien* for *Qi* cultivation. Qigong and Tai chi aim to promote good circulation of *Qi* in the body. These techniques can be learned and practiced by people with various problems to maintain general health and wellness.

Yin-Yang Theory

Tai chi and Qigong work according to the Chinese theory of Yin-Yang. The Yin-Yang theory expresses the Chinese belief that good health is the result of the balanced flow of *Qi* in the mind and the body. Yin represents the feminine component, and Yang represents the masculine component. These two energies are opposites and create tension; however, they are complementary polarities. They are constantly changing. While the Yin energy grows, the Yang energy decays. Strong movements are balanced with soft ones, leftward movements are balanced with rightward movements, and internal techniques are balanced with external techniques (McCaffrey & Fowler, 2003). The interaction between Yin and Yang creates the flow

of *Qi*; when these elements are equivalent, the *Qi* is in balance. On the contrary, when the balance of Yin and Yang is upset, disease occurs. One purpose of TCQ is to balance Yin and Yang within the body. TCQ movements and their meditation component integrate to facilitate the flow of *Qi* in each body organ. As Yin-Yang imbalances can be corrected or avoided, an overall health can be achieved (Elinwood, 2002; Khor, 2002; Kuramoto, 2002).

Qigong

In Chinese, the name Qigong is created by combining two words: *Qi* and *gong*. *Qi* in Chinese means vital energy or life force, and *gong* means practice or skill (Schnauzer, 2006). *Qi* is fundamental energy that sustains life. Each person is born with *Qi* and acquires *Qi* from air, food, and water. Qigong is a therapeutic Chinese practice used to optimize and restore energy (*Qi*) to the body, mind, and spirit (McCaffrey & Fowler, 2003). Qigong therapy can be classified into two divisions, the internal Qigong (self-practice) and the external Qigong (*Qi* emission).

Internal Qigong consists of meditation and movement exercises that are self-practiced, and which aims to control internal *Qi* flow, to promote one's health, or to self-heal illness. The self-practice approach requires self-discipline on the part of clients. Once clients learn the skills, they can practice Qigong to generate *Qi* within themselves. Clients may continue to practice Qigong to achieve higher levels of wellness and spiritual awareness (Londorf & Winn, 2000). Qigong exercises consist of a series of coordinated forms including body movement, breath practice, and meditation. These exercises are designed to enhance *Qi* function by drawing upon natural forces to optimize and balance energy through deeply focused and relaxed

states. Practicing Qigong allows people to cultivate the *Qi* associated with physiological and psychological functionality. External Qigong is performed by a trained Qigong master whose practice has reached an advanced level (Ai, 2006). It attempts to achieve healing by transmitting *Qi* from the Qigong master, without direct contact, to the person needing healing. Both internal and external Qigong are seen as affecting the balance and flow of energy and enhancing functionality in the body and the mind. This study focuses on the individual, internal Qigong practice. The internal Qigong practice generally studied in health research incorporates a range of simple and repeated movements, breathing techniques, and a focused and relaxed mind (Jahnke, Larkey, Rogers, & Etnier, n.d.).

Tai Chi

Tai chi means "supreme ultimate" in Chinese (Chen, 2002). It represents a reference to the philosophical bipolar concept of Yin and Yang that also underlies TCM (Birdee, Wayne, Davis, Phillips, & Yeh, 2009). Tai chi was created by a 13th century Taoist priest, Chang San Feng, who was inspired after witnessing a fierce fight between a snake and a crane. The fast forceful movements of the crane contrasted with the slow, near circular, continuous, fluid reactions of the snake. This "yielding" quality formed the basis of the unique characteristics of Tai chi (Chow, 1984; Koh, 1981). Much like a snake, Tai chi utilizes soft, twisting, and resilient forces to conquer powerful and fast strikes. Tai chi was originally developed both as a martial art and as a form of meditation. The practice of Tai chi as meditative movement is expected to elicit internal functional balance for healing, stress neutralization, longevity, and personal harmony (Jahnke et al., n.d.). Tai chi has evolved over the centuries and has become more focused on health maintenance (Y.K. Lee, 2006). It is

a well-known form of exercise or practice for refining *Qi*, and for enhancing physiological and psychological functions. However, even the longer forms of Tai chi incorporate many movements that are similar to Qigong exercises. Usually, the more complex Tai chi routines include Qigong exercises as a warm up and emphasize the same basic principles for practice (i.e., the three regulations of body focus, breath focus, and mind focus) (Jahnke et al., n.d.).

Studies have shown that Tai chi can be classified as moderate exercise because its intensity does not exceed 55% of maximal oxygen intake (J.X. Li, Hong, & Chan, 2001); thus, it is most suitable and beneficial to breathing promotion. Fontana (2000) agreed that Tai chi could be recommended for persons with low exercise tolerance and is a good alternative exercise for persons with chronic diseases. Tai chi includes a full range of shoulder motion movement, and sets of deep inhalation followed by forced stepped exhalations. Klein and Adams (2004) revealed that the slower pace and absence of any explosive or high-impact movements in the Tai chi is primarily beneficial for health. It could improve energy through slow, gentle body movement, controlled rhythmic breathing, relaxation, and mindful awareness. A RCT that studied Tai chi in healthy elders showed that Tai chi could increase physical strength and improve well being, which contributes to QOL (Irwin, Olmstead, & Oxman, 2007; Irwin, Pike, Cole, & Oxman, 2003).

Tai chi Qigong

The foundation of TCQ is a combination of exercise and meditation. Qigong and Tai chi movements can be combined to facilitate energy cultivation and enhance training effects. Qigong uses deep, diaphragmatic breathing in conjunction with slow,

simultaneous Tai chi movements that bring the body, mind, and spirit into alignment and balance (Garripoli, 1999). Qigong and Tai chi are closely associated with Taoism (Gallagher, 2003). One factor that appears to differentiate Tai chi from Qigong is that traditional Tai chi is typically performed as a highly composed, lengthy, and complex series of movements, whereas health enhancement Qigong is typically a simpler, easy to learn, more repetitive practice. A study by Lan et al. (2004) stated that Tai chi displays a better training effect than Qigong because of its higher exercise intensity. However, Qigong is able to enhance breathing efficiency during exercise because of the training effect of DB. Both Qigong and Tai chi incorporate a wide range of physical movements, including slow, meditative flowing, dance-like motions. They incorporate the purposeful regulation of breath and mind, in coordination with the regulation of the body (Jahnke et al., n.d.). These three are the key elements of Qigong and Tai chi. Qigong and Tai chi are both based on theoretical principles considered part of TCM. Bonifonte (2004) stated that Qigong and Tai chi are twins; they are closely related. According to Jahnke et al. (n.d.), health-oriented Qigong and Tai chi emphasize the same principles and practice elements. They suggested that these two forms of meditative movement should be considered as one body of evidence.

Body Training and Breathing Training by TCQ

Body training aims for optimum functioning. TCQ exercises are designed to directly or indirectly stimulate *Qi* circulation in specific areas of the body. Postures and movements are designed to strengthen, stretch, and tone the body to improve the flow of vital energy. Proper body alignment is essential for *Qi* to flow smoothly and at the proper strength through the mind–body energy network. TCQ movements are

performed slowly, gently, and with mental attention to the breath, body movements, and flow of *Qi* (McCaffrey & Fowler, 2003). The breath in TCQ not only delivers vital oxygen from the lungs for distribution throughout the body, but also distributes external *Qi* gathered from the environment and converted to *Qi* in the body. The deep abdominal breathing is done slowly and with the mind's attention focusing on the action of the breath. It deepens the diaphragm and the lower abdominal muscles by moving them in a constant back and forth motion. One benefit of deep abdominal breathing is the massage of the internal organs, which is thought to increase the flow of blood and *Qi*. The vital capacity of the human lungs often decreases with age. Qigong practice strives to increase the awareness of the body function. The development of an awareness of the breath with mental intention directs the breath to every cell in the body. Training in mental intention and breathing can then be used to direct more oxygen to a mind–body area in need of strengthening or healing (McCaffrey & Fowler, 2003). Research has demonstrated that TCQ has beneficial effects on the body, and is becoming a popular holistic modality both in China and in Western countries. The following sections will discuss the health benefits of this ancient art.

Health Benefits of *TCQ*

From the literature, different physiological and psychological health outcomes have been identified. This review groups the outcomes into five categories.

Balance and Fall Prevention

Outcomes related to falls, such as balance, fall rates, and improved strength and flexibility have been reported in TCQ studies. Tai chi has been shown to produce

positive outcomes in balance improvement, postural stability, and fall prevention (Chen, Snyder, & Krichbaum, 2001). W.W.N. Tsang & Hui-Chan (2004) studied 49 community-dwelling elders who voluntarily participated in a supervised Tai chi or general education for eight weeks. The Tai chi group achieved significantly better results in the sensory organization ($P = .006$) and stability tests ($P = 0.018$) compared with the control group. For studies using both Qigong and Tai chi, measures of balance were significantly improved in sedentary women (Audette et al., 2006; Stenlund, Linstrom, Granlun, & Burell, 2005) and in elderly healthy adults compared to wait-list controls (Yang et al., 2007). The results indicated that TCQ could reduce risk factors that lead to falls and could improve the balance control of the community-dwelling elders.

In contrast, studies showed effect of a 16-week Tai chi training on balance in a group of older patients with type 2 diabetes (n = 38) (T. Tsang, Orr, Lam, Comino, & Singh, 2007) to be similar to conventional exercise . The authors claimed that this might due to insufficient level of intensity of Tai chi for the population. Other study (n = 36) using 10 weeks tai chi intervention also demonstrated similar effect to conventional vestibular rehabilitation (McGibbon et al., 2004, 2005). The small sample size and the short duration of Tai chi training might limit the positive changes to become significant.

Cardiopulmonary Function

A variety of cardiopulmonary fitness indicators has been examined for both Qigong and Tai chi. A review of literature by Taylor-Piliae (2003) showed that simplified forms of Tai chi are ideal for people with impaired health conditions, including those

with heart disease and the elderly. Consistent findings were observed in the significant reduction in blood pressure reported in multiple studies, especially when Qigong (M.S. Lee, Lee, Choi, & Chung, 2003; M.S. Lee, Lee, Kim, & Choi, 2004) or Tai chi (Tsai et al., 2003; Wolf et al., 2006) were compared to inactive control groups. Tai chi also showed a significant reduction in blood pressure when compared to active controls, such as aerobic exercise or balance training (Wolf et al., 2003; Young, Appel, Jee, & Miller, 1999).

Other studies, however, have utilized active control interventions with low to moderate levels of physical activity, which showed positive changes for both groups, but without significant differences between Qigong (Cheung et al., 2005) and Tai chi (Motivala et al., 2006). This showed preliminary evidence that TCQ achieves similar results to conventional exercise. Studies that failed to demonstrate significant improvements following Qigong or Tai chi (Burnini et al., 2006; Song, Lee, Lam, & Bae, 2003; Mustian, Katula, & Zhao, 2006) had fewer participants, and distinguishing whether nonsignificant findings in cardiopulmonary fitness were due to chronic and weakening illnesses or if they were a result of the limited statistical power with small sample size proved difficult. A few studies of both Qigong and Tai chi have examined level of intensity (Lan et al., 2004; Taylor-Piliae & Froelicher, 2004), however, for the most part, level of exercise intensity was not reported. Cardiopulmonary benefits of Qigong and Tai chi may partially be explained as response to aerobic exercise. Assessing this factor is important for a better understanding of the elements of TCQ that contribute to outcomes.

Physical Function

Declining physical function is compounded by the natural process of aging (Freemont & Hoyland, 2007). A RCT study of a six-month Tai chi exercise program (n = 94) indicated its effectiveness in improving 65% of physical functions ranging from daily activities, such as walking and lifting, to moderate-vigorous activities, such as running (F. Li et al., 2001). Studies using self-reported measures consistently showed positive results for Tai chi. Self-reported improvement in physical function for sedentary older adults was demonstrated for Tai chi compared to wait-list controls (F. Li et al., 2001) and a stretching exercise control (F. Li et al., 2003). The results suggest health benefits of Tai chi beyond basic ADL.

In contrast, some of the physical function measures were not significantly different between Tai chi and Qigong. In one study with two sets of patients, one with 30 osteoarthritis patients practicing Tai chi twice weekly (Hartman et al., 2000) and one with 36 fibromyalgia patients utilizing a weekly 20-minute Qigong intervention (Mannerkorpi & Arndorw, 2004), neither group achieved significant improvements compared to usual care. The inconsistent results in this category might be because of studies recruiting sedentary, chronically ill or frail elder participants, or inconsistent intensity of interventions. Further studies are needed to examine the factors and to more critically evaluate these interventions.

Psychological Health

Psychological factors such as anxiety, depression, stress, mood, fear of falling, and self-esteem have also been examined. Anxiety decreases for participants practicing Qigong compared to an active exercise group has been reported (Cheung et al., 2005;

M.S. Lee et al., 2003; Tsai et al., 2003). Depression was shown to improve significantly when comparing a group using Qigong to an inactive control (H.W.H. Tsang, Fung, Chan, Lee, & Chan, 2006), and for a Tai chi practicing group compared to usual care group (Chou et al., 2004; Mustian et al, 2006; Wang et al., 2005). General measures of mood were improved significantly for participants practicing Tai chi compared to usual care controls (Galantino et al., 2005; Gemmell & Leathem, 2006) and for those practicing Qigong compared to a wait-list control group (M.S. Lee, Lim, & Lee, 2004).

No changes in anxiety were reported when using Tai chi compared to a relaxation intervention (Hammond & Freeman, 2006). Self-esteem was reported to significantly improve in tests of Tai chi compared to usual care (L.Y.K. Lee, Lee, & Woo, 2007); however, the increase in self-esteem compared to exercise and education controls was not significant (Kutner, Barnhart, Wolf, McNeely, & Xu, 1997). This category of symptoms, particularly anxiety, showed fairly consistent responses in both Tai chi and Qigong groups, especially when the control did not include active interventions such as exercise.

Quality of Life

QOL is a broad-ranging concept derived in a complex process from measures of the perceived physical health, psychological state, personal beliefs, social relationships and relation to relevant features of a person's environment (WHO, 2002b). QOL was reported to be significantly improved by Tai chi compared to inactive control group (Galantino et al., 2005; Y.K. Lee et al., 2007) or active controls (Hart et al., 2004), and by Qigong compared to inactive control (H.W.H. Tsang, Mok, Au Yeung, &

Chan, 2003; H.W.H. Tsang, et al., 2006). Chin (1995) also claimed that Tai chi could increase physical strength and improve well being, which contribute to the QOL of clients with chronic illness.

Conversely, insignificant results in QOL were reported by two studies (Gemmell & Leathem, 2006; Kutner et al., 1997). The comparison of results in one study was made in a group of severely health-compromised individuals. No change in QOL was reported in a short duration (six weeks) Tai chi program conducted in patients with traumatic brain injury (Gemmell & Leathem, 2006). The results might have contributed to the inadequacy of the duration of Tai chi in producing significant results in QOL. Another study also reported no change in QOL with Tai chi compared to balance training and education control among healthy older adults (Kutner et al., 1997). As participants were healthy elderly who already had good QOL at baseline, there might not be much room for further improvement.

Possible Benefits of TCQ on Respiratory System

TCQ is recognized as beneficial for men and women over a wide age range. A previous study (Lindemann, Hammer, Muche, Nikolaus, & Becker, 2003) indicated that even short-duration (12 weeks) interventions of TCQ could improve physical performance and cognition in healthy elders. According to Parry (1997), Tai chi is an excellent preventative therapy and a good way of assisting recovery because exercise helps to maintain the heart and lungs, thereby improving circulation. Qigong can enhance breathing efficiency during exercise because of the training effect of DB (Lan et al., 2004). A number of studies have emphasized the benefits of TCQ exercise for the respiratory system because of breathing promotion.

TCQ is a whole-body exercise that integrates breathing training with harmonious movement of body training, which can benefit ventilation and improve physical capacity (Chao et al., 2002). Studies have shown that Tai chi can be classified as moderate exercise, as its intensity does not exceed 55% of maximal oxygen intake (J.X. Li et al., 2001). A study by Chao, Chen, Lan and Lai (2002) showed that the average exercise intensity of TCQ is 3.1 MET (metabolic equivalent). This level of intensity is suitable for cardiopulmonary patients due to benefits previously mentioned in this thesis.

The study of J.X. Li et al. (2001) showed that Tai chi's slow, deep, and diaphragmatic breathing, and an integration of body movement and breathing action are more efficient compared to that of cycling in terms of ventilatory responses. They confirmed that Tai chi is beneficial to cardiorespiratory function. According to Chen et al. (2001), Tai chi is especially appropriate for people with chronic illnesses because of its low intensity, steady rhythm, and low physical and mental tension. Chen (2001) also stated that practicing Tai chi with a peaceful, focused mind and incorporating smooth breathing into each movement could lead to an enhanced well being. Taylor-Piliae (2003) indicated that the function of the Tai chi movements is to guide breathing and circulation as a means of helping vital energy flow through the body, and therefore have beneficial effects. Slow, controlled graceful movements characterize Tai chi, integrating mental concentration and breathing control. Movements flow from one to another without excess energy expenditure from unnecessary muscle contraction. Every posture, performed evenly from beginning to end with the same continuous rhythm, is thought to improve circulation and

breathing and strengthen internal organs. TCM practitioners also claim that health benefits might be gained for the heart and lungs through the breathing techniques and improvement of circulation resulting from free-flowing *Qi* within the body. Rochford (2003) also stated that greater oxygenation of blood via improved breathing would be another benefit.

Therefore, the health benefits of TCQ include benefits for the lungs. The open- and closed-arm movements of Tai chi are coordinated with breathing. The deep breathing draws the breath down into the lower *tantien* (the main energy center of the body), putting less pressure on the lungs, which increases the lung capacity (Sum & Li, 1999). Overall, breathing is the soul of TCQ. DB helps the lungs to function in the most efficient manner. The exercises and movements of Tai chi are performed in a slow and relaxed fashion, as opposed to most Western styles of exercise. Tai chi is noncompetitive, nonimpact, and highly aerobic in the sense of breathing deeply, useful for increasing blood oxygen levels and flow. Using DB techniques in Qigong ensures a full, oxygen-rich cardiovascular system (Bonifonte, 2004).

In conclusion, TCQ has enormous benefits for the lungs. The continued expanding and contracting movements of the form massage and stimulate the lungs, helping them to take in life-giving oxygen and to eliminate waste gases from the bloodstream. With a good supply of oxygen, all the organs and systems of body are able to function well (Parry, 1997). However, despite studies provide evidence of the potential beneficial effects of TCQ on respiratory functions, there are limited data on the use of TCQ for pulmonary conditions (Birdee et al., 2009). The benefits of TCQ

on COPD clients should be investigated in order to improve the physical and psychosocial status of these clients.

Mode of Delivery of the Intervention

Previous experimental studies generally implemented the intervention in the form of a program. All the adopted programs were implemented on a group basis, with the duration and intensity stated clearly. Besides, a Tai chi or Qigong instructor was responsible in conducting all the sessions within the program. Delivering TCQ in the mode of a program within a group environment by an instructor seems to be a widely accepted practice. By taking the above similarities into account, the effects of TCQ can mostly be interpreted among the study population of a TCQ program within a group-learning environment.

The Dose of TCQ Practice

Variation in the dose of Tai chi and Qigong practice between studies can cause difficulty in determining the therapeutic dose of intervention. In the present analysis, the dose of Tai chi practice specifically refers to the duration and intensity of the Tai chi and Qigong practice. In RCTs, the duration of the Tai chi or Qigong program ranged from three weeks (Gatts & Woollacott, 2006) to 12 months (Chan et al., 2004; Thomas et al., 2005; Woo, Hong, Lau, & Lynn, 2007). The duration of each session lasted from 20 minutes (Mannerkorpi & Arndorw, 2004) to 90 minutes (Gatts & Woollacott, 2006; Pippa et al., 2007). The situation was complicated by the fact that different studies arranged the TCQ session at different intensities, ranging from once a week (Mannerkorpi & Arndorw, 2004; McGibbon et al., 2004; Motivala et al., 2006; Voukelatos, Cumming, Lord, & Rissel, 2007) to seven times per week (Zhang,

Ishikawa-Takata, Yamazaki, Morita, & Ohta, 2006). The issue of variation in the TCQ practice is considered serious because the amount of practice can directly influence the way in which TCQ practitioners perform the movements. Additionally, the inconsistency of intensity also makes ascertaining the effective dose of TCQ difficult.

Currently, evidence regarding the optimal intensity of a TCQ program remains inconclusive. On top of the duration and intensity of the TCQ program, another concern related to the dose of TCQ practice is the amount of self-practice that continues beyond the prescribed regimen. Because self-practice can directly affect the dose of intervention being received, the researcher should consider it cautiously. In case self-practice is allowed, a stringent recording and monitoring method should be implemented concurrently. Additionally, information about self-practice should also be incorporated into analysis when determining the effect of the TCQ program (Y.K. Lee, 2007).

The TCQ Style

Regarding the style of TCQ, variations among studies also occurred. Some studies do not mention the type of style adopted (Galantino et al., 2005; L.Y.K. Lee et al., 2007). Therefore, comparison of findings between studies is difficult. Although all the Tai chi and Qigong styles share the same essential features (i.e., slow body movements accompanied with controlled breathing and mind concentration), each style has its own emphasis and movements. Existing evidence concerning the influence of TCQ style on health outcomes is ambiguous. Whereas Jin (1989) found that the Yang style and Wu style did not reveal distinct difference in producing

physiological change, Taylor-Piliae and Froelicher (2004) revealed that style is a significant factor in explaining the effect of Tai chi. Moreover, in a systematic review, Wu (2002) was unable to conclude if Tai chi style could affect the health outcome because of the inconsistencies in the measurement used and length of the Tai chi program adopted. Wide variation of the TCQ programs among previous studies not only hinders the comparison between studies but also leads to two adverse consequences: (1) weakened the generalization of study findings and (2) non concrete information and inability to form suggestions regarding the design of the TCQ program for future studies. In future studies, with the aim of designing a TCQ program with adequate intensity for bringing about health benefits, reference should be made to a broader literature source, including previous TCQ studies, as well as other exercise studies for the population.

Concerns for Conducting a TCQ Study for COPD Clients

With the favorable results obtained from previous research studies, TCQ appears to be a possible intervention to improve physiological and psychosocial health among clients with chronic illnesses. The less healthy physical status among the clients with COPD is another concern when considering a TCQ program. The applicably of TCQ among people with COPD deserves special attention. Despite the limited evidence available, isolated studies can lead to initial support in this aspect. Irwin et al. (2003) indicated that older people with more severe physical impairments at baseline have revealed the greatest increases in psychological health as measured by SF-36, (a widely used instrument for measuring QOL). Therefore, the concern for the feasibility and beneficial effect of TCQ on the weaker population is preliminarily supported. Nevertheless, available information is limited in providing strong claim

regarding the effectiveness and applicability of TCQ to the clients with COPD because previous work investigated the topic primarily on the healthy older people and people with chronic illnesses. Because promotion of physiological and psychosocial health among the people with COPD represents an important goal of client care, evaluating the beneficial effect and clinical applicability of TCQ in this particular population is worthwhile. If a TCQ study is to be considered for the COPD clients, the characteristics of the clients should be taken into account. Careful consideration of these characteristics is important because they can contribute to the proper launching of the TCQ program and accurate evaluation of the intervention effect.

Methodological Flaws

To ensure a rigorous evaluation of the physiological and psychosocial effect of TCQ, common methodological flaws committed by previous TCQ studies need to be identified and addressed. Such flaws include having a small sample size, subject selection bias, inability to control the confounding effect of covariate, and having inconsistent comparisons among study groups.

Summary

COPD is a progressive, incurable, and disabling disease. Hospital readmissions caused by this disease are common over the world, and it can be overwhelming in many instances. By 2030, COPD is predicted to become third in the indicators of global burden, presenting a serious impact on world health because of the prevalence of the disease and the associated high mortality corresponding to a growing aging population. In Hong Kong, COPD is a common cause of hospitalization, being the

fifth leading cause of death. The literature demonstrates that hospital readmission due to chronic disease occurs naturally and is unavoidable; however, it can be decreased or delayed.

Exercise intolerance is one of the main factors limiting participation in ADL among people with COPD. The cardinal symptoms of COPD that limit exercise in most clients are dyspnoea and/or fatigue resulting from ventilatory constraints, pulmonary gas exchange abnormalities, and peripheral muscle dysfunction. Anxiety and poor motivation are also associated with exercise intolerance (ATS, 2006). Inactivity can lead to physical deconditioning that further limits exercise tolerance. Therefore, keeping COPD clients physically active is important to reduce the impact of the lung damage (Halpin, 2003; WHO, 2002a). Regular exercise within limitations imposed by shortness of breath maintains fitness and reduces disability.

The evidence that PRP improves the lives of clients with COPD is conclusive; thus, PRP is now recognized as an essential part of the management of clients with COPD. However, only 1.7% of the COPD population has access to a PRP in 2002 (Blackler, Jones, & Mooney, 2007). PRP is still not yet widely available to the community population. If intervention program can become more accessible, it would be more attractive to COPD clients. The community setting may also be more effective in encouraging and empowering clients to exercise for life.

Living with COPD imposes a certain degree of physiological and psychosocial challenge to the individuals. Many studies have revealed that the disease predisposes the clients to a number of physical and psychosocial challenges, such as decline of

lung functions, reduced exercise capacity, poor QOL, and poor perceived social support. These challenges may lead to poor adjustment to their life. Because performing regular physical exercise is beneficial to the physical and psychosocial health of a person, exercise can therefore be considered as a possible means to promote physiological and psychosocial health among people with COPD. As the general characteristics of Tai chi and Qigong are suitable for frail elders, the implementation of a TCQ program in the community is recommended to address this issue.

Most evidence on the physiological and psychosocial benefit of TCQ can be generalized to the older population receiving intervention in the form of a TCQ program within a group-learning environment. Interpretation of previous findings considered the similarities of previous studies, variations in the dose of TCQ practice, and the styles. The implementation of a TCQ program for the COPD clients could be of value. In view of the specific health needs among the COPD clients and the scarcity of literature documenting the health benefits of TCQ to this population, future research on this particular population is worthwhile. The overall aim of the study seeks to establish evidence on the effectiveness of TCQ in improving physiological and psychosocial health among COPD clients. The physiological outcomes of the study are suggested to be lung functions and exercise tolerance. The psychosocial outcomes of the study are suggested to be HRQL and perceived social support.

To achieve this aim, a single-blind, randomized controlled trial with adequate sample size was adopted to demonstrate the physiological and psychosocial effects of TCQ

practice. A number of physiological and psychosocial outcome variables were assessed using repeated-measures analysis of variances (RANOVA). Finally, when designing the TCQ program for future study, careful consideration should be given to the duration and intensity of the program, as well as to the style of TCQ to be adopted.

CHAPTER 3

METHODS

The aim of this study was to evaluate the effectiveness of a TCQ program in enhancing physiological and psychosocial health of the clients with COPD. This chapter begins with the research objectives and hypotheses. It then explains the use of RCT to achieve the study aim. This is followed by a discussion of the sampling framework, including sample selection and sample size determination. The tested interventions are then described. The next sections consist of the discussion on selection of appropriate measuring tools, data collection procedures, and data analysis. The concluding section addresses the ethical considerations in the implementation of this study.

Research Aim

The overall aim of this study was to investigate the effect of a TCQ program on the improvement of physiological and psychosocial health of clients with COPD.

Research Objectives

The objectives were to determine the effectiveness of a TCQ program among COPD clients based on the following variables:

1. Physiological outcomes:
    a. lung function
    b. exercise capacity
    c. levels of dyspnoea and fatigue, and oxygen saturation after walking exercise
    d. number of acute exacerbations
    e. extra usage of short-acting β_2 agonist bronchodilator

f. number of hospital admissions related to respiratory problems

2. Psychosocial outcomes:
   a. HRQL
   b. self-perceived social support

Null Hypotheses

The null hypothesis formulated for this study stated that there is no significant difference in outcomes among the three groups. The hypothesis was tested on the nine outcome measures listed below. Compared to those in the exercise and the control groups, COPD participants in the TCQ group demonstrate no differences in the following:

1. Hypothesis 1, there is no significant difference in the change of lung functions among the three study groups across a period of six months
2. Hypothesis 2, there is no significant difference in the change of exercise capacity among the three study groups across a period of six months
3. Hypothesis 3, there is no significant difference in the change of dyspnoea and fatigue levels among the three study groups across a period of six months
4. Hypothesis 4, there is no significant difference in the change of oxygen saturation level among the three study groups across a period of six months
5. Hypothesis 5, there is no significant difference in the change of number of acute exacerbations among the three study groups across a period of six months
6. Hypothesis 6, there is no significant difference in the change of number of hospital admissions among the three study groups across a period of six months

7. Hypothesis 7, there is no significant difference in the change of extra usage of the short-acting β2 agonist inhaler among the three study groups across a period of six months
8. Hypothesis 8, there is no significant difference in the change of HRQL among the three study groups across a period of six months
9. Hypothesis 9, there is no significant difference in the change of perceived social support among the three study groups across a period of six months

Operational Definitions

Tai chi Qigong

TCQ is a combination of exercise and meditation. Qigong uses deep, diaphragmatic breathing in conjunction with slow, simultaneous Tai chi movements. Qigong and Tai chi movements are combined to facilitate energy cultivation and to enhance training effects.

Health-related Quality Of Life

HRQL is a multidimensional, subjective, and cultural-specific construct (Anderson & Bruckhardt, 1999) that encompasses an individual's physical health, psychological state, social functioning (including relationships), and perceptions of health, fitness, life satisfaction, and well being (Bowling, 2001). In general, this construct covers a broad range of components that constructs QOL in either the wellness or illness situation. In this study, the HRQL is measured by the SGRQ-HKC.

Social Support

Social support is a multidimensional construct that includes social network, contact with members in the social network, instrumental support, emotional support, quality of social support, and reciprocal helping of others (Chou, 2000). Social support refers to the existence of people upon whom an individual can rely (Sarason, Levine, Bashman, & Sarason, 1983). In this study, social support is measured by the MSPSS-C.

Study Design

A RCT was employed to test the effectiveness of a TCQ program in enhancing the health outcomes of clients with COPD. This was a single-blind study in which the research assistants (RAs) responsible for data collection were blind to the study. They were unable to identify the group assignments of the study participants. Eligible clients admitted to the study were randomly assigned into one of the three groups: TCQ, exercise, and control. Subjects in the TCQ group received a TCQ program consisting of two 60-minute sessions each week for three months. Subjects in the exercise group were taught to practice breathing techniques combined with walking as an exercise. Subjects in the control group were instructed to maintain their normal daily activities, and no extra exercise was recommended. The study protocol is illustrated in Figure 3.1

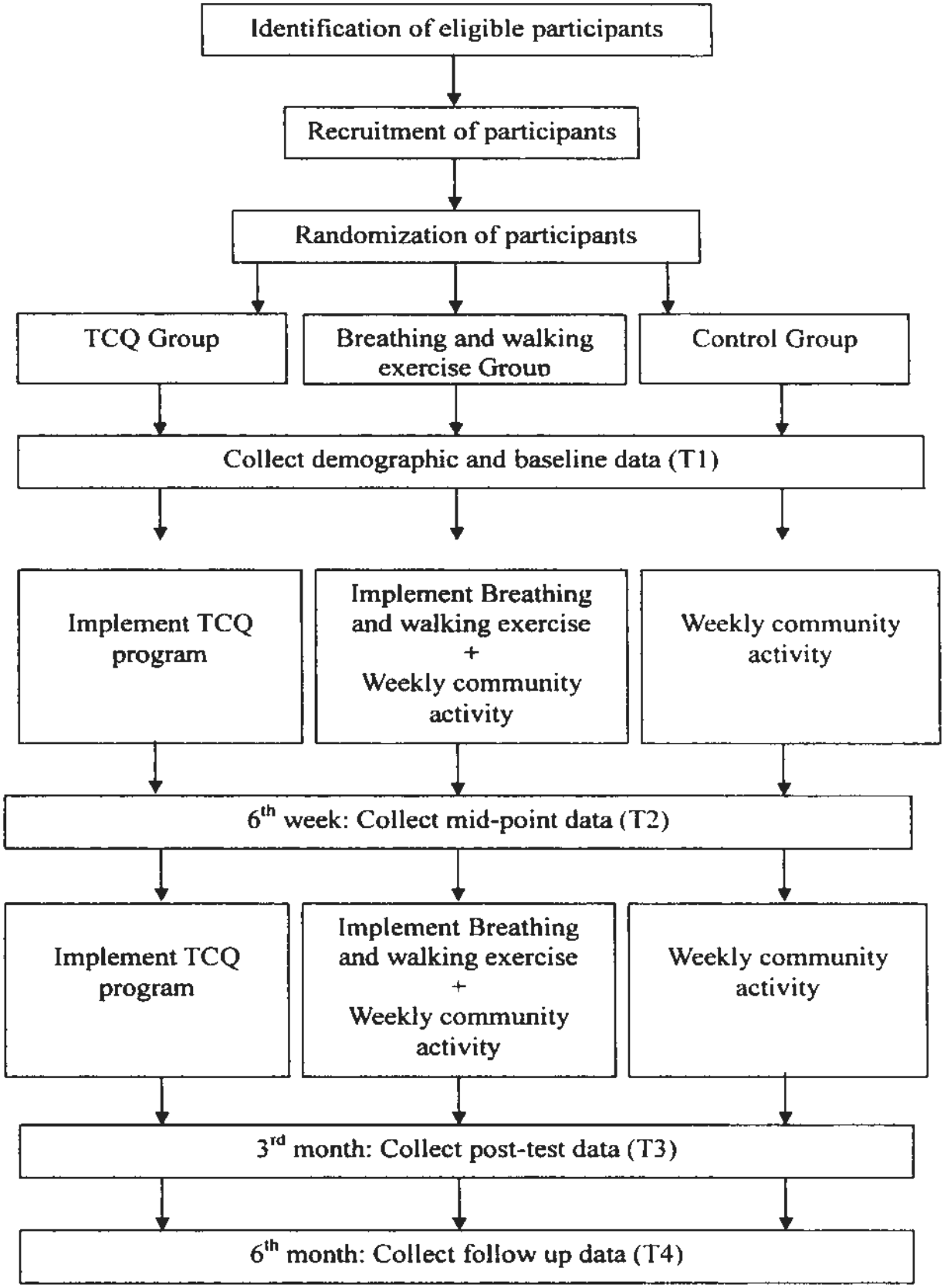


Figure 3.1 The study protocol

Rationale for the Selected Design

The focus of this study was to investigate the effectiveness of a TCQ program in improving the health outcomes of clients with COPD. The study employed a methodology designed to establish the purported cause-and-effect relationship between the study intervention and the outcomes. A randomized controlled trial can strengthen the internal and external validity of a study with regard to assessing causality (Portney & Wilkin, 2000). Its strengths are attributed to its randomness in the involvement of independent control and experimental groups, the randomization of the independent variable of the TCQ program, and the incorporation of a repeated factor of time in a pre-test/post-test approach (Bowling, 2002; Portney & Watkins, 2000). Incorporating all these characteristics into the study design allows a rigorous control of the internal validity of the study. This study also adopted a single-blind design to control the possible researcher bias (Friedman, Furberg, & DeMets, 1996; Karlberg & Tsang, 1998).

Rationales for Recruiting an Active Control Group

From the literature review in Chapter 2, significant improvement of outcome measures was observed in the TCQ group compared to wait-list controls (Stenlund, Linstrom, Granlun, & Burell, 2005; Yang et al., 2007). In contrast, effects of TCQ were similar to conventional exercise or physical therapy control interventions (Hammond & Freeman, 2006; T. Tsang, Orr, Lam, Comino, & Singh, 2007). To test the hypothesis that TCQ would achieve better results to conventional exercise, an active control of exercise group was recruited in this study.

Rationales for Recruiting a Control Group

Random assignment of the control group in this study allowed a more stringent evaluation of the effects of the treatment through between-group comparisons, and resulted in increasing the internal validity of this study. Internal validity means that the results obtained are attributed to the actual effect of the study intervention (Portney & Watkins, 2000), but not the conduct or process of experimentation itself (Gary, Williamson, Karp, & Dalphin, 2007). The use of a randomized control group in this study eliminated several possible sources of threat to internal validity, including the maturation, history, and reactive effects. It also provided a means for controlling the confounding effect of the possible extra-therapeutic factor, which is unrelated to the active component of the intervention study.

Limiting the Possible Confounding Effect

In this study, the experimental intervention involved a TCQ program that consisted of two sessions a week for three months. The resulting attention paid by the TCQ instructor to the participants might have exerted an important confounding effect on the treatment outcomes. The integration of an active control group and a usual care control group provided a channel to neutralize such confounding effects because the participants regularly joined community classes aimed at providing a comparable amount of regular social gatherings among the three groups. Such a study design would result in greater confidence in attributing the outcome of the study to the pure effect of the TCQ program and thus strengthen the internal validity of the study (Bowling, 2002). Because of ethical concerns, usual care was not withheld from the exercise group and the control group. The purpose was to ensure fair usual care to all the participants. Given the fact that the participants in the TCQ group also received

the usual care, its confounding effect on the study outcomes would therefore be cancelled out among these three study groups and would not affect the internal validity (Portney & Watkins, 2000). Additional benefits of TCQ on top of usual care could also be investigated.

Using Randomization in Sample Allocation

Simple random sampling and random assignment are two of the best and most popular methods attaining the pretreatment equivalence of contrasted groups in medical research (O'Fallon et al., 1978). One of the most appealing characteristics of random sampling and randomization is that these methods can equate groups on several nuisance variables simultaneously (Hsu, 1989). Randomization is the most effective method of controlling individual extraneous variables. The primary function of randomization is to secure comparable groups (i.e., to equalize groups with respect to extraneous variables). A distinct advantage of random assignment, compared with other control methods, is that randomization controls "all possible sources of extraneous variation, without any conscious decision on the researcher's part about which variables need to be controlled" (Polit & Beck, 2008, p. 203). Randomization not only eliminates possible selection bias, but also enhances the likelihood that the characteristics of the participants in all aspects are evenly balanced between the intervention and control groups at the baseline (Burns & Gove, 2001). The variances in the study outcomes, which were effects of the extraneous variables, not the TCQ program, were therefore reduced (Burns & Gove, 2001).

A Pretest and Repeated Posttest Design

The purpose of adopting a pretest and repeated posttest measurement in this study design was to allow a more rigorous evaluation of the effectiveness of the TCQ program. Conducting the pretest measurement strengthened the validity of this study. In this study, although the participants were assigned to one of the three groups randomly, this step only enhances (and does not guarantee) the initial equivalence between these groups (Portney & Watkins, 2000). Adopting the pretest measurement could strengthen the validity of a study by detecting any initial difference between groups (Polit & Beck, 2008). Statistical methods could, therefore, be used to identify and address the associated bias. Also, obtaining the pretest data from the study participants would provide information about the demographic and clinical profile of those who drop out during the course of the study. Comparison of the characteristics between the dropout participants and those who completed the study would allow the detection of any possible threat to the validity of the study (Burns & Gove, 2001). The repeated measures design provided the researcher a more stringent and thorough investigation on the effects of the TCQ program. Since regular practice of TCQ is required for the effect to occur, repeated time interval in measuring the outcomes allowed the detection of both short term and the long term intervention effects. This approach also allowed the detection on the effects of the interaction between time and the intervention, so that that any possible influences by individual characteristics on the outcomes of this study are eliminated (Bowling, 2002).

A Single-blind Study Design

A blinding study design involves using methods to withhold information about the treatment allocation from both the study participants and the investigators; it is regarded as an important step in avoiding potential bias during data collection (Karlberg& Tsang, 1998). However, unlike drug trials, the double-blind approach is not feasible for most healthcare interventions because the interventions are more difficult to disguise than drugs (Polit & Beck, 2008). Implementation of blinding to the participants in the current study was difficult because TCQ intervention and exercise intervention were not delivered as "usual care" for the COPD clients. In order to overcome this shortcoming, this study adopted a single-blind design in which the RAs collecting the data were not informed of the group assignment. This type of blinding eliminates researcher bias that might have occur when the expectations of the effects of the RA unintentionally influences the responses of the participants (Bowling, 2002). The purpose is to minimize assessment bias arising from the knowledge of the status of the intervention groups or the expectation of the investigators (Polit & Beck, 2008). Although a single-blind study is less stringent than a double-blind study in maintaining the internal validity, the former is regarded as an especially important strategy to reduce bias when the double-blind study design is not feasible in a clinical study (Karlberg & Tsang, 1998).

Study Setting

The study was carried out at five general outpatient clinics (GOPCs) in one of the 18 districts in Hong Kong. The selected GOPCs provide care to a population of 600,000 in the district. These GOPCs had similar patient profiles, staff mix, and treatment protocol, and were similarly governed by the Hong Kong Hospital Authority.

Selection of Sample

Subjects who had their medical follow-up in the five GOPCs and fulfilled both the inclusion and exclusion criteria were invited to participate.

The selection criteria were as follows:

1. clinically diagnosed COPD defined according to the ATS (2004) guidelines
2. intact cognitive function
3. able to stand and walk independently
4. able to communicate in Cantonese

The exclusion criteria were as follows:

1. impaired bilateral hearing or vision
2. suffering from symptomatic ischemic heart disease
3. previous training and practicing TCQ within a year prior to the commencement of the study
4. musculoskeletal disorders or other disabling diseases that may limit the practice of TCQ
5. currently participating in other studies

In order to enhance the integrity of the study intervention, all the participants were assessed to cognitively and physically competent to learn and practice the TCQ, follow instruction, understand questions, and give reliable answers in the baseline assessment.

Sample Size Determination

Sample size calculation was determined using power analysis to decrease the likelihood of making Type I and Type II errors based on three parameters: significant α level, effect size, and power (Cohen, 1992). Using a convention developed by Cohen (1988), the estimated power should approach a minimum of a desired 0.80 to minimize type II error. The probability of making a type I error is controlled through the level of significance, α (Tabachnick & Fidell, 2007). This α level is generally considered as the acceptable statistical risk in clinical studies (Polit & Sherman, 1990; Portney, 2000). The effect size measures the strength of relationships between the means of two variables in the population and expected variation of the particular sample being studied.

Because there are limited earlier studies of TCQ program for COPD clients, the sample size was based on Tai chi exercise studies for references. Previous meta-analysis studies provided data regarding the effect of Tai chi on health outcomes of sedentary clients or clients with chronic illnesses. The results indicated that variation exists among the effect size, which ranged from small to large effect size (Taylor-Piliae et al., 2004). Based on the previous findings, medium effect of Tai chi on HRQL was also reported (Y.K. Lee, 2007). Therefore, a medium effect size was estimated to determine the sample size in this study. According to Cohen (1992), for $\alpha = 0.05$, a medium effect size of RANOVA test with three arms, 156 (52 per group) subjects can achieve a power of 0.80. According to previous studies involving Tai chi programs, the attrition rate was 25% on average (Lan, Lai, Chen, & Wong, 1998; Li, Harmer, & McAuley, 2001; Tsang & Hui-Chan, 2004). The anticipated sample size calculated in addition to the attrition rate was 69 subjects in each group.

Method of Randomization

A randomization procedure was used to assign the participants to one of the three groups: TCQ, exercise, or control. The random allocation was applied using the computerized randomizer program (Social Psychology Network, 2007). This program used a JavaScript random number generator to produce customized sets of random numbers. This computerized program was designed for researchers to generate random numbers and randomly assign participants to different groups. The randomization avoids the shortcoming of yielding a highly disparate sample size in the study groups while preserving many positive attributes of simple randomization. The particular strength of this method is its ability to generate unpredictable sample allocation sequence.

Outline of the Experimental Protocol

TCQ Program

The experimental intervention is a TCQ program. This program aims to help clients with COPD to develop the skills of TCQ exercise and to incorporate such exercise into their daily living activities through the implementation of a three-month TCQ program. The program was conducted two times a week, and each session lasted for one hour. The decision on the duration and frequency of the current TCQ program was made with reference to a previous study that indicated that even a short-duration intervention (i.e., twelve-week TCQ program) can improve physical performance in elderly people (Lindermann et al., 2003). The study has chosen three months for COPD subjects as the period of training how to balance the time for optimal result and the issue of compliance. Based on experience from COPD rehabilitation

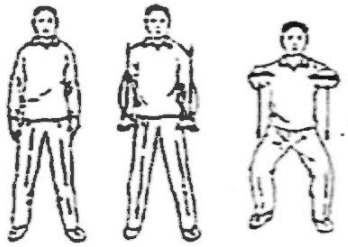
programs, intensive intervention beyond 12 weeks lead to dropping out from the study (O'Shea, Taylor, & Paratz, 2007; Ringbaek, Brondum, Martinez, Thogersen, & Lange, 2010). High attrition rate would seriously affect the validity of the study. In addition, three months is adequate for subjects to learn and master the TCQ forms, as recommended by two TCQ experts. The subjects could then practice TCQ by themselves once they learned the skills.

The TCQ program consisted of a 13 movements of breathing regulating Tai chi Qigong (BRTCQ), which were selected and modified from the 18 movements of Taiji Qigong (HKDH, 2003). This modified 13-form TCQ was designed to make the program easy to learn and allow clients to master the skills in a shorter period. The 13-form BRTCQ was chosen to emphasize on elements of breathing, range of motion on upper limbs for enhancing lung expansion, and overall coordination. Participants were required to coordinate their breathing with the movement motions. The modified 13 forms of BRTCQ had been sought comments from two TCQ experts on their validity and feasibility to be used in clients with COPD. Prior to the study, a pilot study was conducted to test the feasibility of the study procedures. Two forms of BRTCQ were modified again after the pilot study, as suggested by the TCQ instructor for it to be tailor-made for COPD clients. Table 3.1 and Figure 3.2 illustrate the names and the pictures of the 13 forms of BRTCQ. The names (both English and Chinese) of the 13 forms BRTCQ are illustrated in Appendix 1.

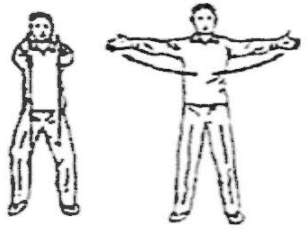
Table 3.1 The 13 Movements of Breathing Regulating Tai chi Qigong

1.	Commencing Form and Regulating Breathing
2.	Expanding Your Chest
3.	Circling Arms Separate the Clouds
4.	Swinging Arms at Stationary Position
5.	Rowing a Boat in the Middle of the Lake
6.	Holding a Ball in Front of the Shoulders
7.	Twisting Waist and Pushing Palms
8.	Riding Horse and Swaying Arms
9.	Undulating Waves
10.	Dove Spreading Wings
11.	Punching with Outstretched Arms
12.	Wild Goose Flying
13.	Pressing Palms in Calmness

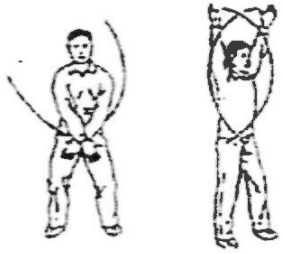
Modified from the 18 movements of Taiji Qigong, Department of Health, Hong Kong (2003).



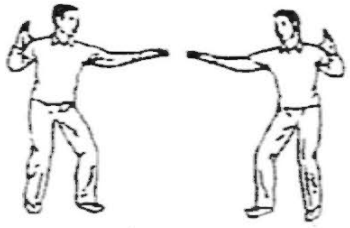
1. Commencing Form and Regulating Breathing



2. Expanding Your Chest

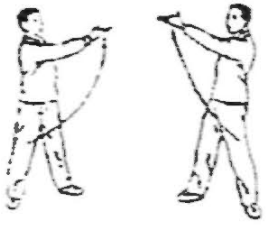


3. Circling Arms Separate the Clouds

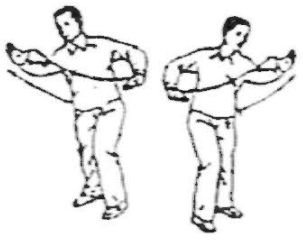


4. Swinging Arms at Stationary Position

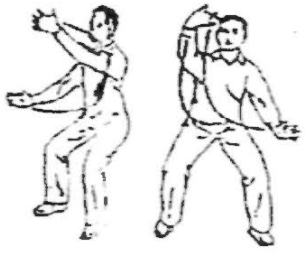
5. Rowing a Boat in the Middle of the Lake



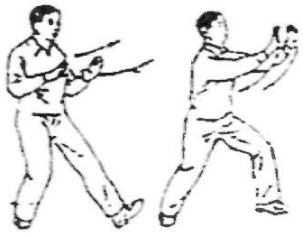
6. Holding a Ball in Front of the Shoulders



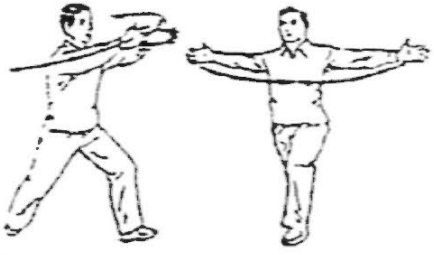
7. Twisting Waist and Pushing Palms



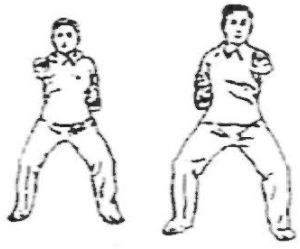
8. Riding Horse and Swaying Arms



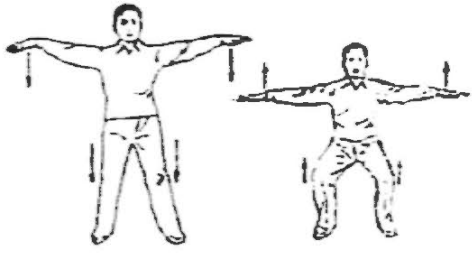
9. Undulating Waves



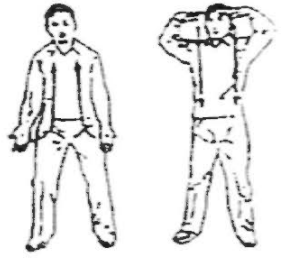
10. Dove Spreading Wings



11. Punching with Outstretched Arms



12. Wild Goose Flying



13. Pressing Palms in Calmness

Figure 3.2 Pictures of the 13-Movements of Breathing Regulating Tai chi Qigong

The TCQ sessions were conducted on a group basis. During the TCQ practice sessions, participants, led by an experienced TCQ instructor, replicated the motions, postures, and speed of movement of the instructor (Figure 3.3). Participants were encouraged to practice TCQ at home every day when no TCQ sessions were scheduled. An audiovisual DVD (Appendix 2) and TCQ pictures (Appendix 3) were produced to instruct the practice of the 13 forms of movements and, together with the coordination of breathing patterns, were given to each participant to facilitate self-practice at home. This served as an important reminder in enabling the participants to practice TCQ at home. Participants expressed that the DVD and TCQ picture were helpful to assist them in their self-practice at home. In order to monitor the compliance rate, a self-recording diary (Appendix 4) was given to the participants so that they could record the frequency of their self-practicing TCQ at home. The skill mastery was assessed by the TCQ instructor at the end of TCQ program.

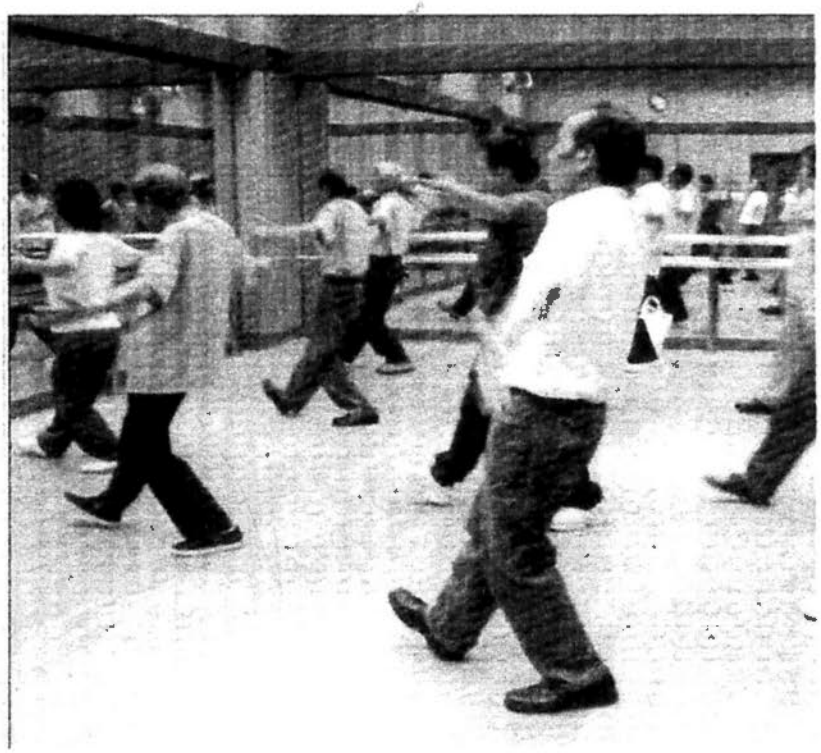


Figure 3.3 The TCQ program was led by the experienced TCQ Instructor

Integrity of the TCQ Intervention

Integrity of the intervention refers to extent of adherence to the assigned intervention (Burns & Gove, 2001). Maintaining the integrity of intervention is important in order to ensure the validity of clinical studies (McGuire et al., 2000). In this study, integrity of the intervention of TCQ program was greatly determined by the intervener's qualification, consistency in the implementation of the TCQ program, participants' mastery of skill, and compliance to the program. These four factors contributed to the maintenance of the integrity of intervention.

Qualification of the Intervener

An experienced and qualified TCQ instructor was invited to conduct the TCQ program. The instructor held a number of Tai chi qualifications, such as (1) Hong Kong Chinese Martial Arts Association Ltd Nei Jia Chuan Judge, (2) Hong Kong Tai Chi Association Tai Chi Chuan, Sword Coach, (3) Hong Kong Wushu Union-led First-rank Coach, and (4) Genuine Shaolin 8 Section Brocade Yang Sheung Kung Coach. She has won numerous awards on Tai chi and Qigong competitions in Hong Kong and Mainland China. She has been teaching TCQ for more than 10 years. The instructor was responsible for teaching the 13 BRTCQ movements, including the breathing patterns. During the classes, the instructor demonstrated the TCQ movements while the participants imitated the motions and postures at the same speed. Before the implementation of the TCQ program, the researcher and the instructor discussed the areas that needed special attention when teaching COPD clients. The TCQ instructor, being the intervener of the study, was independent of the data collection. Moreover, in order to eliminate bias in implementation of the

intervention and interactions with the participants, the instructor was blinded to all the outcome measures.

Consistency of the Implementation of Intervention

The consistency of the TCQ program in terms of content, intensity, and physical environment was maintained throughout the intervention period. To maintain the consistency of the content, a teaching plan for the TCQ program was developed by the researcher and the instructor. In addition, the consistency of the TCQ training sessions was also maintained by having the same instructor conduct all the sessions to minimize variations among different instructors. The number of participants in each TCQ session was limited less than 20, which was considered by the instructor as manageable and feasible in terms of teaching and learning.

Physical Environment

To maintain the consistency of the physical environment of the intervention, special consideration was made when selecting the intervention venues. In this study, the TCQ program took place within three indoor sport centers in the community of the study district. Subjects were assigned to the center nearest their homes. All sport centers were organizations under the Hong Kong Government. The space and environment of each sport center were similar. The TCQ sessions were arranged in an activity room inside each sport center. Such arrangement could ensure that the physical environment was kept constant throughout the intervention period. Interference within the room was kept to minimal. Figure 3.4 shows the participants practicing TCQ in the venue during the TCQ training session.

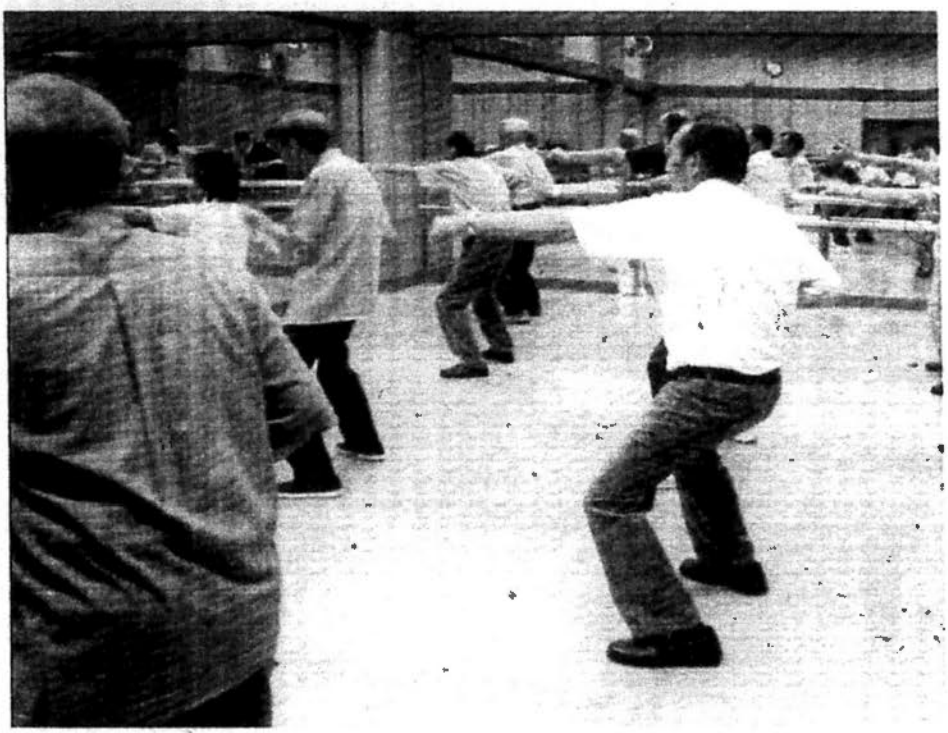


Figure 3.4 Participants were practicing TCQ in the indoor activity room of the sport centre

Skills Mastery of the Participants

Ensuring the skills mastery of the participants is essential to guarantee a successful delivery of the intervention. For the TCQ group, the instructor assessed the skills mastery of the participants from their return demonstration during the class. Any incorrect performance was identified and rectified. At the end of the last session, the level of the skills mastery of each participant was assessed by observing their pacing and accuracy. A three-point rating scale, with 1 representing "skill not yet mastered" and 3 representing "skill well mastered," was used. All the skill mastery assessments were performed by the TCQ instructor.

TCQ Program Evaluation

Program evaluation was conducted after the completion of the TCQ program. To examine the perceptions and satisfaction level of the participants, a self-administered five-point Likert scale questionnaire was used wherein 5 indicated "most" and 1

indicated "least" (see Appendix 5 for the English version and Appendix 6 for the Chinese version). The aim of the program evaluation was to collect information regarding perceptions of the benefits and the perceived limitations of the TCQ program. Information collected from the questionnaires enabled the researcher to explain why and how the intervention worked. In addition, this helped the researcher to understand the strengths and limitations of the TCQ program and to make suggestions for improvement in future studies.

There were three parts to the questionnaire. The first part evaluated perceived effects of TCQ exercise in improving the respiratory functions and exercise capacity of the participants, as well as its effect in broadening their social network. The second part evaluated satisfactory level of the participants toward the TCQ program in terms of the time, venue, duration of the program arrangement; the performance of the TCQ instructor; and the appropriateness of the intensity of TCQ forms. Finally, three open-ended questions were asked to solicit suggestions and feedback on the TCQ program.

Breathing and Walking Exercise

The goal of breathing exercise was to teach participants to relax the accessory muscles of breathing. Subjects in the exercise group were taught breathing techniques coordinated with walking exercise. The uses of PLB and DB techniques were taught by a qualified nurse.

PLB is breathing in through the nose, and breathing out through the mouth. The expiratory time is double the inspiratory time. PLB is used for prolonging exhalation in COPD clients. This helps to maintain air pressure in the small airways, preventing

them from collapsing (Bellamy & Booker, 2005). PLB is a simple technique that can be used with all activities. PLB can slow exhalatory flow during exertion and enable alveolar emptying, thereby creating mechanical advantage for the subsequent inhalation (Tiep, 2007).

DB is breathing in assisted by contracting the diaphragm and breathing out slowly while the diaphragm is relaxed. The method of DB involves having the subject comfortably seated with one hand placed over the abdomen. The subject is instructed to move the abdomen outward during inspiration and to move the abdomen inward during expiration. The subject is reminded to maintain the upper chest relatively motion-free to minimize the use of accessory muscles (Cahalin, Braga, Matsuo, & Hernandez, 2002). This maneuver increases lung capacity by lowering the diaphragm and allows air to reach the bottom of the lungs. The reduced respiratory rate leads to increased tidal volume and may improve gas exchange in the alveoli, thereby improving blood gases (Tiep, Burns, Kao, Madison, & Herrera, 1986).

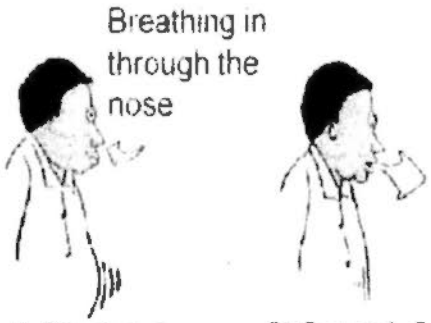
Participants in the exercise group were taught to coordinate breathing with walking as the physical exercise (Figure 3.5). Return demonstration of breathing techniques was performed to ensure proper skills practice of the participants. Participants were advised to perform breathing and walking exercises for one hour every day for three months. Leaflets with pictures and instructions were given to the subjects to facilitate daily self-practice (Appendices 7 and 8). Their breathing techniques were reassessed at the sixth week and at the third month to ensure proper skills were maintained. In order to monitor their compliance rate, a diary was also given to the participants for recording the frequency of their self-practice (Appendix 9).

Breathing Exercise

1. Pursed-lip breathing

To improve the obstructed airway, and decrease dyspnoea

Relax your shoulders, breathing out all the air in slow motion



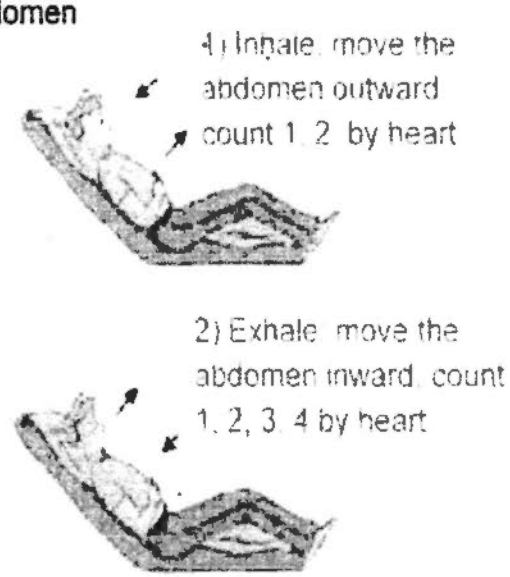
1) Count 1, 2 by heart

2) Count 1, 2, 3, 4 by heart

2. Diaphragmatic breathing

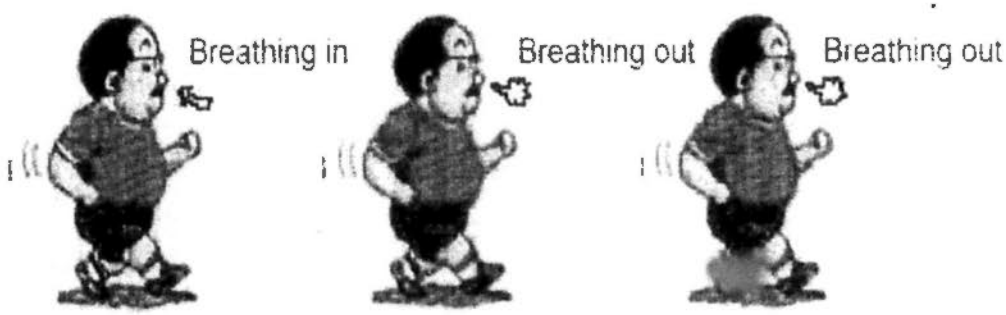
To increase breathing efficacy, relieve dyspnoea.

Relax yourself and put your hand on the abdomen



Walking coordinating with breathing exercise

When walking, use pursed-lip breathing and diaphragmatic breathing.
The walking steps should coordinate with breathing pattern.
Follow the ratio of 1 : 2
E.g. 1st step breathing in, 2nd and 3rd steps breathing out



>> Breathing in >>> Breathing out >>> Breathing out >> Repeat

(Dr. Leung, 2007)

Figure 3.5 Pursed-lip breathing and Diaphragmatic breathing coordinated with walking exercise

Control Group

During the study period, participants in the control group continued to receive their usual medical treatment. They were advised to maintain their routine activities without participating in any exercise classes. No extra exercise was recommended.

Regular Social Gatherings

During the study period, all subjects continued their prescribed medical treatments. In order to enhance the internal validity of the study findings, arrangements were made for participants in the exercise and control groups to join community activities, such as Putonghua or writing classes, to ensure that all groups consistently attended weekly gatherings. The purpose of maintaining regular gatherings for all participants was to balance the emotional effect of the extra weekly gatherings of the TCQ group during the process of TCQ training.

Physiological Measurement

In this study, the outcome variables of physiological measurement were lung functions, exercise capacity, oxygen saturation, dyspnoea and fatigue level after exercise exertion, the number of COPD exacerbations, the number of hospital admissions, and the number of extra times needed to use short-acting β_2 agonist inhalers.

Psychosocial Measurement

The outcome variables of psychosocial measurement were HRQL measurement and the self-perceived social support satisfaction.

Physiological Measuring Instruments

Spirometry

Spirometry is the most robust test of airflow limitation in clients with COPD (Warrell, Cox, Firth, & Benz, 2003). It is standardized, reproducible, and the most objective measurement of airflow limitation available (Hansel & Barnes, 2004). Spirometry measures the volume of air (liters) exhaled by a client as a function of time (Evans & Scanlon, 2003). FEV_1 is measured by a portable spirometer. It requires the client to forcefully expel air from a point of maximal inspiration to a point of maximal expiration. A low FEV_1 with a ratio of FEV_1 to FVC (FEV_1/FVC) below the normal range is a diagnostic criterion for COPD. The FEV_1, as a percentage of the predicted value, is used to assess the severity of the disease (ATS, 2004; Warrell, Cox, Firth, & Benz, 2003).

Six-minute Walk Test

The 6MWT is a useful measure of functional capacity. The test has been widely used for measuring the response to therapeutic interventions for pulmonary and cardiac disease. A review of functional walking tests concluded that the 6MWT is easy to administer, better tolerated, and more reflective of ADL than the other walking tests (Solway, Brooks, Lacasse, & Thomas, 2001). The client was encouraged to walk as far as possible at his or her own pace for six minutes, and the total distance measured was recorded. The distance covered correlated well with lung function and diffusing capacity. 6MWT is a valuable and simple index for following progression of COPD in the individual client (Hansel & Barnes, 2004).

The 6MWT in this study followed the practical guidelines from the ATS (2002). The test was performed indoors on a long flat straight corridor. The clients were allowed to stop for rest during the 6MWT if needed. The dyspnoea level and fatigue level were assessed using the Borg scale (Borg, 1982) at baseline and after the 6MWT. The cutaneous oxygen saturation (SaO_2) and heart rate were also measured before and after the 6MWT.

The Borg Scale

The Borg scale is a self-rated dyspnoea and fatigue scale. The scale has a range of 0–10. A power function is incorporated by spreading the verbal descriptors out at the high end of the scale and placing them closer together at the low end of the scale. Thus "very, very severe" is 10, "very, very weak" is 0.5, and "moderate" is 3. Clients were shown an enlarged copy of the Borg scale and were asked to rate their dyspnoea level and then their fatigue level. The following table (Table 3.2) demonstrates the 0–10 scale where "0" indicates no dyspnoea and no fatigue, whereas "10" indicates the maximal dyspnoea and the maximal fatigue (Borg, 1982; Borg & Ottoson, 1986).

Table 3.2 The Borg Scale

0	Nothing at all
0.5	Very, very slight (just noticeable)
1	Very slight
2	Slight (light)
3	Moderate
4	Somewhat severe
5	Severe (heavy)
6	
7	Very severe
8	
9	
10	Very, very severe (maximal)

According to the ATS (2002) guideline, before the 6MWT, the client is asked to grade his/her level of shortness of breath using this scale. The client is also asked to grade his/her level of fatigue using this scale. At the end of the 6MWT, the client is asked to again grade his/her dysnoea level and level of fatigue. The Chinese and English versions of Borg scale are attached in Appendices 10 and 11.

Oximetry

This is a noninvasive pulse oximetry used to estimate arterial oxyhemoglobin saturation at rest and after the 6MWT. It measures the cutaneous oxygen saturation (SaO_2). Desaturation measured at either time point is a sensitive indicator of gas exchange abnormalities (Warrell, Cox, Firth, & Benz, 2003).

Exacerbations, Admissions, and Usage of Inhaler

The number of exacerbations and number of hospital admissions in the past six weeks were recorded. The number of extra times short-acting β_2 agonist inhalers needed to be used in the preceding week was also recorded.

Psychosocial Measuring Instruments

St. George's Respiratory Questionnaire

COPD may have a major impact on QOL of clients. SGRQ is a disease-specific measure of health status for use in COPD (Jones, 2005) (Appendix 1). SGRQ consists of two parts: (1) symptoms score and (2) activity and impacts scores. The symptoms score cover distress caused by respiratory symptoms. The activity score covers physical activities that cause or are limited by breathlessness. The impacts score covers the whole range of social and psychological effects of the disease. SGRQ ranges from 0 to 100, where 0 indicates best health and 100 indicates worst health. An increase in score indicates worsening health status. SGRQ has been shown to be a valid measure of health impairment in chronic airflow limitation and to respond to change with therapy (Spencer, Calverley, Burge, & Jones, 2001). The Chinese version (SGRQ-HKC) has been tested to be a valid, sensitive, and reliable instrument that can be used to assess QOL in Hong Kong Chinese people with COPD (Appendix 13). Cronbach's α ranges from 0.74 to 0.95 for the whole questionnaire and its three subscales. Test-retest reliability shows intraclass correlation coefficients of all the dimensions exceeding 0.70 ($P < .001$) (Yu, R.J. Scudds, & R.A. Scudds, 2004). The SGRQ-HKC has also been tested to be a reliable and valid instrument in Chinese clients with COPD in Mainland China (Lu, Zhang, Hu, Ma, & Zhu, 2003).

The Multidimensional Scale of Perceived Social Support

MSPSS (Zimet, Dahlem, Zimet, & Farley, 1988) is a 12-item questionnaire, which examines the self-perceived social support from social relationships including family, friends, and significant others. It uses a seven-point Likert scale set from 1 (strongly disagree) to 7 (strongly agree). The total score ranges from 12 to 84, with higher scores indicating higher levels of perceived support. Scores can be calculated for the three subscales (i.e., family, friends, and significant others) (Appendix 14). The psychometric properties of the Chinese version (MSPSS-C) have been examined in 475 Chinese adolescents. The result demonstrated high internal consistency, with a Cronbach's α equal to 0.89; its validity and reliability have confirmed (Chou, 2000) (Appendix 15).

Demographic Data Sheet

Demographic information of the participants with COPD was collected using the demographic data sheet developed by the investigator (Appendix 16 for English version; Appendix 17 for Chinese version). Demographic data consisted of three components: personal, socioeconomic, and medical profiles. The personal profile included age, gender, marital status, education level, religion, body weight and height, and exercise habits. The socioeconomic profile included information on the employment status, household income, living arrangement, and type of housing of the participants. The medical profile provided information regarding the health status of the participants, including history of COPD, frequency of COPD admissions within the preceding six weeks, frequency of COPD exacerbation within the preceding six weeks, number of extra usage of short-acting β_2 agonist inhalers in the preceding week, comorbidities, and number of medications currently being taken.

Data Collection

The medical records of all participants were reviewed for demographic information and health history. Data were collected by physiological assessments and questionnaires.

Baseline (T1) measures were obtained before intervention began. Second (T2, at the sixth week) and third (T3, at the third month) assessments were conducted as midway and after-intervention measures, respectively. In order to monitor the long-term compliance behaviors of the participants, a follow-up evaluation was conducted at the sixth month (T4).

Data Collection Procedure

Recruiting the Participants

Ethical approval for this study was obtained from the Joint Clinical Research Ethics Committee of the Chinese University of Hong Kong and New Territory East Cluster (Appendix 18). Permissions for conducting the study in the selected GOPCs were also obtained. Potential eligible participants were identified by reviewing the Clinical Management System (CMS). Those who fulfilled all the inclusion criteria were contacted by telephone and invited to participate. The eligible participants were then randomly assigned to one of the three groups, and arrangements were made for these participants for baseline assessment at the research clinic. An informed consent form (Appendix 19 for English version and Appendix 20 for Chinese version) that outlined the purpose and details of the study was provided to each participant. The participants were assured that their information and personal data would be handled

confidentially and anonymously. They were also advised of their right to withdraw from the study at anytime without any impact on the care they were receiving. Written consent was obtained after thorough explanation of the research procedure.

Collecting the Data

RAs were blinded to the treatment allocation of the participants. Keeping the RAs unaware of the treatment status of the participants would eliminate bias in data collection associated with preconceived expectations on the intervention effect. This is known as a single-blind study (Portney & Watkins, 2000). Although a double-blind study that involves blinding both the participants and the researchers can best protect against observation bias, it is not always feasible in the clinical situation (Polit & Beck, 2008). In this study, blinding the participants was not feasible because the TCQ program and the breathing exercises were not delivered as "usual care." A single-blind design was therefore adopted to strengthen the validity of the study conclusions. Because the RAs used the same approach to collect data for all participants, consistency of data collection was preserved. Spirometry was supervised by the same researcher for all subjects to ensure their proper techniques and to avoid measuring discrepancy.

The Four Stages of Data Collection

Each participant was required to visit the research clinic four times: the time of baseline screening (T1), data collection at the sixth week (T2), data collection at the third month (T3), and follow-up evaluation conducted at the sixth month (T4) to monitor the long-term compliance behaviors of participants on TCQ practice, and

breathing and walking exercise practice. The timetable for data collection is summarized in Table 3.3, and the study protocol is illustrated in Figure 3.1 (p.58).

Table 3.3 Data collection time plan

	Baseline (T1)	6th week (T2)	3rd month (T3)	6th month (T4)
Demographic data	√			
Spirometry	√	√	√	√
6MWT	√	√	√	√
Borg Scale	√	√	√	√
SaO_2	√	√	√	√
SGRQ-HKC	√	√	√	√
MSPSS-C	√	√	√	√
No. of exacerbation	√	√	√	√
No. of admission	√	√	√	√
Extra usage of inhaler	√	√	√	√

SGRQ-HKC: St. George's Respiratory Questionnaire – Hong Kong Chinese version

MSPSS-C: Multidimensional Scale of Perceived Social Support – Chinese version

Pre-study Screening to Exclude Asthmatic Subjects

Pre- and Post-bronchodilator Spirometry

The pre- and post-bronchodilator spirometry was performed for each participant to exclude non-COPD subjects during the baseline assessment. The objectives of these pre- and post-bronchodilator tests were to detect reversible FEV_1 who were actually asthmatic. Tests were performed when clients were clinically stable and free from infection. Clients should not have taken inhaled short-acting bronchodilators in the previous six hours, long-acting β agonists in the previous 12 hours, or sustained release theophyllines in the 24 hours preceding the assessment (Pearson, Alderslade, & Allen, 1997).

Response to Bronchodilator

Spirometric values were measured before and after an adequate dose of inhaled bronchodilator. The recommended dosage protocol was before and 30 minutes after 400 micrograms of salbutamol (Hansel & Barnes, 2004). An increase in FEV_1 both greater than 200 ml and a 15% increase over the pre-bronchodilator value is considered significantly reversible (Pearson, Alderslade, & Allen, 1997). Clients with significant reversible spirometric values were presumed asthmatic and were excluded from the study.

Baseline demographic data and clinical data were collected. The pre-interventional data, including the outcome variables and possible covariates, were then collected (T1) by physical assessment and face-to-face interview.

Pilot Study

A pilot study was conducted to test the feasibility of the participant recruitment process, data collection methods, study instruments, and the study interventions. Interrater reliability test among RAs was also performed to ensure consistency in data collection process.

The Recruitment Process

Twenty eligible participants were recruited from one of the settings of the main study. They were randomly allocated into one of the three groups: TCQ, exercise, and control. The recruitment process went smoothly. After informed consent was obtained from each participant, demographic data and pre-test data were collected following the described procedure. The venue, the content of the TCQ training sessions, and the interveners were identical to those in the main study.

The Data Collection Process

The pilot study took three months to complete the data collection for T1, T2, and T3. Follow-up assessment at the sixth month was not performed because the pilot study was used to test the feasibility of data collection process, intervention process, and the use of instruments.

Interrater reliability test among the RAs were conducted. Data collection procedures on clients were performed by the RAs at the same time and then data were compared. The discrepancies among the data were discussed and compromised to a consistent way of data collection to ensure consistency in the data collection process.

The average time needed to complete data collection instruments and physiological tests was 60 minutes for baseline assessment and 30 minutes for subsequent assessments at the sixth week and the third month. The longer time for baseline assessment was because demographic data were taken, and pre- and post-bronchodilator spirometries were performed. For the subsequent assessments, only pre-bronchodilator spirometry was performed. Participant responses toward the data collection instruments generally indicated that the questionnaires were understandable and that the physiological tests were easy to perform.

The Study Interventions

Participants in the TCQ group completed a 60-minute TCQ training session two times a week for three months. Participants did not experience any discomfort and difficulty during the TCQ practice. The TCQ instructor repeated the taught TCQ forms in each session to ensure the participants' mastery of the skills before introducing new forms. Normally the TCQ instructor taught a new form in each session after revising the taught forms. Participants were able to master the TCQ skills within the three-month training period.

Participants in the exercise group were taught the breathing techniques in coordination with walking exercise. Return demonstration of breathing techniques was performed by subjects. They showed understanding and reported no major difficulties.

Characteristics of the Pilot Sample

The 20 pilot participants were randomly assigned to one of the three groups: TCQ (n = 8), exercise (n = 7), and control (n = 5). The ages of the participants were 61 to 93 years old, with a mean age of 76.4 (SD=8.4). Of the 20 subjects, 15 (75%) were males and 5 (25%) were females. Based on the ATS (2004) criteria, 40% of the subjects were at a severe stage of COPD, 35% were at a moderate stage, and 25% were at a mild stage. Table 3.4 shows demographic characteristics of the subjects by group allocation. No significant differences were found in the demographic data.

Table 3.4 Demographic data of subjects by group allocation

Characteristics	TCQ (n=8)	Exercise (n=7)	Control (n=5)	P-Value
Age, years, mean (SD)	76.5 (6.9)	77.1 (9.4)	75.2 (10.8)	.932*
Gender				.559#
Male, n (%)	5 (62.5)	6 (85.7)	4 (80.0)	
Female, n (%)	3 (37.5)	1 (14.3)	1 (20.0)	
Marital Status				.466#
Married, n (%)	6 (75.0)	6 (85.7)	4 (80.0)	
Separated, n (%)	0 (0)	1 (14.3)	0 (0)	
Widowed, n (%)	2 (25.0)	0 (0)	1 (20.0)	
Education Level				.494#
Uneducated, n (%)	3 (37.5)	2 (28.6)	1 (20.0)	
Primary, n (%)	5 (62.5)	5 (71.4)	3 (60.0)	
Secondary, n (%)	0 (0.0)	0 (0.0)	1 (20.0)	
Financial support				.618#
Self, n (%)	0 (0)	2 (28.6)	1 (20.0)	
Family, n (%)	4 (50.0)	3 (42.9)	2 (40.0)	
Social allowance, n (%)	4 (50.0)	2 (28.6)	2 (40.0)	
Income				.610#
=< $3000, n (%)	5 (62.5)	5 (71.4)	3 (60.0)	
3001 – 5000, n (%)	2 (25.0)	1 (14.3)	0 (0)	
5001 – 10000, n (%)	1 (12.5)	1 (14.3)	2 (40.0)	
Smoke				.509#
Never, n (%)	3 (37.5)	1 (14.3)	0 (0)	
Quit, n (%)	4 (50.0)	4 (57.1)	4 (80.0)	
Still smoke, n (%)	1 (12.5)	2 (28.6)	1 (20.0)	
Medical history				
Heart disease, n (%)	1 (12.5)	0 (0)	1 (20.0)	.499#
HT, n (%)	3 (37.5)	3 (42.9)	0 (0)	.234#
DM, n (%)	1 (12.5)	1 (14.3)	1 (20.0)	.932#
BMI, mean (SD)	21.4 (3.2)	22.2 (3.0)	18.9 (3.5)	.235*
Duration of COPD				.678#
<3 years, n(%)	3 (37.5)	3 (42.9)	0 (0)	
3-5 years, n(%)	2 (25.0)	1 (14.3)	2 (40.0)	
5-7 years, n(%)	1 (12.5)	1 (14.3)	0 (0)	
7-9 years, n(%)	1 (12.5)	0 (0)	1 (20.0)	
> 9 years, n(%)	1 (12.5)	2 (28.6)	2 (40.0)	
Severity of COPD				.578#
Mild, n (%)	3 (37.5)	2 (28.6)	0 (0)	
Moderate, n (%)	3 (37.5)	2 (28.6)	2 (40.0)	
Severe, n(%)	2 (25.0)	3 (42.9)	3 (60.0)	
No. of admission in Preceding 6 weeks, n (%)	1 (12.5)	0 (0)	0 (0)	.454#

* Tested by one-way ANOVA, #Tested by χ^2

Statistical Analysis

Data analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 16.0. Descriptive statistics including the frequency distribution, mean, and standard deviation were used to describe the demographic characteristics of the sample. Inferential statistics, including the chi-square and one-way analysis of variance (ANOVA), were used for checking the homogeneity of the study groups. Repeated-measures ANOVA was used to examine the differences of outcome measures, including spirometry, 6MWT, HRQL (SGRQ-HKC), and perceived social support (MSPSS-C) before and after the intervention programs, within groups and between groups. If any covariance was identified, repeated-measures analysis of covariance (ANCOVA) was used. A *P*-value of 0.05 was used as the level of statistical significance. All of the hypothesis testing was done with two-sided tests. To preserve the value of randomization, an intention-to-treat (ITT) analysis was applied in calculating the missing values at other time points. In the case of withdrawals, data of last observation were carried forward.

Data Cleansing

Data cleansing was conducted using descriptive statistics to eliminate any discrepancy between the raw data and the entered data (Portney & Watkins, 2000). The frequency count was checked for all the categorical variables to rule out any missing data. Frequency distribution, mean, standard deviation, minimums, and maximums were run, and the values were inspected for any outliers that lay beyond the possible range of scores. This procedure increases the validity of the data analysis (Portney & Watkins, 2000).

Sample Description and Assessment of Homogeneity of the Study Groups

Descriptive statistics were used to describe the background characteristics of the sample. Frequency, distribution, and percentage were used to summarize the sample attributes that were categorical in nature. For continuous variables, central tendency and dispersion were illustrated by mean, standard deviation, and range. Inferential statistics were used to determine whether there was any systemic difference among the three study groups with regard to the demographic data and baseline characteristics. This analysis is crucial because random assignment only enhances, and does not guarantee, equivalence between the study groups (Portney & Watkins, 2000). The chi-square test was used to compare the homogeneity of categorical variables between the study groups. One-way ANOVA was used for the continuous data in pursuing the same purpose. The statistical assumption of equal variance between the study groups underlying the one-way ANOVA was assessed by the Levene test for the homogeneity of variance (Portney & Watkins, 2000). Any non-equality detected between the study groups would be considered when interpreting the major findings.

Repeated-measures ANOVA

Repeated-measures ANOVA were used to measure the effect of the interventions on physiological and psychosocial health across time. The interventions, as between-subject variables, divided the subjects into three groups. The four points of time, as a within-subject variable, distinguished the measurements taken on the same subject. Using repeated-measures ANOVA to analyze the dependent variables and time factor enables the determination of whether there are main effects for each of the outcome variables and whether the interaction between the time and the group is significant. It

illustrates whether there is a change in the outcome variables over time (main effect for time). It also allows comparison of the three groups with different interventions in terms of their effectiveness in the change of outcomes (main effect for group). Finally, it illustrate whether the change in outcome variables over time is different for the three groups (interaction effect) (Pallant, 2007).

The drawback of repeated-measures ANOVA is that the results do not differentiate time periods. Therefore, post hoc pairwise comparisons with Bonferroni adjustment were conducted. The Bonferroni adjustment is designed to reduce the risk of Type I error because of multiple comparisons (Darren & Mallery, 2006). To ensure the validity of the analysis in repeated-measures ANOVA, the data need to meet a number of statistical assumptions, including normality, absence of outliers, homogeneity of variance-covariance matrix, and linearity (Tabachnick & Fidell, 2007).

Repeated-measures ANCOVA

In the event that a covariate was identified in the study, repeated-measures ANCOVA would be used to detect the intervention effect. Repeated-measures ANCOVA is an extension of repeated-measures ANOVA that allows the researcher to explore differences between groups while statistically controlling for the effect of covariates (Tabachnick & Fidell, 2007). In an experimental study, a covariate is a variable that may influence scores on the dependent variables. SPSS uses regression procedures to remove the variation in the dependent variable due to the covariate, and then performs the normal ANOVA techniques on the corrected or adjusted scores. By removing the influence of these additional variables, ANCOVA is able to increase the

power or sensitivity of the *F* test. In other words, it is able to increase the likelihood to detect differences between the study groups (Pallant, 2007).

Evaluation of Clinical Significance of SGRQ

According to Osman, Godden, Friend, Legge, and Douglas (1997), respiratory QOL measures focus on the client's experience of symptoms, how symptoms limit activity, and how much distress the disease causes the client. However, studies have found that improvement in QOL does not correlate strongly with changes in physiological indicators (Wijkstra et al., 1994). This weak correlation raises the question of whether HRQL scores have real clinical significance (Osman et al., 1997). SGRQ is well-established disease-specific QOL measure for clients with COPD. A number of methods have been used for estimating the minimum clinically important difference (MCID) of SGRQ (Beaton, Boers, & Wells, 2002; Jones, 2002; Jones, 2005; Osman et al., 1997). In an attempt to evaluate the clinical significance of SGRQ in the current study, the interpretation of MCID is explained below.

Minimum Clinically Important Difference

MCID is defined as the smallest difference in score in the domain of interest of the client perceived as beneficial or important (Jaeschke, 1989; Lacasse et al., 1996). It is used to evaluate the clinical significance of the effects of SGRQ perceived by clients. The threshold for each of the SGRQ domains, as well as for the total SGRQ score, is four units (Jones, 2002). This threshold score provides an indicator of the change compatible with a clinically significant change for the client. The mean treatment effect and its confidence intervals (CIs) are compared with the threshold for clinical significance (Jones, 2002).

According to Jones (2005), there are five different categories of response (Figure 3.6):

1. *Not significant*

   The upper CI of the intervention effect crosses zero.

2. *Significantly but not clinically significant*

   The mean intervention effect lies between zero and the MCID, the upper CI does not include zero, and the lower CI does not include the MCID.

3. *Not significantly inferior to a clinically significant*

   The mean intervention effect is statistically significant, but the lower 95% CI includes the MCID.

4. *Equivalent to a clinically significant effect*

   The mean change is greater than four units, and the upper CI includes the MCID.

5. *Greater than MCID*

   The upper CI of the intervention is below the MCID

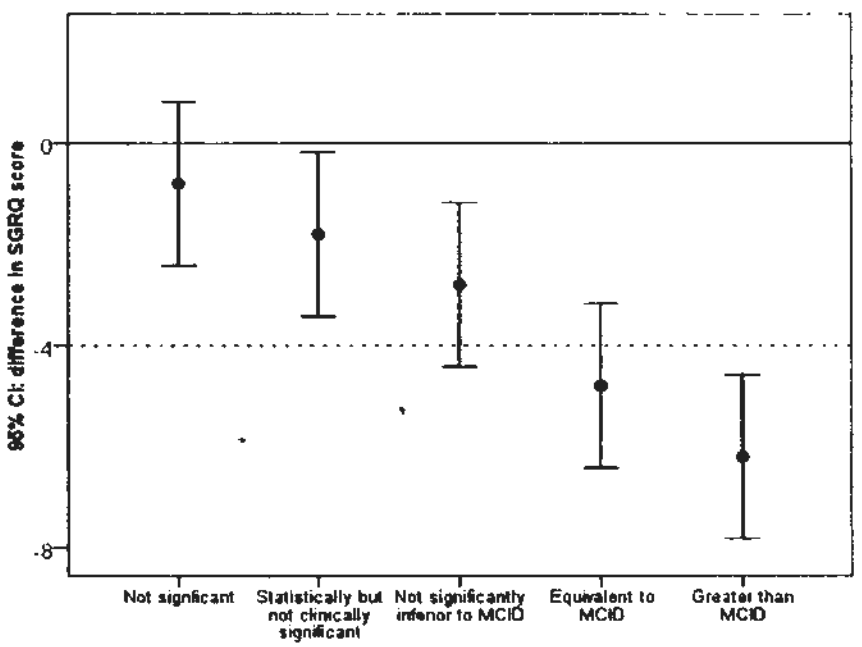


Figure 3.6 Changes in SGRQ score relative to the minimum clinically important difference (MCID). Lower score indicates better health. Error bars indicate 95% Confidence Intervals (Jones, 2005)

Generalized Estimating Equations Models

Generalized estimating equations (GEE) models were employed to assess the association among the outcome variables and social support scales. The GEE models account for intracorrelated repeated-measures data and can be fit to various types of data with the use of appropriate link-function.

Management of Attrition

In a longitudinal study involving older people with chronic illnesses, such as the present study, and in which the study endpoint is extended to the sixth month after the baseline test, attrition is generally anticipated (Patrician, 2002). This problem of attrition or nonresponse bias is pervasive and compromises the validity of the study findings (Portney & Watkins, 2000). Tabachnick and Fidell (2007) stated the need to consider the randomness of the missing data. Randomization alone, however, is not sufficient to provide an unbiased comparison of interventions (Lachin, 2000). Missing data can be handled in several ways: using listwise deletion, pairwise deletion, or intention-to-treat analysis (Munro, 2005). Nevertheless, no standardized way to handle missing data has been identified.

The listwise deletion is the easiest and most direct method for dealing with missing data because it analyzes only cases with complete data. However, this procedure produces larger standard errors because of the decrease in sample size, resulting in misleading results and decrease analytic power especially if a large number of cases are removed (Patrician, 2002). Pairwise deletion analysis only uses cases that have

available data on the variables. This method permits cases to be deleted only if the variables being used in the analysis have missing data. This approach is often used for correlations, factor analysis, and linear regression (Allison, 2001). Intention-to-treat analysis includes all subjects regardless of subsequent withdrawal or deviation from the protocol.

According to Lachin (2000), a sufficient condition to provide an unbiased comparison is to obtain complete data on all randomized subjects. This can be achieved by an intention-to-treat design, wherein all subjects are observed until the end of the trial, regardless of whether the subject continues to receive or comply with the assigned intervention. The Cochrane Collaboration also recommends an intention-to-treat analysis should include a patient's loss of follow-up by making data adjustments (Mulrow & Oxman, 1997). One of the most popular methods for dealing with missing data in a randomized analysis is the last observation carried forward (LOCF) analysis (Lachin, 2000), wherein the last observation obtained from a subject is substituted for all subsequent observations that are either missing or non-evaluable. This strategy assumes that the last observation of each such subject is an unbiased representation of what is missing. Although LOCF is argued as conservative and may dilute the treatment effect compared to what would have been observed (Veberke, Molenberghs, Bijnens, & Shaw, 1997), the intention-to-treat design, wherein all subjects continue to be observed, is especially powerful when an effective intervention arrests progression of disease during its administration. Lachin (2000) also suggested using the observations carried forward analysis is likely to prove more powerful. Because this approach analyzes data collected from all the participants and considers the influence of participant attrition (Hollis & Campbell,

1999) and compliance (Montori & Guyatt, 2001) on study outcomes, it can be seen as more appropriate to reflect the usual clinical circumstances. Based on the above justifications, this study adopted an approach to analyze data using intention-to-treat design. The missing data because of default follow-up or loss of contact were made up for using the LOCF analysis.

Ethical Considerations

Ethical approval for this study was obtained from the Joint Clinical Research Ethics Committee of the Chinese University of Hong Kong and New Territory East Cluster. International ethical codes of conduct have been developed to guide and provide maxims for research involving human subjects. According to the regularly updated World Medical Association Declaration of Helsinki (World Medical Association, 2008), in medical research involving competent human subjects, each potential subject must be adequately informed of the aims, methods, the anticipated benefits and potential risks, and the discomfort the study may entail. The Belmont Report (NIH, 2004) has established three fundamental ethical principles that are relevant to all research involving human subjects: respect for persons, beneficence, and justice. Although other important principles also apply to research, these three principles provide a comprehensive framework for ethical decision making. These three principles provided the ethical basis for guiding the development, design, and implementation of the current study.

Principle of Respect for Persons

This principle acknowledges the dignity and autonomy of individuals and requires that subjects give informed consent to participate in research (NIH, 2004). For the

current study, the written informed consent (Appendix 15 for Chinese version; Appendix 16 for English version) illustrated the research title, the purposes, and explanation of the research and the procedures of the study. Risks and benefits were clearly explained to participants. Each participant was given the opportunity to ask questions, and was informed that he/she was free to refuse to answer any questions and any assessments or withdraw from the study at any time. After ensuring that the information was clearly understood, written informed consent was obtained from every eligible subject who agreed to participate. Participants were again informed that their participation was entirely voluntary and that they had the right to refuse to participate or to withdraw consent at any time without reprisal.

Principle of Beneficence

This principle requires researchers to protect individuals by maximizing anticipated benefits and minimizing possible harm (NIH, 2004). Therefore, carefully examining the design of the study and its risks and benefits is necessary. Research risks must always be justified by the expected benefits of research. Existing theoretical and empirical support for the health benefits of TCQ is promising in general. Participants might experience improvement in health status after practicing TCQ. Another possible benefit would be the acquisition of TCQ knowledge and skills. Once participants have learned the skills, they could practice TCQ by themselves in the future as well.

Potential risks or side effects arising from TCQ are rare. One normal reaction is tiredness, which is easily resolved by resting. The researcher had taken these challenges into consideration and carefully monitored the participants' physical

condition and tolerance during first few TCQ sessions. Subjects were advised to bring along their inhalers and use them before the exercise if needed. The participants were allowed to rest if they experienced any discomfort or dyspnoea. They were also assured that they could refuse the interventions if they were or became intolerable.

Concerning the issue of maintaining the privacy information of the participants, special strategies were used to ensure confidentiality and anonymity during data handling. Data were kept in a safe place accessible only to the researcher. The participants' names would not be used in the research report. Instead, a code was assigned to each participant for identification purposes. All the collected information would be used for research purposes only. Once the study had been completed, all the data records would be destroyed.

Principle of Justice

This principle requires that researchers treat subjects fairly. For example, subjects should be carefully and equitably chosen to ensure that certain individuals or classes of individuals are not systematically selected or excluded, unless there are scientifically or ethically valid reasons for doing so. In addition, unless there is careful justification for an exception, researchers should not involve persons from groups that are unlikely to benefit from the research. The use of the GOPCs for the recruitment of participants was mainly based on the representativeness and accessibility of the sample to the population being studied. It was not based on any issues of convenience, acceptance, or to the compromised position of the study participants. In order to maintain their fairness of treatment, all subjects received

their usual care and medical treatment, which ensured that the control group was not being disadvantaged. They were also informed of the researcher's contact telephone number, so that they could make any clarification with the researcher at any point during the study. In addition, fairness in the allocation of interventions was achieved by the method of random assignment. This method was regarded as ethically justified without violating the principle of justice (McCleary, 2002). In addition to fairness, all participants in the exercise group and the control group received a TCQ DVD at the end of study, which taught them the modified 13-form TCQ and for their self-practice.

Summary

This chapter presented the methodology used for achieving the research aims, objectives, and hypotheses. The rationales for choosing the study design, sampling, and measures adopted at the outcomes and process evaluation were also discussed. This study adopted a RCT design. The participants were clients with COPD. Five GOPCs were selected. COPD clients who met the inclusion criteria were invited to participate. The sample size was determined by considering a medium effect size and a power of 0.80 with significant level set at 0.05 (Cohen, 1992). By taking into account a 25% expected attrition rate, a sample size of 195 was targeted.

The study intervention was a three-month TCQ program. It was conducted two times a week, and each session lasted for one hour. A qualified TCQ instructor conducted all the sessions. The exercise group was taught the breathing techniques and combined with walking as an exercise. The control group was advised to maintain

their routine activities. All participants in the three groups continued their usual medical treatment.

Physiological health was assessed by physical assessment. Psychosocial health was assessed in terms of HRQL and social support by interview using questionnaires. All the variables were assessed by validated instruments. A pilot study was performed to test the feasibility of the participant recruitment process, data collection method, and the study interventions. Ethical approval was granted from the university, and permission to conduct the study was obtained from the selected GOPCs. Data analysis was performed using one-way ANOVA, chi-square test, and repeated-measures ANOVA, or repeated-measures ANCOVA in case a covariate was identified.

CHAPTER 4

RESULTS

This chapter presents the results of the study, which examines the effect of the TCQ program in enhancing the physiological and psychosocial health outcomes in clients with COPD. The chapter consists of four sections. The first section describes the recruitment of participants. The second section describes the demographic, physiological, psychosocial, and baseline characteristics among the TCQ group, the exercise group, and the control group. The characteristics of participants, who completed the study and those who withdrew during the study period, are described and compared. Further analysis is also undertaken to examine the homogeneity of the demographic and the outcome variables of the study sample. The third section presents the results of the statistical analyses undertaken to test the hypotheses. The final section presents the information about the skill mastery of the TCQ group on the TCQ forms. The perception and satisfaction level of the participants for the TCQ program are also illustrated. Such information plays a role in enhancing the interpretation of the effects of the TCQ program.

SECTION I

Recruitment of the Participants

The period for recruitment procedure started from November 2007 to February 2009. Five GOPCs from the New Territories East cluster were selected for the study. From the CMS, clients with a diagnosis of COPD were searched starting from the period of January 1997 to September 2007. A total of 2216 clients of COPD were generated from the CMS. Some of the subjects were not appropriate for the study because of the following reasons: had duplicated identities (enrolled in more than one GOPC), lost of contact, death, old age home residence, had moved out of the cluster area, engaged in other studies, no longer attends follow-up in the GOPCs. The medical records of the 449 subjects were identified for the recruitment to the study were reviewed, of 81 subjects were deemed ineligible because of failure to fulfill the ATS guidelines, having sensory deficit, language barrier, impaired physical mobility, or presence of critical illnesses or conditions. The remaining 368 clients were then contacted by telephone and invited to participate in the study. Among the 368 clients, 143 refused to participate because they were not interested, 7 clients verbalized difficulties in attending the intervention sessions due to their work, 5 clients were residents of Mainland China who only came to Hong Kong for medical follow-up, and 3 subjects were engaged in other research studies. The remaining 206 subjects who agreed to participate in the study were then randomly assigned to one of the three groups, and arrangements were made for them to attend the research clinic for baseline assessment. Figure 4.1 illustrates the situation of the recruitment of the participants.

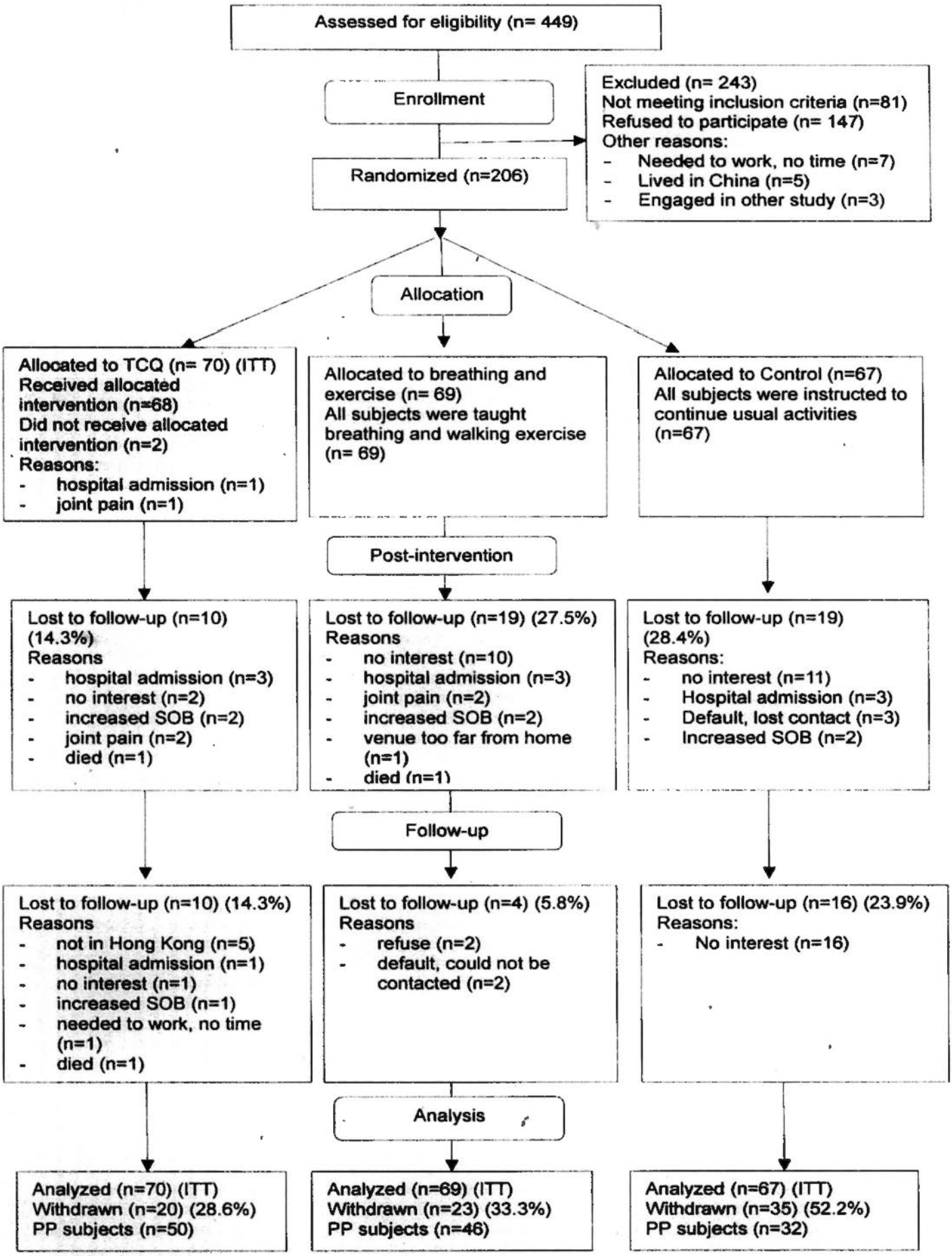


Figure 4.1: CONSORT (2005) flowchart to track participants through randomized controlled trail. *ITT* Intention To-Treat; *PP* per protocol

Of the 206 subjects, 158 (TCQ group = 60, exercise group = 50, and control group = 48) completed the study program at the third month. The main reasons for attrition were disinterest to continue (n = 22), hospital admissions (n = 9), increased dyspnoea (n = 6), joint pain (n = 4), lost of contact (n = 3), death (n = 2), venue was too far (n = 1), and needed to work (n = 1). A total of 128 subjects (TCQ group = 50, exercise group = 46, and control group = 32) received the follow-up assessment at the sixth month.

The attrition rates at the third month in the TCQ, exercise, and control groups were 14.3%, 27.5% and 28.4%, respectively. The number of dropout subjects in the TCQ group was the lowest among the three study groups.

The attrition rates at the sixth-month follow-up were 28.6% in the TCQ group, 33.3% in the exercise group, and 52.2% in the control group. The number of dropout subjects in the control group was the highest among the three study groups. The main reason for the high attrition rate was the lack of interest to continue participating in the study because the participants perceived no improvement in their conditions.

SECTION II

Baseline Characteristics of the Study Sample

Two hundred and six eligible subjects were recruited in the study. Majority of the subjects were married and lived with their families. Education level in average was at primary level or above. The participants had an age range of 55 to 88 years, with a mean age (standard deviation) of 72.9 (7.7). The mean duration of COPD was 11.1 (9.6) years. Of the 206 subjects, 187 (90.8%) were males and 19 (9.2%) were females. The obvious difference in the number of male and female participants may have been because COPD is traditionally more common in men (WHO, 2006). Based on the criteria of the ATS, the spirometry results indicated that 42.7% of the subjects were at a severe stage of COPD, 41.7% were at a moderate stage, and 15.5% were at a mild stage. The most common coexisting disease was hypertension, followed by heart disease and diabetes mellitus.

Comparison of Participants Who Completed the Study vs. Dropout Subjects

Homogeneity of the demographic data and baseline characteristics of the participants who completed the study were compared with the subjects who did not finish the study. The results are summarized in Tables 4.1 and 4.2. The subjects were ascertained of homogeneity in the demographic and baseline data. The only statistical difference observed was in the 6MWD (F (2, 128) = –.326, P = .01), where the dropout subjects walked a shorter distance (mean = 270 meters) in six minutes compared to the subjects who completed the study (mean = 303 meters). However, there was no significant difference in the baseline of the 6MWD among the three study groups who completed the study (F (2, 128) = .118, P = .89). Also, the dropout subjects were random in nature among the three study groups, the differences in the walking distance would therefore being cancelled out.

Table 4.1 Demographic characteristic of participants who completed the program and the dropout subjects at the third month and at the sixth month

	Completed program at 3rd month (n = 157)	Dropout at 3rd month (n = 49)	*t*	*P*	Completed program at 6th month (n = 129)	Dropout at 6th month (n = 77)	*t*	*P*
Age (yr) :Mean (SD)	72.3 (7.9)	75.1 (6.9)	2.23	.03*	72.2 (8.1)	74.2 (7.0)	1.81	.07
Yrs of COPD: Mean (SD)	10.9 (9.2)	11.2 (10.5)	.18	.73	11.3 (9.8)	10.6 (9.2)	-.46	.64
Income: Mean (SD)	3920 (3369)	3014 (2302)	-1.69	.09	3909 (3067)	3365 (3339)	-1.15	.25
BMI: Mean (SD)	22.0 (3.9)	20.6 (3.7)	-2.28	.02*	22.0 (3.7)	21.2 (4.2)	-1.30	.19
Exercise, mean hour per week (SD)	16.2 (13.1)	14.8 (13.5)	.43	.51	16.9 (13.5)	14.3 (12.6)	1.92	.17
			χ^2	*P*			χ^2	*P*
Gender:			.70	.40			3.76	.05
Male (%)	144 (91.7)	43 (87.8)			121 (93.8)	66 (85.7)		
Female (%)	13 (8.3)	6 (12.2)			8 (6.2)	11 (14.3)		
Marital status:			1.20	.75			.62	.89
Married (%)	136 (86.6)	42 (85.7)			113 (87.6)	65 (84.4)		
Single (%)	3 (1.9)	0 (0)			2 (1.6)	1 (1.3)		
Separated (%)	3 (1.9)	1 (2.0)			2 (1.6)	2 (2.6)		
Widowed (%)	15 (9.6)	6 (12.2)			12 (9.3)	9 (11.7)		
Live with:			.24	.62			.00	.99
Alone (%)	13 (8.3)	3 (6.1)			10 (7.8)	6 (7.8)		
Family (%)	144 (91.7)	46 (93.9)			119 (92.2)	71 (92.2)		
Education level:			6.59	.09			4.68	.20
Illiteracy (%)	24 (15.3)	9 (18.4)			16 (12.4)	17 (22.1)		
Primary (%)	90 (57.3)	35 (71.4)			79 (61.2)	46 (59.7)		
Secondary (%)	37 (23.6)	5 (10.2)			29 (22.5)	13 (16.9)		
Tertiary or above (%)	6 (3.8)	0 (0)			5 (3.9)	1 (1.3)		
Religion:			.115	.73			1.82	.18
Yes (%)	63 (40.1)	21 (42.9)			48 (37.2)	36 (46.8)		
No (%)	94 (59.9)	28 (57.1)			81 (62.8)	41 (53.2)		

(Table continues)

Table 4.1 *(continued)* Demographic characteristic of participants who completed the program and the dropout subjects at the third month and at the sixth month

	Completed program at 3rd month (n = 157)	Dropout at 3rd month (n = 49)	χ^2	*P*	Completed program at 6th month (n = 129)	Dropout at 6th month (n = 77)	χ^2	*P*
Smoking Status:			5.26	.15			1.01	.80
Second hand smoker (%)	6 (3.8)	0 (0)			4 (3.1)	2 (2.6)		
Never smoke (%)	8 (5.1)	1 (2.0)			7 (5.4)	2 (2.6)		
Ex-smoker (%)	107 (68.2)	41 (83.7)			91 (70.5)	57 (74.0)		
Current smoker (%)	36 (22.9)	7 (14.3)			27 (20.9)	16 (20.8)		
Stage of COPD:			.084	.96			.33	.85
Mild (%)	25 (15.9)	7 (14.3)			21 (16.3)	11 (14.3)		
Moderate (%)	65 (41.4)	21 (42.9)			52 (40.3)	34 (44.2)		
Severe (%)	67 (42.7)	21 (42.9)			56 (43.4)	32 (41.6)		
Co-existing diseases:								
Heart disease (%)	19 (12.9)	6 (12.2)	.001	.98	15 (11.6)	10 (13.0)	.08	.77
HT (%)	74 (47.1)	19 (38.8)	1.05	.31	61 (47.3)	32 (41.6)	.64	.42
DM (%)	17 (10.8)	3 (6.1)	.94	.33	14 (10.9)	6 (7.8)	.52	.47

* $P < .05$

Table 4.2 Baseline characteristic of participants who completed the program and the dropout subjects at the third month and at the sixth month

	Completed program at 3rd month (n = 157)	Dropout at 3rd month (n = 49)	*t*	*P*	Completed program at 6th month (n = 129)	Dropout at 6th month (n = 77)	*t*	*P*
FVC, litre, mean (SD)	1.92 (.56)	1.75 (.62)	-1.83	.07	1.93 (.56)	1.79 (.59)	-1.65	.10
FEV_1, litre, mean (SD)	.92 (.38)	.81 (.38)	-1.67	.10	.93 (.40)	.84 (.36)	-1.76	.08
FEV_1%Pred, mean (SD)	50.07 (21.79)	56.44 (25.57)	-.69	.49	54.73 (24.49)	52.34 (22.27)	-.70	.48
Dyspnoea, mean (SD)	.80 (1.00))	.92 (1.20)	.67	.50	.85 (1.03)	.81 (1.09)	-.26	.79
Fatigue, mean (SD)	.87 (1.16)	.81 (1.16)	-.35	.73	.93 (1.18)	.74 (1.11)	-1.12	.26
SaO_2, mean (SD)	95 (2.66)	95 (2.70)	-.38	.70	96 (2.52)	95 (2.88)	-.91	.37
Exacerbation rate, median (range)	.00 (0-4)	.00 (0-4)	.97#	.33	.00 (0-4)	.00 (0-4)	.15#	.23
No. of admission, median (range)	.00 (0-4)	.00 (0-4)	.03#	.87	.00 (0-4)	.00 (0-4)	.14#	.71
Extra usage of inhaler, mean (SD)	2.55 (6.58)	2.82 (5.65)	.26	.80	2.56 (6.46)	2.86 (5.92)	.26	.80
6MWD, mean meter (SD)	298 (73.53)	269 (69.73)	-2.41	.02*	303 (75.49)	270 (65.21)	-3.26	.01*
SGRQ-HKC, mean (SD)	38.47 (15.58)	43.61 (17.08)	1.97	.05	38.40 (15.65)	41.86 (16.60)	1.50	.14
MSPSS-C, mean (SD)	49.71 (17.46)	49.37 (18.11)	-.12	.91	50.09 (17.10)	48.87 (18.43)	-.48	.63

FVC Forced volume capacity; *FEV_1* Forced expiratory volume in one second; *FEV1%Pred* FEV_1 percent predicted normal values; *SaO_2* Oxygen saturation; *6MWD* six-minute walking distance; *SGRQ-HKC* St. George's Respiratory Questionnaire–Hong Kong Chinese version; *MSPSS-C* Multidimensional Scale of Perceived Social Support–Chinese version; *$P < .05$, # Chi-squared test

Outcome Evaluation Data Analysis

Parametric and Nonparametric Test

Parametric tests have several advantages. They are more powerful and more flexible than nonparametric techniques. They allow the researcher to study the effect of many independent variables on the dependent variable, and they are able to study the interaction of these variables. The most important assumption of parametric tests is that the variable in the sample is normally distributed (Munro, 2005).

Nonparametric tests can be used in small samples and serious distortions of the data. When the data are significantly skewed, one approach is to transform the data to achieve a normal distribution; the other approach is to use nonparametric tests. An advantage of the nonparametric approach is that the data retain their original values, making interpretation easier (Munro, 2005).

In this study, the sample size was satisfactory. The test of normality of baseline data was performed using normal P-P plots (illustrated in Section III), and most of the data were distributed in a reasonably normal distribution. Therefore, a parametric test was chosen for most of the continuous scales, such as lung function and six-minute walking tests, and the ordinal data, such as the HRQL (SGRQ), the Borg scale, and the MSPSS. Before conducting proper data analysis of parametric tests, reliability of the data was ensured by performing data screening and cleaning, checks for normality and homogeneity, and tests for assumption for parametric tests. For the acute exacerbation rates and hospital admission rates, serious distortions of the normal distributions were evident; therefore, the data were analyzed by the

comparison of the number of exacerbation and the number of hospital admission from baseline (T1) to the study endpoint (T4) for the three study groups.

Type I Error, Type II Error, and Power

The purpose of ANOVA procedures is to test hypotheses. With this type of analysis, two different types of error can occur during data analysis. Type I error refers to when the researcher rejects the null hypothesis when it is, in fact, true. This possibility can be minimized by selecting an appropriate α level. Type II error refers to when the researcher fails to reject the null hypothesis when it is, in fact, false. This error can be reduced by selecting an appropriate test to prove the result.

The power of a test becomes evident when the researcher correctly identifies whether there is a difference between the study groups. The power of a test can be influenced by several factors: (1) sample size, (2) effect size, and (3) α level.

In addition, controlling all extraneous variables especially for the initial difference of the individual characteristic is impossible (Polit & Beck, 2008). Some measures were adopted to increase the statistical power. First, a one-way ANOVA was used to determine whether there was any significant difference among the three study groups regarding the continuous variable at baseline, whereas chi-square tests were used to test for categorical variables. If the result was not homogenous for the variable at baseline, the variable was then identified as a potential risk factor that might have a significant impact on the outcomes. If there were significant associations between the heterogeneous data and the dependent variables, the ANCOVA method was adopted

because it can adjust for initial differences between three groups. The final analysis could then be compared (Darren & Mallery, 2006).

Homogeneity of Baseline Data of the Three Study Groups

The participants were randomly assigned to one of the three groups: TCQ (n = 70), exercise (n = 69), and control (n = 67). The mean age of the TCQ group, the exercise group, and the control group were 71.7, 73.6, and 73.6 respectively. Homogeneity of the three groups in terms of demographic data, and physiological and psychological characteristics were examined. Chi-square tests were used to detect differences in demographic data on nominal variables. One-way ANOVA was performed on continuous variables. Tables 4.3 and 4.4 illustrate the demographic data of the subjects by group allocation. The three groups were homogeneous in majority of the measured characteristics. The only demonstrated significant difference in the demographic data was in gender (χ^2 = 7.70, P = .021). This was due to fewer females (n = 19) in the study. The confounding effect of gender was therefore controlled as a confounding variable in data analyses. For the dependent outcome variables, statistical difference was observed in the exacerbation rate (F (2, 203) = 8.10, P < .001) (Table 4.4). The difference was handled during the statistical analysis procedure.

Table 4.3 Demographic data and baseline characteristics of study sample by group allocation

	TCQ (n=70)	Exercise (n=69)	Control (n=67)	*F*	One-way ANOVA *P*-value
Age (yr) :Mean (SD)	71.7(8.2)	73.6 (7.5)	73.6 (7.4)	1.46	.24
Yrs of COPD: Mean (SD)	10.3 (9.3)	10.6 (8.8)	12.4 (10.6)	.65	.39
BMI: Mean (SD)	21.5 (3.6)	21.7 (3.9)	22.0 (4.2)	.24	.79
Exercise, mean hours Per week (SD)	16.8 (16.3)	13.4 (9.6)	17.5 (12.6)	1.90	.15
				χ^2	*P*
Gender:				7.70	.02*
Male (%)	69 (99)	61(88)	58 (87)		
Female (%)	1 (1)	8 (12)	9 (13)		
Marital status:				5.31	.51
Married (%)	64 (91.4)	60 (87.0)	54 (80.6)		
Single (%)	1 (1.4)	0 (0.0)	2 (3.0)		
Separated (%)	1 (1.4)	1 (1.4)	2 (3.0)		
Widowed (%)	4 (5.7)	8 (11.6)	9 (13.4)		
Live with:				2.41	.30
Alone (%)	4 (5.7)	4 (5.8)	8 (11.9)		
Family (%)	66 (94.3)	65 (94.2)	59 (88.1)		
Education level:				6.42	.38
Illiteracy (%)	9 (12.9)	10 (14.5)	14 (20.9)		
Primary (%)	41 (58.6)	47 (68.1)	37 (55.2)		
Secondary (%)	18 (25.7)	9 (13.0)	15 (22.4)		
Tertiary or above (%)	2 (2.9)	3 (4.3)	1 (1.5)		
Income				10.87	.21
=< $3000 (%)	34 (48.6)	42 (60.9)	38 (56.7)		
3001 – 5000 (%)	17 (24.3)	9 (13.0)	16 (23.9)		
5001 – 10000 (%)	13 (18.6)	10 (14.5)	11 (16.4)		
10001 – 15000 (%)	2 (2.9)	0 (0)	0 (0)		
Refuse to tell (%)	4 (5.7)	8 (11.6)	2 (3.0)		
Religion:				.33	.85
Yes (%)	28 (40.0)	30 (43.5)	26 (38.8)		
No (%)	42 (60.0)	39 (56.5)	41 (61.2)		
Smoking Status:				3.17	.79
Second hand smoker (%)	1 (1.4)	2 (2.9)	3 (4.5)		
Never smoke (%)	2 (2.9)	4 (5.8)	3 (4.5)		
Ex-smoker (%)	55 (78.6)	47 (68.1)	46 (68.7)		
Current smoker (%)	12 (17.1)	16 (23.2)	15 (22.4)		
Stage of COPD:				2.93	.57
Mild (%)	7 (10)	13 (19)	12 (18)		
Moderate (%)	31 (44)	26 (38)	29 (43)		
Severe (%)	32 (46)	30 (43)	26 (39)		
Co-existing diseases:					
Heart disease (%)	9 (13)	10 (15)	6 (9)	1.03	.60
HT (%)	28 (40)	36 (52)	28 (42)	2.22	.33
DM (%)	7 (10)	6 (9)	7 (10)	.13	.94

* P < .05

Table 4.4 Baseline characteristics of study sample by group allocation

	TCQ (n=70)	Exercise (n=69)	Control (n=67)	One-way ANOVA *F*	P-value
FVC, litre, mean (SD)	1.97 (.62)	1.84 (.52)	1.82 (.58)	1.45	.24
FEV_1, litre, mean (SD)	.89 (.38)	.91 (.39)	.89 (.39)	.06	.94
FEV_1%Pred, mean (SD)	50.07 (21.79)	56.44 (25.57)	55.10 (23.34)	1.40	.25
Dyspnoea, mean (SD)	1.06 (1.10)	.62 (.98)	.81 (1.04)	3.14	.05
Fatigue, mean (SD)	.99 (1.14)	.88 (1.25)	.70 (1.06)	1.05	.35
SaO_2, mean (SD)	96 (3.16)	95 (2.40)	95 (2.41)	.29	.75
Heart rate, mean (SD)	84 (12.8)	84 (12.8)	84 (13.2)	.02	.98
Exacerbation rate, median	.00 (0-4)	.00 (0-4)	.00 (0-4)	13.40#	<.01*
No. of admission, median	.00 (0-4)	.00 (0-4)	.00 (0-4)	3.98#	.14
Extra usage of inhaler, mean (SD)	2.80 (5.99)	3.01 (7.87)	2.00 (4.86)	.48	.62
6MWD, mean meter (SD)	298 (68.53)	285 (79.11)	290 72.97)	.58	.56
SGRQ-HKC, mean (SD)	42.7 (15.1)	37.0 (16.6)	39.4 (16.2)	2.26	.11
MSPSS-C, mean (SD)	50.3 (18.1)	50.2 (17.1)	46.6 (16.4)	.98	.38

FVC Forced volume capacity; *FEV_1* Forced expiratory volume in one second; *FEV1%Pred* FEV_1 percent predicted normal values; *6MWD* six-minute walking distance; *SaO_2* Oxygen saturation; *SGRQ-HKC* St. George's Respiratory Questionnaire–Hong Kong Chinese version; *MSPSS-C* Multidimensional Scale of Perceived Social Support–Chinese version; *$P < .05$, #Chi-squared test

Smoking Status among the Three Groups

Smoking status and history have known association with COPD (Lin et al., 2008; Lindberg et al., 2005). Nearly 90% of COPD cases are related to smoking or exposure to smoking (HKDH, 2010). Although smoking status was homogenous in baseline among the three study groups, the association of smoking status and the dependent variables was examined in this study before running statistical analysis. The results shown in Table 4.5 indicate that there was no significant difference in the association of smoking status and all outcome variables at baseline.

Table 4.5 Association of smoking status and dependent variables among the three groups

	One-way ANOVA		
	df	*F*	*P*- value
FVC	2	.950	.388
FEV_1	2	.051	.950
FEV1%pred	2	.028	.972
Pre-dyspnoea	2	.279	.757
Pre-fatigue	2	.090	.914
Pre-SaO_2	2	2.207	.113
Pre-heart rate	2	.016	.817
6MWT	2	2.585	.078
Symptom	2	.889	.412
Activity	2	.070	.933
Impacts	2	.314	.731
Total SGRQ	2	.195	.823
Significant other	2	2.475	.087
Family	2	.533	.587
Friend	2	2.595	.077
Total MSPSS	2	2.419	.092

FVC Forced volume capacity; *FEV_1* Forced expiratory volume in one second; *FEV1%Pred* FEV_1 percent predicted normal values; *SaO_2* Oxygen saturation; *6MWT* six-minute walking test; *SGRQ* St. George's Respiratory Questionnaire; *MSPSS* Multidimensional Scale of Perceived Social Support

Repeated Measures ANCOVA

Because of the presence of significant differences of gender between groups at baseline, the association of gender and all the dependent variables were examined. Gender was considered a covariate, and its confounding effect was controlled using repeated-measures ANCOVA in order to examine the intervention effect on the dependent outcome variables.

Evaluation of the Statistical Assumption for Repeated Measures ANCOVA

Normality of the Data

The normality of the distribution of scores on all the dependent variables in this study was assessed using a graphical method. The distribution of each dependent variable was checked using a normal P-P plot. A reasonably diagonal line indicated that there was no violation of the assumption of normality. The P-P plots are displayed in figures before each set of results.

Homogeneity of Variance

The sphericity assumption was supported by nonsignificant results of the Mauchly test. However, when the Mauchly test of sphericity was significant ($P < .001$), this indicated that these data violate the assumption of the univariate approach to repeated-measures of variance. The effect of violating sphericity is a loss of power (i.e., an increased probability of a Type II error) and a test statistic (F ratio) that simply cannot be compared to tabulated values of the F distribution (Field, 2009). If the data violate the sphericity assumption, there are several corrections that can be applied to produce a valid F ratio: (1) Greenhouse and Geisser, (2) Huynh and Feldt, and (3) the Lower Bound.estimate. All of these corrections involve adjusting the

degrees of freedom associated with the F value. In this study, if the assumption of homogeneity of variance was violated, the Greenhouse-Geisser correction was used to report the results because this is the most frequently approach.

Assumption of homogeneity of variance for the between-subjects factor was supported by the insignificant results of the Levene test in this study ($P > .05$).

SECTION III

Comparison of Changes in the Outcome Variables Within and Between the Study Groups

This section analyzes the changes in the outcome variables of the study groups across the study period. The outcome variables of the TCQ group, the exercise group, and the control group across the four stages of data collection are summarized statistically using mean and standard deviations, with their changes across the study period and presented in terms of mean and percentage. Information about the outcome variables at various study endpoints in terms of estimated marginal means are also presented graphically. To summarize, the results showed that the physiological outcome variables in the TCQ group change in a favorable trend from baseline to the six-month follow-up study endpoint. Regarding the psychosocial outcomes, the participants in the TCQ group also reported an overall improvement in HRQL and perceived social support from friends. The participants in the exercise group showed slight improvement in lung functions; however, they also reported deterioration in HRQL. On the contrary, the participants in the control group demonstrated deterioration both in lung functions and in HRQL. No obvious change was observed in the perceived social support in both the exercise group and the control group. A summary of the results of major outcome variables is listed in Table 4.6

Table 4.6 Summary of Study Results

Changes of outcome variables at 6th month (T4) from baseline (T1)	TCQ Group Mean (95% CI)	Exercise Group Mean (95% CI)	Control Group Mean (95% CI)	Time*Group *P*-value
Lung functions:				
FVC, litre	0.19 (0.10, 0.28)	0.10 (0.12, 0.19)	-0.13 (-0.20, -0.06)	< 0.001*
FEV_1, litre	0.10 (0.05, 0.15)	0.32 (-0.02, 0.09)	-0.05 (-0.09, -0.02)	< 0.001*
6-minute walk distance, meters	51.5 (37.0, 66.0)	13.4 (1.7, 25.2)	7 (-3.3, 18.0)	< 0.001*
Post 6-minute walk:				
Dyspnoea score	-0.16 (-0.45, 0.12)	-0.01 (-0.25, 0.22)	0.20 (-0.05, 0.45)	0.052
Fatigue score	-0.11 (-0.42, 0.19)	0.23 (0.04, 0.42)	-0.13 (-0.41, 0.15)	0.379
SaO_2, %	-0.69 (-1.33, -0.05)	-0.32 (-1.19, 0.55)	-0.46 (-1.03, 0.10)	0.458
SGRQ-HKC:				
Symptoms	-4.64 (-8.88, -0.40)	-1.64 (-1.85, 6.46)	5.24 (1.09, 9.39)	< 0.001*
Activity	-2.53 (-6.95, 1.90)	-2.53 (1.49, 10.55)	4.48 (0.67, 8.28)	0.026*
Impact	-1.63 (-5.36, 2.11)	-1.63 (0.68, 8.51)	4.71 (1.24, 8.19)	0.030*
Total Score	-2.40 (-5.72, 0.92)	-2.40 (1.63, 7.64)	4.72 (2.02, 7.42)	0.002*
MSPSS-C:				
Family	1.89 (0.27, 3.50)	0.54 (-0.98, 2.05)	1.18 (-0.31, 2.67)	0.602
Friends	2.49 (0.25, 4.72)	0.26 (-1.88, 2.40)	1.87 (-0.03, 3.76)	0.047*
Significant other	2.60 (0.21, 4.99)	0.67 (-1.43, 2.76)	1.18 (-0.83, 3.19)	0.101
Total MSPSS	6.97 (1.62, 12.32)	1.59 (-3.00, 6.18)	4.19 (0.18, 8.21)	0.056

*$p < 0.05$ for repeated measures of ANCOVA

Changes in Lung Functions

The assumption of normality of baseline data for the outcome variables was examined using graphical analysis. The graphical method involved the use of normal P-P plots. A reasonably diagonal line indicated that there was no violation of the assumptions of normality. The results are displayed in Figures 4.2 to 4.4. The observed values for lung function tests laid approximately along the straight line for the expected values of normality. These variables were considered to have followed normal distribution.

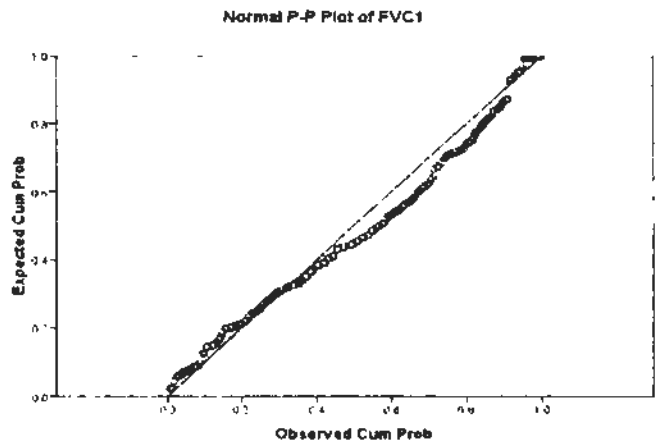


Figure 4.2 Normal P-P plot of forced expiratory volume in one second (FEV_1)

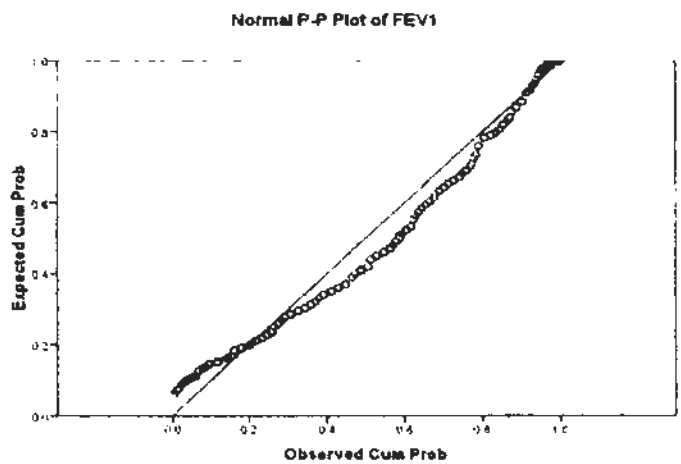


Figure 4.3 Normal P-P plot of Log transformation of FEV_1

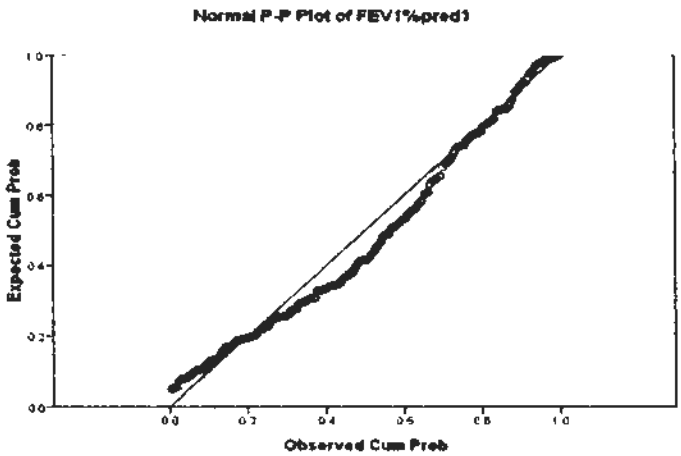


Figure 4.4 Normal P-P plot of FEV_1 percent predicted normal value (FEV_1%pred)

Changes in FVC

After adjusting the confounding effect of gender, repeated-measures ANCOVA was used to test the within-group and between-group difference in FVC across six months at four points. Figure 4.5 shows the pattern of change of FVC of each study group across time. The TCQ group showed a steady improvement from the baseline (T1) to the endpoint (T4) at the sixth month. FVC increased by .19 liter (190 ml, 9.40%) in the TCQ group and by .11 liter (110 ml, 5.86%) in the exercise group, but decreased by .13 liter (−130 ml, −7.24%) in the control group (Table 4.7).

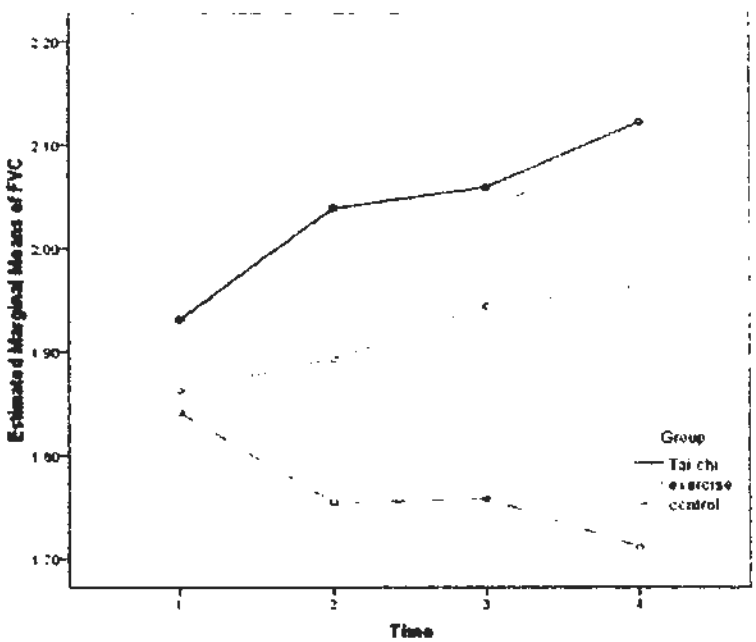


Figure 4.5 Estimated marginal means of forced vital capacity (FVC)

Table 4.7 Comparison of lung functions Outcome variables at baseline, 6th week, 3rd month and 6th month

	TCQ (n=70)		Exercise (n=69)		Control (n=67)	
	M (SD)	Change from last Measurement M (%)	M (SD)	Change from last Measurement M (%)	M (SD)	Change from last Measurement M (%)
FVC, litre						
Baseline (T1)	1.97 (.62)		1.84 (.52)		1.82 (.58)	
6-week (T2)	2.08 (.65)	.11 (5.58)	1.87 (.59)	.03 (1.63)	1.73 (.56)	-.09 (-4.95)
3-month (T3)	2.10 (.62)	.02 (.96)	1.92 (.63)	.05 (2.67)	1.74 (.58)	.01 (.58)
6-month (T4)	2.16 (.63)	.06 (2.86)	1.95 (.62)	.03 (1.56))	1.69 (.48)	-.05 (-2.87)
FEV_1, litre						
Baseline (T1)	.89 (.38)		.91 (.39)		.89 (.39)	
6-week (T2)	.96 (.40)	.07 (7.87)	.92 (.39)	.01 (1.10)	.85 (.36)	-.04 (-4.49)
3-month (T3)	.96 (.39)	0 (0)	.92 (.38)	0 (0)	.85 (.35)	0 (0)
6-month (T4)	.99 (.42)	.03 (3.13)	.94 (.42)	.02 (2.17)	.84 (.31)	-.01 (-1.18)
FEV_1%Pred						
Baseline (T1)	50.07 (21.79)		56.44 (25.57)		55.10 (23.34)	
6-week (T2)	54.66 (23.57)	4.59 (9.17)	57.04 (24.55)	.60 (1.08)	53.69 (23.64)	-1.41 (-2.56)
3-month (T3)	53.75 (22.53)	-.91 (-1.66)	57.49 (25.37)	.45 (.79)	53.36 (22.59)	-.33 (-.61)
6-month (T4)	56.02 (24.43)	2.27 (4.22)	59.03 (26.53)	1.54 (2.68)	52.81 (21.72)	-.55 (-1.03)

FVC Forced volume capacity; *FEV_1* Forced expiratory volume in one second; *FEV1%Pred* FEV_1 percent predicted normal values

The changes of the significant results in FVC at 95% CI at the six-week, three-month, and six-month study endpoints from baseline are shown in Figure 4.6.

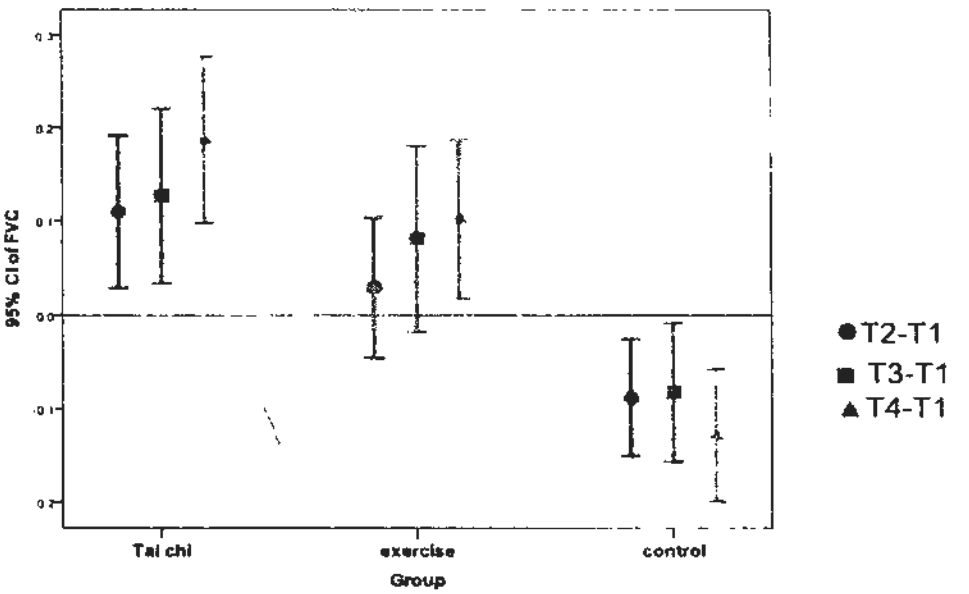


Figure 4.6 Changes in the forced vital capacity (FVC, litre) from baseline. T2-T1 = changes at 6th week study endpoint from baseline; T3-T1 = changes at 3rd month study endpoint from baseline; T4-T1 = changes at 6th month study endpoint from baseline.

The Mauchly test indicated that the assumption of sphericity had been violated, $\chi^2(5) = 31.93$, $P < .05$; therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity.

Within-subject tests showed a significant interaction effect of time by group (F (5.39, 544.82) = 6.33, $P < .001$), indicating that the changes in FVC over time among the three study groups were significantly different. With regard to time effect, the results indicated a nonsignificant time effect (F (2.70, 544.82) = .14, P = .92) for the three study groups.

Between-subject effects also showed significant differences (F (2, 202) = 4.23, P = .016) among the three groups (Table 4.8). Post hoc pairwise comparisons were

performed with Bonferroni adjustment, indicating there was significant differences between the TCQ and the control groups (P = .01) (Table 4.9). There was no difference between the TCQ and the exercise groups (P = .57). There were also no significant differences between the exercise and the control groups (P = .32).

Effect size. As indicated by the value of the partial eta squared, the effect sizes for interaction effect and between-group effect were .059 and .040, respectively (Table 4.7). According to the criteria of Cohen (1988), the effect size, as represented by partial eta squared, can range from very small (<.01) to small (.01–.05), to medium (.06–.13), and finally, to large (≥.14). The value reported in the current study indicated that the TCQ group had a medium effect size in improving the FVC between the three study groups over time. Finally, the ability of the statistical test to find a significant interaction effect was high, as indicated by a power of .998.

Table 4.8 Within-subject effects and between-subject effects for Spirometry outcome variables using repeated measures ANVOA

Outcome variable	Effect	*df*	*F*	*P*	Partial eta squared
FVC	Time	2.70, 544.82	.139	.922	
	Interaction	5.39, 544.82	6.334	<.001*	.059
	Group	2, 202	4.227	.016*	.040
FEV_1	Time	2.30, 464.00	1.483	.226	
	Interaction	4.59, 464.00	6.356	<.001*	.059
	Group	2, 202	.785	.458	
FEV_1%pred	Time	2.49, 502.51	1.989	.126	
	Interaction	4.98, 516.83	4.788	<.001*	.045
	Group	2, 202	.489	.614	

RANCOVA Repeated measures of analysis of covariance; *FVC* Forced volume capacity;
FEV_1 Forced expiratory volume in one second;
FEV1%Pred FEV_1 percent) predicted normal values; *P < .05

Table 4.9 Pairwise comparisons for FVC among the three groups

Group	Group	P-value [a]	95% for difference [a]
TCQ	Exercise	.573	-.10 - .35
	Control	.012*	.05 - .50
Exercise	TCQ	.573	-.35 - .10
	Control	.322	-.07 - .37

[a]. Adjustment for multiple comparisons: Bonferroni;

* The mean difference is significant at the .05 level;

FVC Forced volume capacity

Changes in FEV_1

Regarding FEV_1, the Mauchly test indicated that the assumption of sphericity had been violated, χ^2 (5) = 92.38, $P < .05$; therefore, results were reported using Greenhouse-Geisser correction.

As shown in Figure 4.7, the TCQ group showed more prominent improvement from the baseline (T1) to the sixth month (T4). FEV_1 increased by .10 liter (100 ml, 11.00%) in the TCQ group and by .03 liter (30 ml, 3.27%) in the exercise group, whereas it decreased by .05 liter (-50 ml, -5.67%) in the control group (Table 4.7).

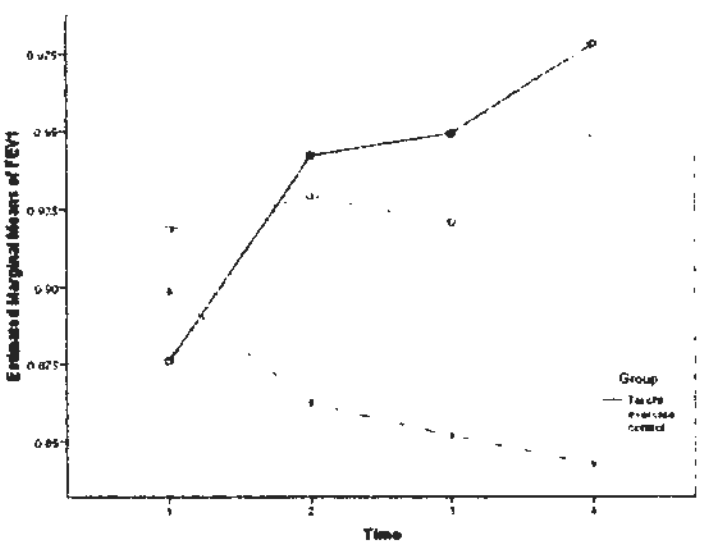


Figure 4.7 Estimated marginal means of forced expiratory volume in one second (FEV_1)

The changes of the significant results in FEV_1 at 95% CI at the six-week, three-month, and six-month study endpoints from baseline are shown in Figure 4.8.

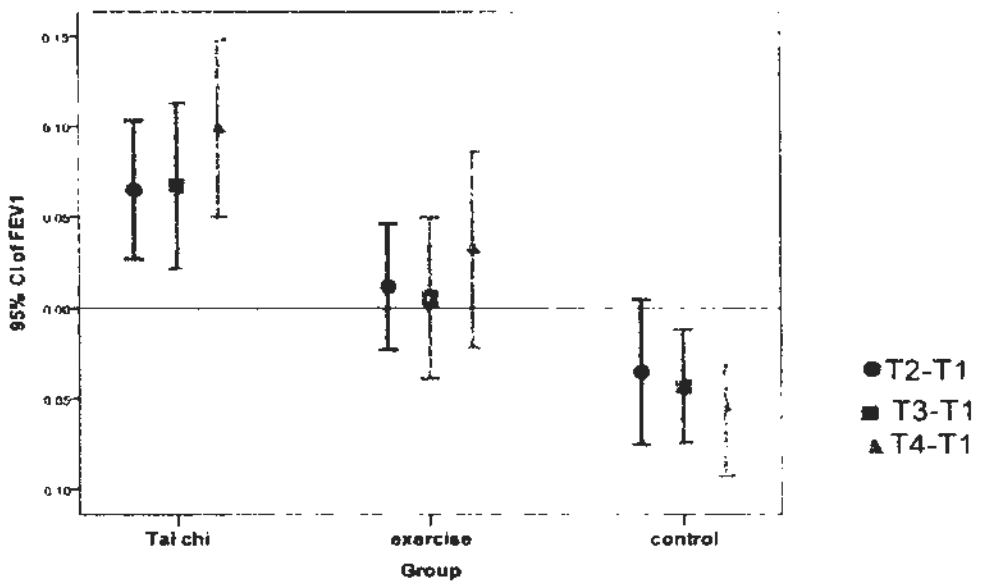


Figure 4.8 Changes in the forced expiratory volume in one second (FEV_1, litre) from baseline. T2-T1 = changes at 6th week study endpoint from baseline; T3-T1 = changes at 3rd month study endpoint from baseline; T4-T1 = changes at 6th month study endpoint from baseline.

Within-subject tests showed a significant interaction effect of time by group (F (4.59, 464.00) = 6.36, P < .001), indicating there were significant differences in the intervention effects among the three study groups across time. In relation to time effect, the result indicated a nonsignificant time effect for the three study groups (F (2.30, 464.00) = 1.48, P = .23).

In the between-subject effects, there were no significant group differences among the intervention, exercise, and control groups (F (2, 202) = .79, P = .46) (Table 4.8).

Effect size. The effect size for interaction effect was .06. This value indicated the TCQ group had a medium effect size in improving the FEV_1 level among the three

study groups over time (Cohen, 1988). Finally, the ability of the statistical test to find a significant interaction effect was high as indicated by a power of .996.

Changes in FEV_1%pred

Regarding the FEV_1 percentage predicted normal value (FEV_1%pred), the Mauchly test indicated that the assumption of sphericity had been violated, χ^2 (5) = 76.70, P < .05; therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity.

From the plotted graph (Figure 4.9), the TCQ group showed larger improvement than the other two groups. FEV_1%pred increased gradually from T1 to T4 by 11.73% in the TCQ group and by 4.53% in the exercise group, and decreased by 4.20% in the control group. There were no significant differences for between-subjects effects (F (2, 202) = .49, P = .61) (Table 4.8, p.125).

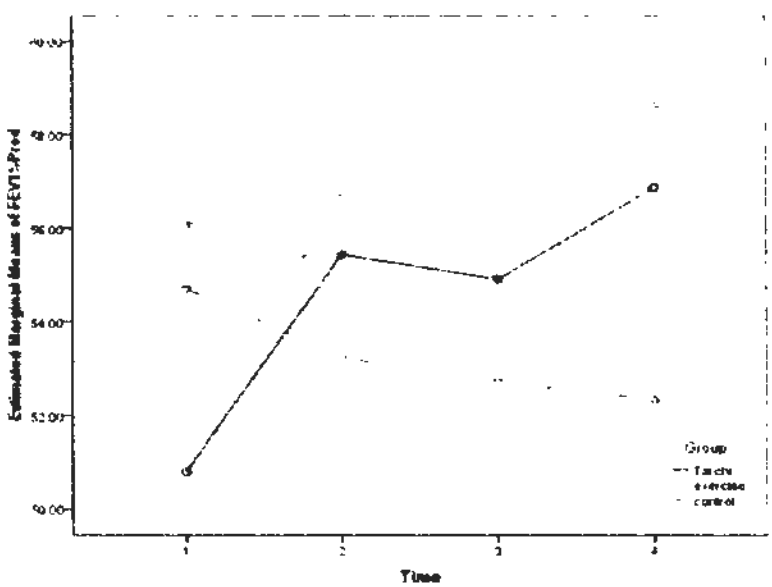


Figure 4.9 Estimated marginal means of FEV_1 percent predicted normal value

The changes of the significant results in FEV_1%pred at 95% CI at the six-week, three-month, and six-month study endpoints from baseline are shown in Figure 4.10.

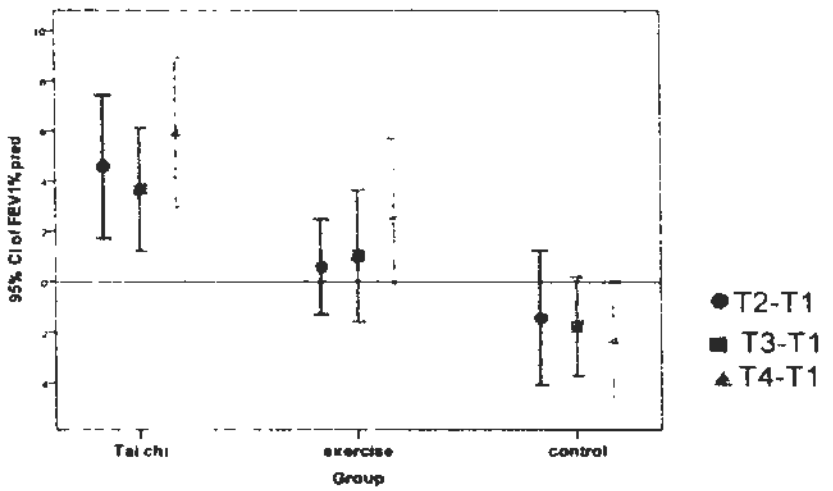


Figure 4.10 Changes in the FEV_1 percent predicted normal value (FEV_1%pred, litre) from baseline. T2-T1 = changes at 6th week study endpoint from baseline; T3-T1 = changes at 3rd month study endpoint from baseline; T4-T1 = changes at 6th month study endpoint from baseline.

In the within-group effects, there was significant group by time interaction effect (F (4.98, 502.51) = 4.79, $P < .01$) indicating significant differences of the intervention effects among the three study groups across time. For the time effect, there were no significant differences among the three study groups (F (2.49, 502.51) = 1.99, P = .13).

Between-subjects effects showed insignificant differences (F (2, 202) = .49, P = .61) among the three groups (Table 4.8, p.125).

Effect size. The effect size for interaction effect was .05 (Table 4.7), as represented by partial eta squared, indicating that the TCQ group has a medium effect size in improving the FEV_1%pred among the three study groups over time. Finally, the ability of the statistical test to find a significant interaction effect was high as indicated by a power of .981.

The TCQ group showed an overall improvement in lung functions across the study period. Findings indicated more prominent improvement in the first time segment from baseline to the sixth week (T1 to T2), and then maintained the improvement steadily in the rest of the study endpoints. In summary, participants in the TCQ group had statistically greater improvement in lung functions during the six-month study period, whereas participants in the exercise group had demonstrated relatively stable lung functions. However, participants in the control group showed a gradual deterioration in lung functions during the study period.

Therefore, Hypothesis 1 is rejected, and it was concluded that participants practicing TCQ demonstrates better improvement in lung functions when compared to participants in the exercise and the control groups. The significant effect of TCQ in the improvement of physiological health in COPD clients has been published in an internationally refereed journal (Chan, Lee, Suen, & Tam, 2011).

Changes of Exercise Capacity

The assumption of normality of baseline data for 6MWT was examined using normal P-P plot. The result is displayed in Figure 4.11. The observed value laid approximately along the straight line for the expected value of normality and was considered to have followed a normal distribution.

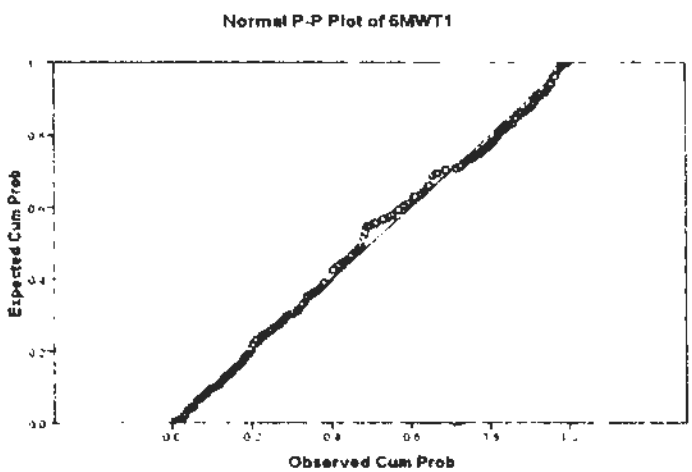


Figure 4.11 Normal P-P plot of six-minute walk test

Changes of 6MWT

Regarding the analysis of 6MWT, the Mauchly test indicated that the assumption of sphericity had been violated, χ^2 (5) = 50.21, $P < .05$; therefore, repeated-measures ANCOVA using Greenhouse-Geisser corrections were reported.

Within-subject tests showed a significant time by group effect (F (5.10, 515.29) = 7.87, $P < .001$). The TCQ group showed prominent increase in the walking distance from baseline (T1) to the endpoint at the sixth month (T4) (Figure 4.12). The mean distance walked in six minutes in the TCQ group increased by 51 meters (16.38%) from T1 to T4 (Table 4.10). Participants in the exercise group and the control group maintained a relatively stable exercise capacity during the study period. The time

effect for 6MWT was nonsignificant (F (2.55, 515.29) = 1.31, P = .27) for the three study groups (Table 4.10).

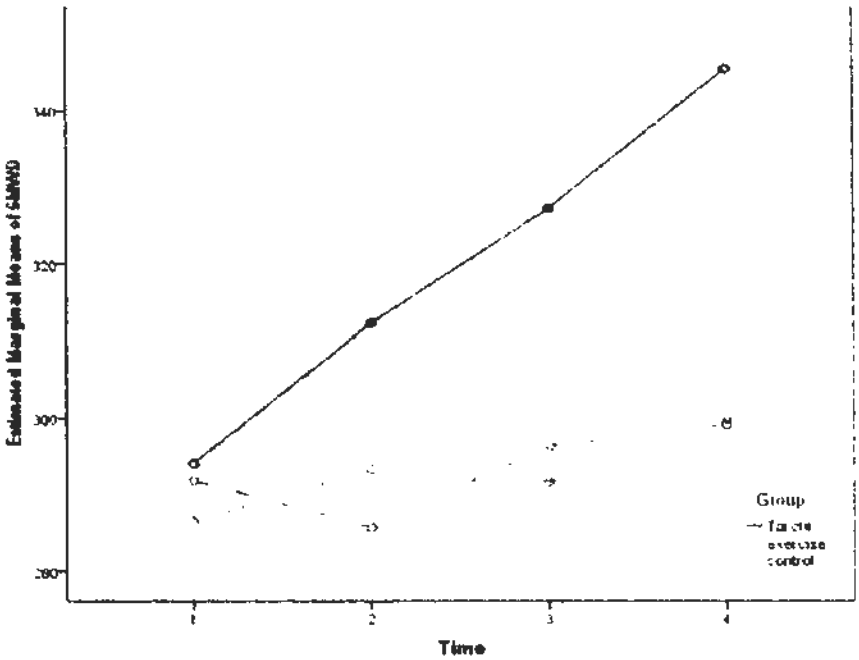


Figure 4.12 Estimated marginal means of six-minute walking distance

Table 4.10 Comparisons of 6MWT at baseline, 6th week, 3rd month and 6th month

	TCQ (n=70)		Exercise (n=69)		Control (n=67)	
	M(SD)	Change from last Measurement M (%)	M (SD)	Change from last Measurement M (%)	M (SD)	Change from last Measurement M (%)
6MWD, meters						
Baseline (T1)	297.91 (68.53)		284.64 (79.11)		289.75 (72.97)	
6-week (T2)	316.37 (60.15)	18.46 (6.20)	291.33 (84.82)	6.69 (2.35)	283.55 (82.25)	-6.20 (-2.14)
3-month (T3)	330.74 (61.86)	14.37 (4.54)	290.04 (80.09)	-1.29 (-.44)	294.57 (78.05)	11.02 (3.89)
6-month (T4)	349.41 (70.69)	18.67 (5.64)	298.07 (87.74)	8.03 (2.77)	297.09 (84.25)	2.52 (8.55)

6MWD six-minute walking distance

Table 4.11 Within-subject effects and between-subjects effects for 6MWT using repeated measures ANCOVA

Outcome variable	Effect	*df*	*F*	*P*	Partial eta squared
6MWD	Time	2.55, 515.29	1.312	.271	
	Interaction	5.10, 515.29	7.871	<.001*	.072
	Group	2, 202	3.220	.042*	.031

6MWT six-minute walk test; *6MWD* six-minute walking distance; * $P \leq .05$

Table 4.12 Pairwise comparisons for 6MWD among the three groups

Group	Group	P-value [a]	95% for difference [a]
TCQ	Exercise	027*	3.10 – 50.86
	Control	031*	2.50 – 50.65
Exercise	TCQ	027*	-50.86 - -3.10
	Control	.973	-24.22 – 23.41

[a]. Adjustment for multiple comparisons: Bonferroni

* The mean difference is significant at the .05 level

6MWD Six-minute walking distance

The changes of the significant results in 6MWT at 95% CI at the six-week, three-month, and six-month study endpoints from baseline are shown in Figure 4.13.

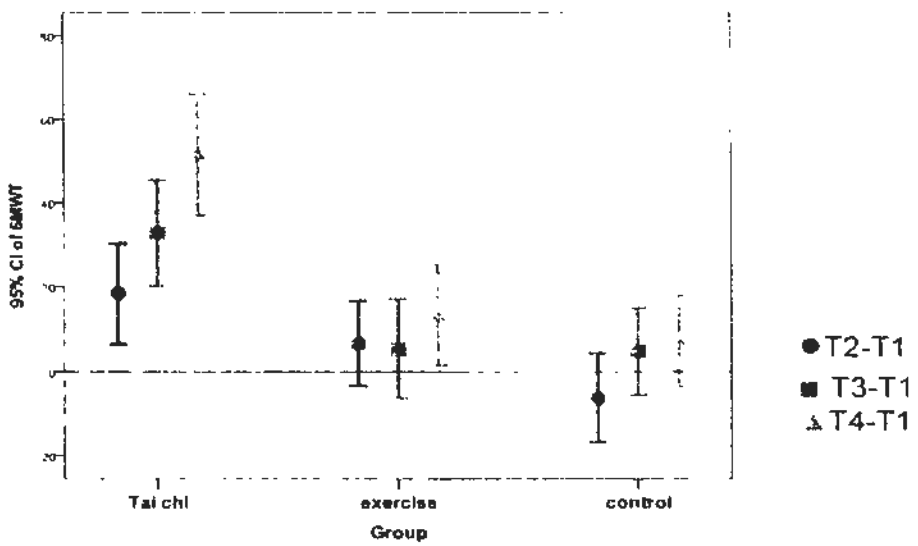


Figure 4.13 Changes in the six-minute walk test (6MWT, meter) from baseline. T2-T1 = changes at 6th week study endpoint from baseline; T3-T1 = changes at 3rd month study endpoint from baseline; T4-T1 = changes at 6th month study endpoint from baseline.

Between-subjects effects showed significant differences (F (2, 202) = 3.22, P = .042) among the three groups (Table 4.11). Post hoc pairwise comparisons (Table 4.12) with Bonferroni adjustment indicated there were significant differences between the TCQ and exercise groups (P = .03), and between the TCQ and control groups (P = .03). No differences were noted between the exercise group and the control group (P = .97)

Effect size. As indicated by the value of the partial eta squared, the effect sizes for interaction , and between-group effects were .07 and .03, respectively (Table 4.11). The value reported in the current study indicated that the TCQ group has a medium effect size in improving the walking distance between the three study groups and a small effect size in group effect. Lastly, the ability of the statistical test to find a significant interaction effect was high as indicated by a power of 1.000.

Thus, Hypothesis 2 is rejected, and it was concluded that participants in the TCQ group practicing TCQ increase exercise capacity compared to participants in the exercise group and the control group.

Changes in the Borg Scale

The assumption of normality of baseline data for the outcome variables was examined using normal P-P plots. The results are displayed in Figures 4.14 to 4.16. The observed values for exercise capacity tests laid approximately along the straight line for the expected values of normality. These variables were considered to have followed a normal distribution.

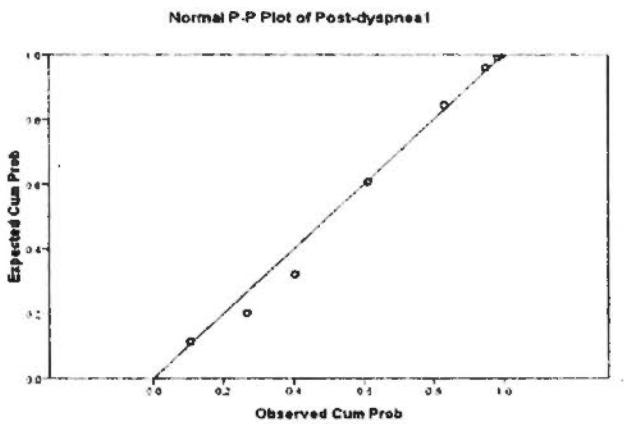


Figure 4.14 Normal P-P plot of Borg scale: dyspnoea level at baseline

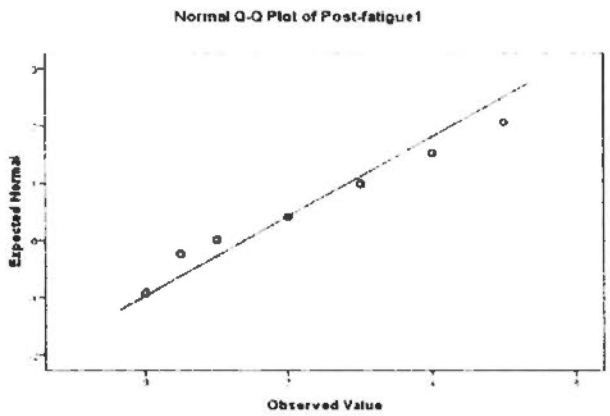


Figure 4.15 Normal P-P plot of Borg scale: fatigue level at baseline

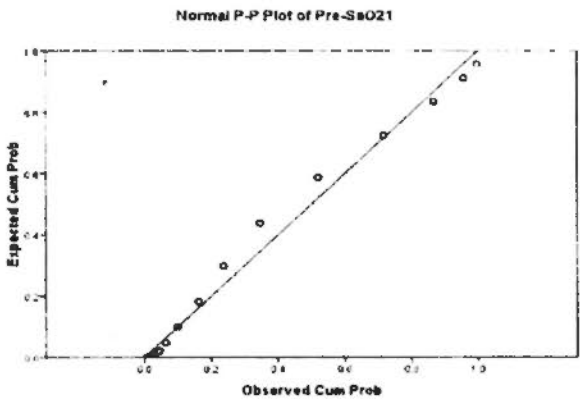


Figure 4.16 Normal P-P plot of oxygen saturation percentage (SaO_2) at baseline

The levels of dyspnoea and fatigue were measured using the Borg scale before and after the 6MWT. Repeated-measures ANCOVA were used to test the group difference of the post dyspnoea and post-fatigue levels. Because the assumption of Mauchly's sphericity had been violated ($P < .05$), the results were reported using Greenhouse-Geisser corrections.

Changes in Dyspnoea Level

Within-subject tests showed a borderline significant time by group interaction effect (F (5.62, 567.65) = 2.13, P = .052) with the TCQ group showing decreased dyspnoea level from baseline (T1) to the sixth week (T4) in the six-month study period when compared to the other two groups (Figure 4.17). Table 4.12 shows the improvement was more obvious in the first time segment (T1–T2) (-7.07%) than in the rest of time segments (–2.69%–1.09%). The exercise group showed an increased dyspnoea level from baseline (T1) to the study endpoint at the sixth month (T4) (16.14%). The control group showed a more obvious deterioration in dyspnoea level across the study period (25.07%). There was no significant time effect for dyspnoea level (F (2.81, 567.65) = .172, P = .91).

The changes of the dyspnoea score at 95% CI at the six-week, three-month, and six-month study endpoints from baseline are shown in Figure 4.18.

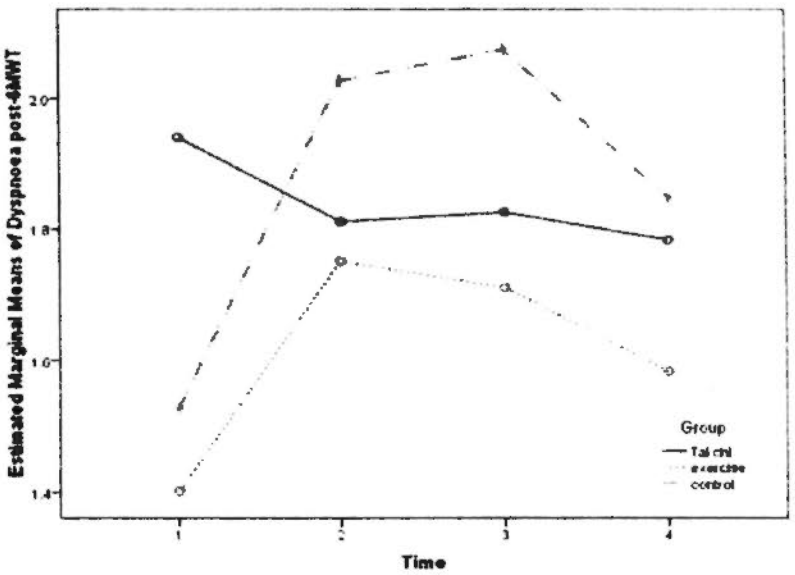


Figure 4.17 Estimated marginal means of dyspnoea score post six-minute walk test (6MWT)

Between-subject effects also showed no statistical differences (F (2, 202) = 1.06, P = .35) among the three study groups (Table 4.13).

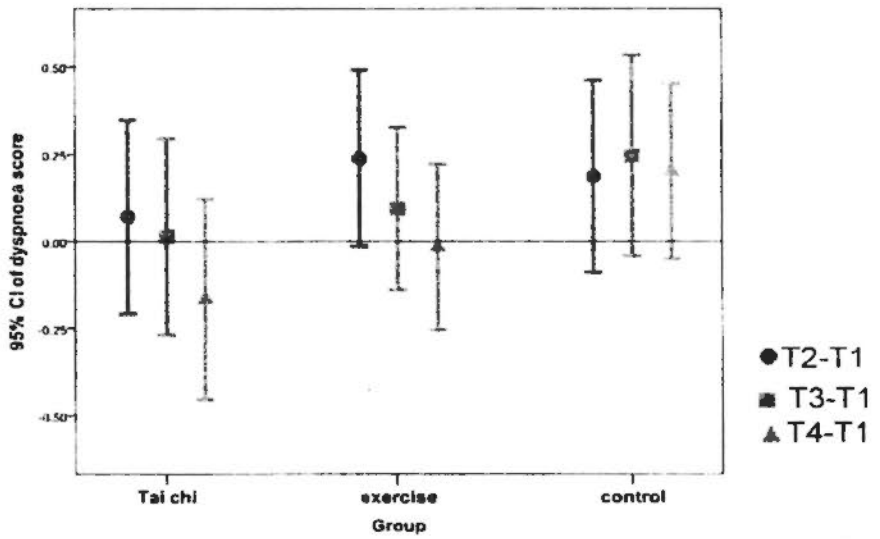


Figure 4.18 Changes in the dyspnoea score from baseline. T2-T1 = changes at 6th week study endpoint from baseline; T3-T1 = changes at 3rd month study endpoint from baseline; T4-T1 = changes at 6th month study endpoint from baseline.

Table 4.13 Comparisons of Borg scale and SaO_2 at baseline, 6th week, 3rd month and 6th month

	TCQ (n=70)		Exercise (n=69)		Control (n=67)	
	M(SD)	Change from last Measurement M (%)	M (SD)	Change from last Measurement M (%)	M (SD)	Change from last Measurement M (%)
Borg scale						
Dyspnoea post 6MWT						
Baseline (T1)	1.98 (1.21)		1.38 (1.74)		1.51 (1.43)	
6-week (T2)	1.84 (1.38)	-.14 (-7.07)	1.74 (1.37)	.36 (26.09)	2.02 (1.50)	.51 (33.77)
3-month (T3)	1.86 (1.25)	.02 (1.09)	1.70 (1.38)	-.04 (-2.30)	2.06 (1.53)	.04 (1 98)
6-month (T4)	1 81 (1.20)	-.05 (-2.69)	1.57 (1.28)	-.13 (-7.65)	1.84 (1 48)	-.22 (-10.68)
Fatigue post 6MWT						
Baseline (T1)	1.49 (1 46)		1.38 (1.42)		1.31 (1.44)	
6-week (T2)	1.72 (1.35)	.23 (15.44)	1.38 (1.36)	0 (0)	1.78 (1.61)	.47 (35.88)
3-month (T3)	1.56 (1.39)	-.16 (-9.30)	1.42 (1.32)	04 (2.90)	1.66 (1.37)	-.12 (-6.74)
6-month (T4)	1.53 (1.32)	-.03 (-1.92)	1.52 (1.34)	10 (7.04)	1.43 (1.33)	-.23 (-13.86)
SaO_2 %, post 6MWT						
Baseline (T1)	94.60 (5.52)		94.33 (4.80)		94.72 (3.49)	
6-week (T2)	94.11 (3.95)	-.49 (-.52)	93.77 (5.54)	-.56 (59)	94.75 (2.98)	.03 (.03)
3-month (T3)	94.03 (5.46)	-.08 (-.09)	94.25 (5.07)	48 (.51)	94.33 (3.31)	-.42 (-.44)
6-month (T4)	94.10 (4.55)	.07 (.07)	94.20 (5.75)	-.05 (-.05)	94.37 (3.45)	.04 (.04)

SaO_2 Oxygen saturation

Table 4.14 Within-subject effects and between-subjects effects for Borg scales and SaO_2 using repeated measures ANCOVA

Outcome variable	Effect	*Df*	*F*	*P*
Dyspnoea	Time	2.81, 567.65	.172	.905
	Interaction	5.62, 567.65	2.133	.052
	Group	2, 202	1.061	.348
Fatigue	Time	2.80, 565.62	.700	543
	Interaction	5.60, 565.62	1.069	379
	Group	2, 202	.573	.565
SaO_2	Time	2.69, 542.53	1.164	.321
	Interaction	5.37, 542.53	.942	.458
	Group	2, 202	.150	.861

SaO_2 Oxygen saturation

Changes in Fatigue Level

Regarding the fatigue level, both of the within-subject group by time interaction effect (F (5.60, 565.62) = 1.07, P = .38) and time effect (F (2.80, 565.62) = .70, P = .54), and the between-subject effects (F (2, 202) = .57, P = .57) were not significant different among the three groups.

Hence, Hypothesis 3 is supported, indicating that no differences were observed in the dyspnoea level and the fatigue level in COPD clients among the three study groups.

Changes of the Oxygen Saturation Level

The oxygen saturation level (SaO_2) was measured by oximetry before and after the 6MWT. Mauchly's sphericity was significant (P = .001). Greenhouse-Geisser corrections were reported. There were no significant differences in both the within-subject (F (5.37, 542.53 = .94, P = .46) and the between-subject effects (F (2, 202) =

.15, $P = .86$). There were also no changes in the time effect (F (2.69, 542.53 = 1.16, $P = .32$) (Table 4.14).

Therefore, Hypothesis 4 is supported, indicating that no difference was detected in the oxygen saturation level in COPD clients among the three study groups.

Changes in the Number of Exacerbations

The number of acute exacerbations refers to the self-reported frequency of exacerbation attacks of the subjects in the preceding six weeks. The assumption of normality of the baseline of acute exacerbation was violated. The observed value in the P-P plot (Figure 4.19) was not a straight line, indicating that the baseline data were not normally distributed.

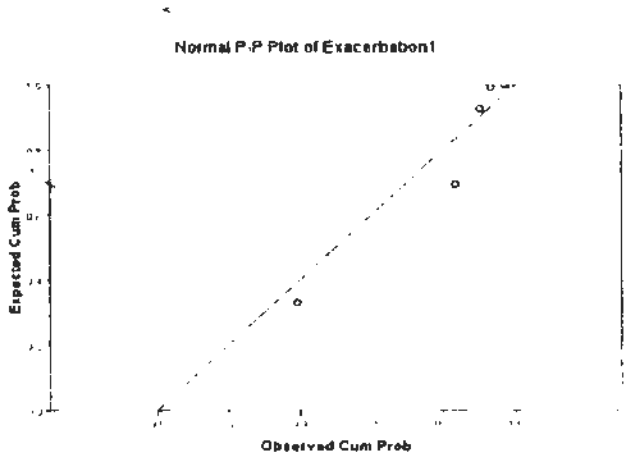


Figure 4.19 Normal P-P plot of baseline of the number of acute exacerbations

Because the outcome variable of the number of acute exacerbations was not normally distributed, parametric tests were not performed to test the changes. The number of exacerbations and its percentage for the three study groups are illustrated in Tables 4.15 to 4.17.

For the TCQ group, there was significant decrease in the number of acute exacerbations. The percentage of "no exacerbation" in the preceding six weeks at baseline (T1) was 65.7%, and was increased to 92.9% at the sixth month (T4), indicating more participants in the TCQ group were free from exacerbation attacks at the sixth-month study endpoint. The number of exacerbations between "one to three occasions" in the preceding six weeks was decreased from 24.2% to 5.7% during the

six-month study period. Participants who had "more than three" acute exacerbation attacks reduced from 10.0% at baseline (T1) to 1.4% at the sixth month study endpoint (T4) (Table 4.15).

Table 4.15 Number of acute exacerbations in the Tai chi Qigong group in the preceding six weeks at baseline, 6th week, 3rd month and 6th month

Number of exacerbation	Baseline (T1)	6th week (T2)	3rd month (T3)	6th month (T4)
0	46 (65.7%)	55 (78.6%)	60 (85.7%)	65 (92.9%)
1	7 (10.0%)	9 (12.9%)	4 (5.7%)	2 (2.9%)
2	5 (7.1%)	2 (2.9%)	0 (0%)	1 (1.4%)
3	5 (7.1%)	1 (1.4%)	3 (4.3%)	1 (1.4%)
More than 3	7 (10.0%)	3 (4.3%)	3 (4.3%)	1 (1.4%)
Total	70 (100%)	70 (100%)	70 (100%)	70 (100%)

For the exercise group, the number of acute exacerbations showed a slight increased from T1 to T4. "No exacerbation" in the preceding six weeks at T1 was 81.2%, and decreased to 78.3% at T4. "One to three occasions" of exacerbations at T1 was 15.9%, and increased to 17.3% at T4. The number of "more than three attacks" increased from 2.9% at T1 to 4.3% at T4 (Table 4.16).

Table 4.16 Number of acute exacerbations in the exercise group in the preceding six weeks at baseline, 6th week, 3rd month and 6th month

Number of exacerbation	Baseline (T1)	6th week (T2)	3rd month (T3)	6th month (T4)
0	56 (81.2%)	59 (85.5%)	54 (78.3%)	54 (78.3%)
1	9 (13.0%)	4 (5.8%)	9 (13.0%)	7 (10.1%)
2	2 (2.9%)	1 (1.4%)	3 (4.3%)	4 (5.8%)
3	0 (0%)	3 (4.3%)	1 (1.4%)	1 (1.4%)
More than 3	2 (2.9%)	2 (2.9%)	2 (2.9%)	3 (4.3%)
Total	69 (100%)	69 (100%)	69 (100%)	69 (100%)

The control group showed unstable exacerbation rates with slight increased number in the first time segment (T1–T2) and then fluctuated in the rest of the study endpoints. The number of "no exacerbation" in the preceding six weeks decreased from 89.6% at T1 to 80.6% at T4. The number of acute attacks from "one to three occasions" during the preceding six weeks decreased from 7.5% at T1 to 2.9% at T4. The number of acute exacerbation attacks for "more than three attacks" fluctuated from T1 to T4 at around 3.0% (Table 4.17).

Table 4.17 Number of acute exacerbations in the control group in the preceding six weeks at baseline, 6th week, 3rd month and 6th month

Number of exacerbation	Baseline (T1)	6th week (T2)	3rd month (T3)	6th month (T4)
0	60 (89.6%)	55 (82.1%)	58 (86 6%)	54 (80.6%)
1	4 (6.0%)	6 (9.0%)	6 (9.0%)	10 (14.9%)
2	1 (1.5%)	1 (1.5%)	0 (%)	1 (1 5%)
3	0 (0%)	2 (3.0%)	1 (1.5%)	0 (0%)
More than 3	2 (3.0%)	3 (4.5%)	2 (3.0%)	2 (3.0%)
Total	67 (100%)	67 (100%)	67 (100%)	67 (100%)

The changes of the significant results in the number of exacerbations in the preceding six weeks at 95% CI at the six-week, three-month, and six-month study endpoints from baseline are shown in Figure 4.20. The mean of the number of acute exacerbations decreased most obviously in the TCQ group compared to the other two study groups.

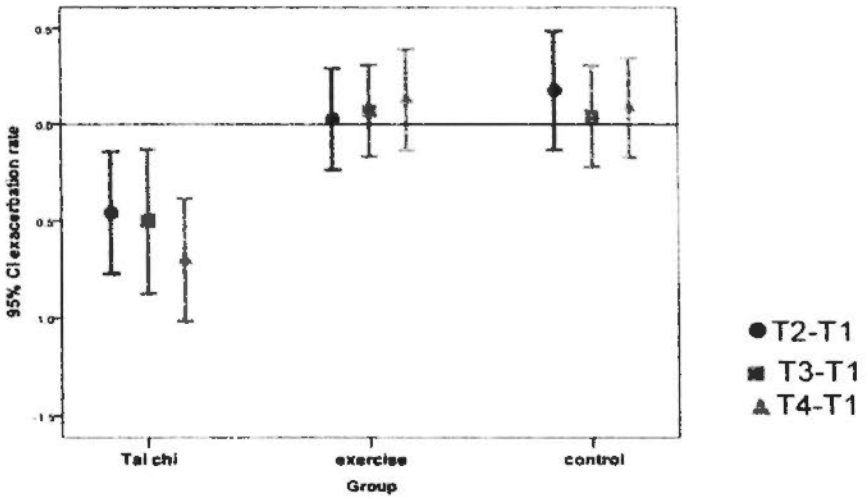


Figure 4.20 Changes in the number of exacerbations from baseline. T2-T1 = changes at 6th week study endpoint from baseline; T3-T1 = changes at 3rd month study endpoint from baseline; T4-T1 = changes at 6th month study endpoint from baseline.

Thus, Hypothesis 5 is rejected, and it was concluded that TCQ exercises could decrease the number of acute exacerbations in COPD clients across time compared to the other two groups.

Changes in Admission Rates and Extra Usage of Short-acting β_2 Agonist Inhalers

The number of hospital admissions related to lung problems in the preceding six weeks, and the extra usage of short-acting β_2 agonist inhalers in the preceding weeks were recorded. The assumptions of normality of the baseline of these data were violated. The observed values in the P-P plots (Figures 4.21–4.22) were not a straight line, indicating that the baseline data were not normally distributed. Parametric tests were not appropriate for testing the changes.

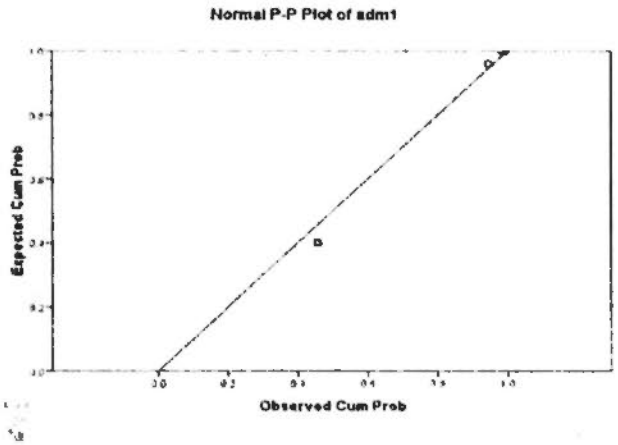


Figure 4.21 Normal P-P plot of hospital admission rates in the preceding six weeks

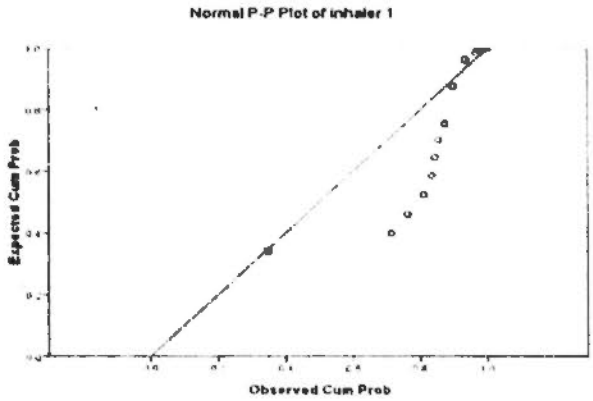


Figure 4.22 Normal P-P plot of extra usage of inhalers in the preceding week

Hospital Admission

The number of hospital admissions and its percentage for the three study groups were illustrated in Tables 4.18 to 4.20. There were no obvious changes in the number of hospital admissions among the three study groups from baseline (T1) to the sixth-month study endpoint (T4).

Table 4.18 Number of hospital admissions in the preceding six weeks in the Tai chi Qigong group at baseline, 6th week, 3rd month and 6th month

Number of admission	Baseline (T1)	6th week (T2)	3rd month (T3)	6th month (T4)
0	62 (88.6%)	63 (90.0%)	63 (90.0%)	64 (91.4%)
1	7 (10.0%)	6 (8.6%)	6 (8.6%)	4 (5.7%)
2	1 (1.4%)	1 (1.4%)	1 (1.4%)	1 (1.4%)
3	0 (0%)	0 (0%)	0 (0%)	1 (1.4%)
Total	70 (100%)	70 (100%)	70 (100%)	70 (100%)

Table 4.19 Number of hospital admissions in the preceding six weeks in the exercise group at baseline, 6th week, 3rd month and 6th month

Number of admission	Baseline (T1)	6th week (T2)	3rd month (T3)	6th month (T4)
0	61(88.4%)	63 (91.3%)	65 (94.2%)	63 (91.3%)
1	6 (8.7%)	3 (4.3%)	3 (4.3%)	3 (4.3%)
2	1 (1.4%)	0 (0%)	0 (0%)	2 (2.9%)
3	0 (0%)	2 (2.9%)	0 (0%)	0 (0%)
4	1 (1.4%)	1 (1.4%)	1 (1.4%)	1 (1.4%)
Total	69 (100%)	69 (100%)	69 (100%)	69 (100%)

Table 4.20 Number of hospital admissions in the preceding six weeks in the control group at baseline, 6th week, 3rd month and 6th month

Number of admission	Baseline (T1)	6th week (T2)	3rd month (T3)	6th month (T4)
0	65 (97.0%)	64 (95.5%)	59 (88.1%)	56 (83.6%)
1	1 (1.5%)	3 (4.5%)	8 (11.9%)	9 (13.4%)
2	0 (0%)	0 (0%)	0 (%)	1 (1.5%)
3	0 (0%)	0 (0%)	0 (0%)	0 (0%)
4	1 (1.5%)	0 (0%)	0 (0%)	0 (0%)
7	0 (0%)	0 (0%)	0 (0%)	2 (3.0%)
Total	67 (100%)	67 (100%)	67 (100%)	67 (100%)

The changes in the number of hospital admissions in the preceding six weeks at 95% CI at the six-week, three-month, and six-month study endpoints from baseline are shown in Figure 4.23.

The three study groups did not show obvious changes from baseline to the study endpoints. Hypothesis 6 is supported, indicating no significant differences in the number of hospital admissions were detected among the three study groups during the six-month study period.

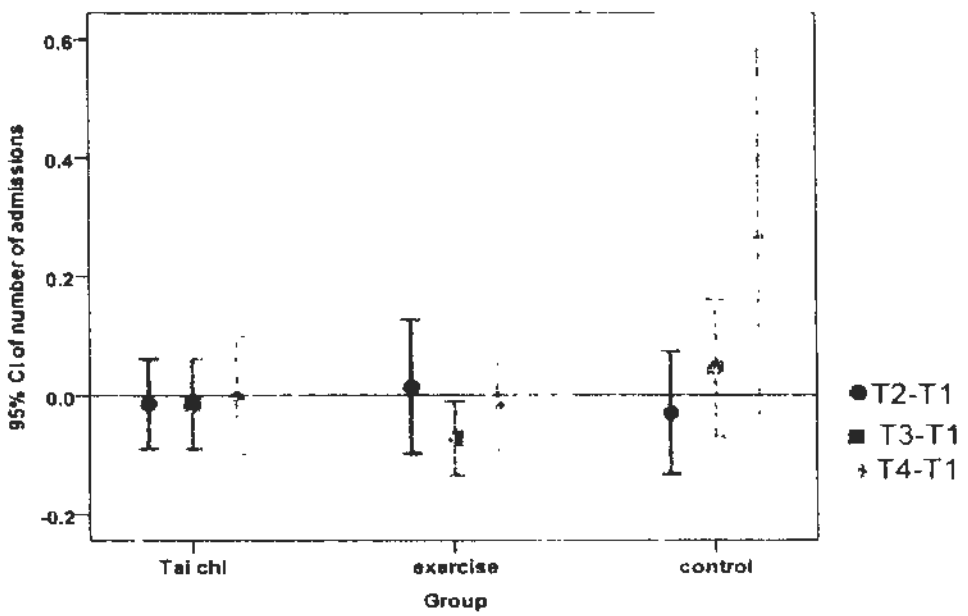


Figure 4.23 Changes in the number of hospital admissions from baseline. T2-T1 = changes at 6th week study endpoint from baseline; T3-T1 = changes at 3rd month study endpoint from baseline; T4-T1 = changes at 6th month study endpoint from baseline.

Extra Usage of Short-acting β_2 Agonist Inhalers

The relation of the number of extra usage of the short-acting β_2 agonist inhalers among the three study groups are illustrated in Tables 4.21 to 4.23.

Table 4.21 Extra number of using short acting beta 2 agonist inhalers in the preceding week in the Tai chi Qigong group at baseline, 6th week, 3rd month and 6th month

Extra number of using inhaler	Baseline (T1)	6th week (T2)	3rd month (T3)	6th month (T4)
0	45 (64.3%)	48 (68.6%)	45 (64.3%)	46 (65.7%)
1-10	19 (27.1%)	17 (24.3%)	19 (27.1%)	20 (28.6%)
11-20	3 (4.3%)	4 (5.7%)	4 (5.7%)	4 (5.7%)
21-30	3 (4.3%)	1 (1.4%)	2 (2.9%)	0 (0%)
Total	70 (100%)	70 (100%)	70 (100%)	70 (100%)

Table 4.22 Extra number of using short acting beta 2 agonist inhalers in the preceding week in the exercise group at baseline, 6th week, 3rd month and 6th month

Extra number of using inhaler	Baseline (T1)	6th week (T2)	3rd month (T3)	6th month (T4)
0	47 (68.1%)	44 (63.8%)	47 (68.1%)	53 (76.8%)
1-10	15 (21.7%)	21 (30.4%)	16 (23.2%)	12 (17.4%)
11-20	5 (7.2%)	2 (2.9%)	4 (5.8%)	3 (4.3%)
21-30	2 (2.9%)	2 (2.9%)	2 (2.9%)	1 (1.4%)
Total	69 (100%)	69 (100%)	69 (100%)	69 (100%)

Table 4.23 Extra number of using short acting beta 2 agonist inhalers in the preceding week in the control group at baseline, 6th week, 3rd month and 6th month

Extra number of using inhaler	Baseline (T1)	6th week (T2)	3rd month (T3)	6th month (T4)
0	51(76.1%)	48 (71.6%)	41 (61.2%)	49 (73.1%)
1-10	10 (14.9%)	14 (20.9%)	20 (29.9%)	14 (20.9%)
11-20	5 (7.5%)	5 (7.5%)	6 (9.0%)	4 (6.0%)
21-30	1 (1.5%)	0 (0%)	0 (0%)	0 (0%)
Total	67 (100%)	67 (100%)	67 (100%)	67 (100%)

The changes in the number of extra usage of short-acting bronchodilator at 95% CI at the six-week, three-month, and six-month study endpoints from baseline are shown in Figure 4.24.

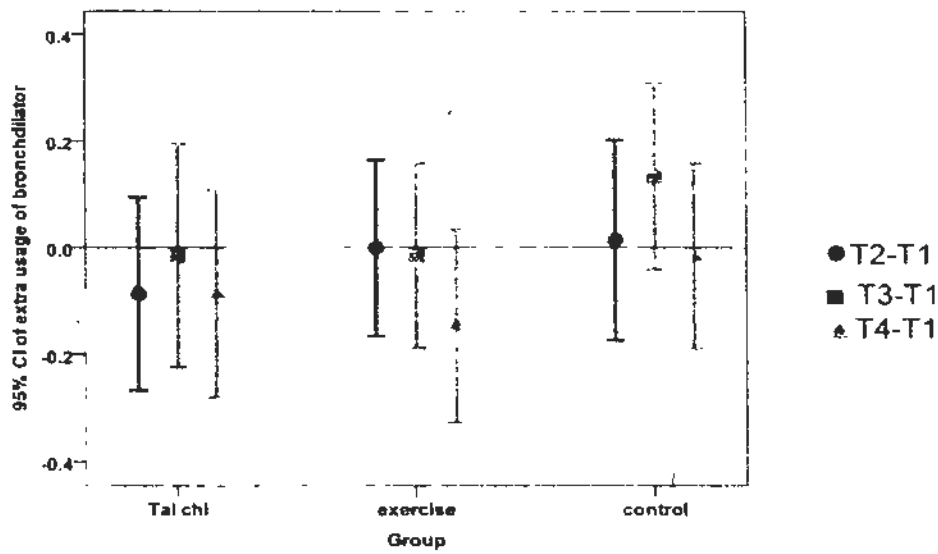


Figure 4.24 Changes in the number of extra usage of short acting bronchodilator from baseline. T2-T1 = changes at 6th week study endpoint from baseline; T3-T1 = changes at 3rd month study endpoint from baseline; T4-T1 = changes at 6th month study endpoint from baseline.

There were no obvious changes among the three groups (Figure 4.24). Therefore, Hypothesis 7 is not rejected, indicating that there were no significant differences in the extra number of usage of the short-acting beta bronchodilators among the three study groups during the six-month study period.

Changes in the HRQL

HRQL was measured by using SGRQ-HKC, which includes three domains: symptom, activity, and impact scores, and the total SGRQ scores. The lower score indicates better health status. The assumptions of normality of the baseline of these data were confirmed by using P-P plots. The observed value in the P-P plots (Figure 4.25–4.28) were laid approximately along the straight line for the expected values of normality, indicating that the baseline data were normally distributed. The Mauchly sphericity test for each of the repeated-measures effect was assumed ($P > .05$). The assumption of homogeneity of variance using the Levene test was also not significant ($P > .05$), indicating that variances were homogeneous for all levels of the repeated-measures variables.

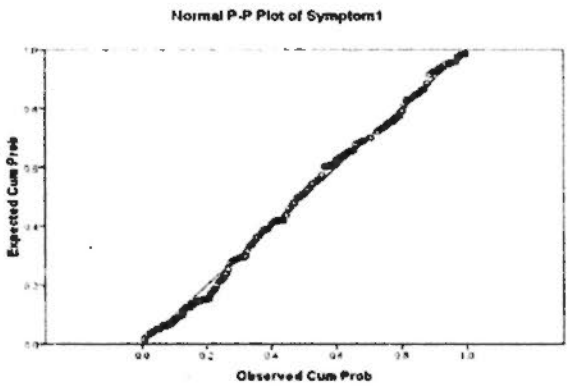


Figure 4.25 Normal P-P plot of the symptom scores (SGRQ-symptom)

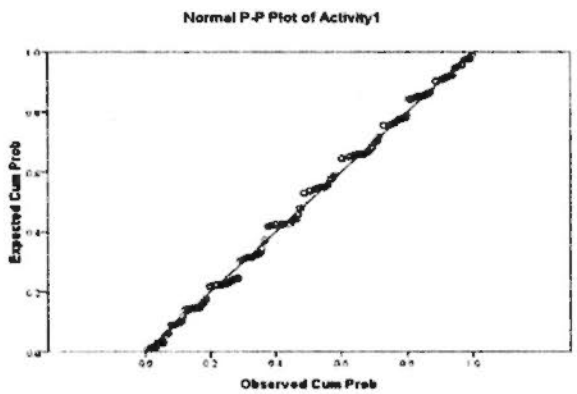


Figure 4.26 Normal P-P plot of the activity scores (SGRQ-activity)

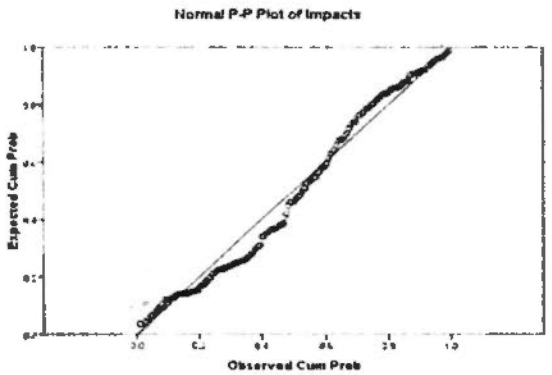


Figure 4.27 Normal P-P plot of the impact scores (SGRQ-impact)

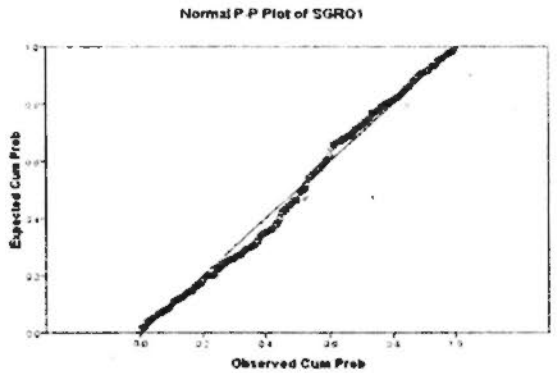


Figure 4.28 Normal P-P plot of the total SGRQ scores

The results of means and standard deviations of the SGRQ-HKC are summarized in Table 4.24. The gender of the participants was considered as a covariate and its confounding effect had been controlled using the repeated-measures ANCOVA.

Table 4.24 Comparison of SGRQ-HKC at baseline, 6th week, 3rd month and 6th month

	TCQ (n=70)		Exercise (n=69)		Control (n=67)	
	M(SD)	Change from last Measurement M (%)	M (SD)	Change from last Measurement M (%)	M (SD)	Change from last Measurement M (%)
Symptoms						
Baseline (T1)	45.75 (18.54)		38.64 (19.44)		37.89 (19.39)	
6-week (T2)	45.50 (17.85)	-.25 (-.55)	36.38 (20.24)	-2.26 (-5.85)	42.86 (18.96)	4.97 (13.12)
3-month (T3)	42.18 (19.03)	-3.32 (-7.30)	37.44 (18.17)	1.06 (2.91)	42.37 (20.07)	-.49 (-1.14)
6-month (T4)	41.11 (21.09)	-1.07 (-2.54)	40.90 (19.79)	3.46 (9.24)	43.13 (19.72)	.76 (1.79)
Activity						
Baseline (T1)	56.05 (19.82)		47.03 (21.65)		51.69 (21.24)	
6-week (T2)	52.43 (20.63)	-3.62 (-6.46)	52.43 (20.32)	5.40 (11.48)	53.42 (20.10)	1.73 (3.35)
3-month (T3)	54.43 (19.50)	2.00 (3.81)	53.51 (22.11)	1.08 (2.06)	54.10 (18.22)	.68 (1.27)
6-month (T4)	53.52 (22.27)	-.91 (-1.67)	53.05 (20.45)	-.46 (-.86)	56.17 (18.56)	2.07 (3.83)
Impact						
Baseline (T1)	34.11 (16.72)		30.67 (18.79)		32.77 (18.53)	
6-week (T2)	33.46 (17.10)	-.65 (-1.91)	32.70 (18.56)	2.03 (6.62)	34.20 (16.59)	1.43 (4.36)
3-month (T3)	34.41 (17.34)	.95 (2.84)	33.79 (17.85)	1.09 (3.33)	37.63 (16.72)	3.43 (10.03)
6-month (T4)	32.49 (18.29)	-1.92 (-5.58)	35.27 (18.67)	1.48 (4.38)	37.48 (16.81)	-.15 (-.40)
Total SGRQ						
Baseline (T1)	42.69 (15.13)		36.97 (16.56)		39.37 (16.18)	
6-week (T2)	41.22 (15.78)	-1.47 (-3.44)	39.31 (15.66)	2.34 (6.33)	41.48 (15.39)	2.11 (5.36)
3-month (T3)	41.77 (15.18)	.55 (1.33)	40.39 (16.10)	1.08 (2.75)	43.41 (14.77)	1.93 (4.64)
6-month (T4)	40.29 (16.94)	-1.48 (-3.54)	41.60 (15.74)	1.21 (3.00)	44.09 (15.01)	.68 (1.57)

SGRQ-HKC St George's Respiratory Questionnaire Hong Kong Chinese version

Changes in the Symptom Score

In the within-group comparison regarding the symptom score, significant group by time interaction effect was noted (F (6, 606) = 3.96, P < .01). There was no significant time effect (F (3, 606) = .55, P = .65) and no between-group effects among the three study groups (F (2, 202) = 1.30, P = .27) (Table 4.24).

Effect size. As indicated by the value of the partial eta squared, the effect size for interaction was .038 (Table 4.25). The value reported in the current study indicated that the TCQ group had a small effect size with regard to improved symptoms among the three study groups across time. The ability of the statistical test to find a significant interaction effect was high, as indicated by a power of .972.

Figure 4.29 shows the pattern of change of the symptom score of each study group across time. The TCQ group reported improved symptoms over time, whereas the other two groups reported declines in the symptom score. The TCQ group improved 10.39% from baseline (T1) to the sixth month (T4). The greatest improvement (7.30%, T2 to T3) was observed at T3. The improvement was continued to the end of the six-month study period (2.54%, T3–T4). The exercise group reported an improvement at T2 (5.86%) from baseline (T1). However, the improvement could not be maintained. Subjects in this group reported a decline of symptom score at T3 (2.91%) and T4 (9.24%). The control group reported deterioration of symptom score from T1 to T4 (13.77%).

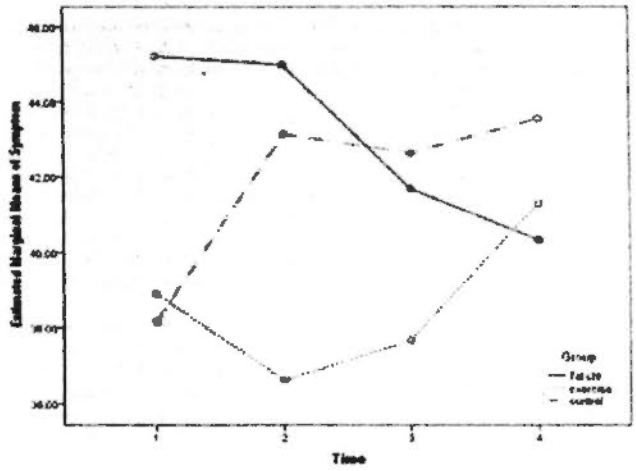


Figure 4.29 Estimated marginal means of symptom scores

Table 4.25 Within-subject effects and between-subjects effects for HRQL Outcome Variables

Outcome variable	Effect	*df*	*F*	*P*	Partial eta squared
Symptom	Time	3, 606	.548	.650	
	Interaction	6, 606	3.959	.001*	.038
	Group	2, 202	1.302	.274	
Activity	Time	3, 606	.614	.606	
	Interaction	6, 606	2.418	.026*	.023
	Group	2, 202	.450	.639	
Impact	Time	3, 606	5.114	.002*	.025
	Interaction	6, 606	2.344	.030*	.023
	Group	2, 202	.570	.566	
Total SGRQ	Time	3, 606	3.176	.024*	.015
	Interaction	6, 606	3.510	.002*	.034
	Group	2, 202	.564	.570	

HRQL Health related quality of life; *SGRQ* St. George's Respiratory Questionnaire; * $P < .05$

Changes in the Activity Score

In the within-group comparison, regarding the activity score, significant group by time interaction effect was noted (F (6, 606) = 2.42, P = .03). There was no significant time effect (F (3, 606) = .61, P = .61) and between-group effects among the three study groups (F (2, 202) = .45, P = .64) (Table 4.25).

Effect size. As indicated by the value of the partial eta squared, the effect size for interaction effect was .023 (Table 4.24). The value reported in the current study indicated that the TCQ group has a small effect size in improving the activity level across the three study groups. The ability of the statistical test to find a significant interaction effect was high, as indicated by a power of .824.

Figure 4.30 shows the pattern of change of the activity score of each study group across time. The TCQ group reported slightly improved activity score over time, whereas the other two groups reported declines in the activity score. The TCQ group reported an improvement in activity score for 4.32% from baseline (T1) to the sixth month (T4). The improvement was more prominent at T2 (6.46%), slightly declined at T3, then improved again at T4 (Table 4.23). Both of the exercise group and the control group reported declines of activity from T1 to T4. The exercise group declined 11.48% at T2; however, it was then able to maintain the activity score at a comparatively stable level without further deterioration. The deterioration of activity score in the control group was gradual from T1 to T4 (8.45%) and showed a deteriorating trend.

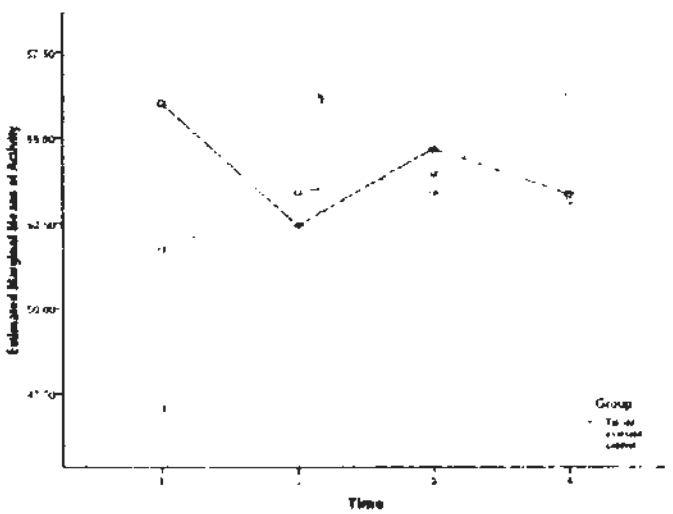


Figure 4.30 Estimated marginal means of activity score

Changes in the Impact Score

In the within-group comparison, regarding the impact score, there was significant interaction effect for group by time (F (6, 606) = 2.34, P = .03). A significant time effect (F (3, 606) = 5.11, P = .03) was also noted. No between-group effects were observed among the three study groups (F (2, 202) = .57, P = .57) (Table 4.25).

Effect size. As indicated by the value of the partial eta squared, the effect sizes for time interaction were .025 and .023, respectively (Table 4.25). The values reported in the current study indicated that the TCQ group has a small effect size in time effect and a small effect size in improving the impact score between the three study groups. The ability of the statistical test to find a significant time effect and interaction effect was high, as indicated by a power of .921 and .810, respectively.

Figure 4.31 shows the pattern of change of the impact score of each study group across time. The TCQ group reported slightly improved impact score over time, whereas the other two groups reported declines in the impact scores. The TCQ group reported a rather stable impact score during the first three months (T1–T3). A more obvious improvement in impact score was observed at T4 (5.58%) in the TCQ group. Both of the exercise group and the control group reported a steady decline of impact score from T1 to T4. The exercise group reported a total decline of impact score of 14.33%. The deterioration in the control group was more obvious from T1 to T3 (14.39%) (Table 4.24).

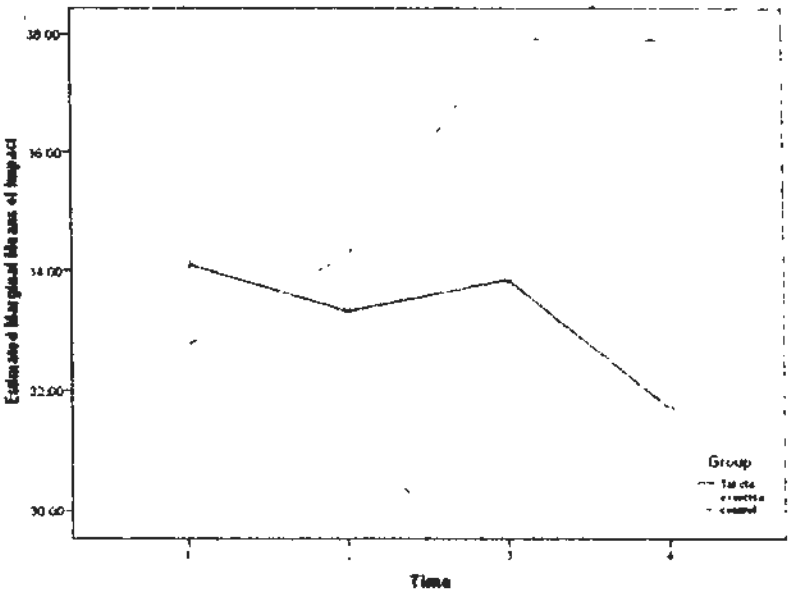


Figure 4.31 Estimated marginal means of impact score

Changes in the Total SGRQ Scores

In the within-group comparison, regarding the total SGRQ score, there were significant interaction effect for group by time and (F (6, 606) = 3.51, P = <.01) time effect (F (3, 606) = 3.18, P =.02). No between-group effects were noted among the three study groups (F (2, 202) = .56, P = .57).

Effect size. As indicated by the value of the partial eta squared, the effect sizes for time and interaction were .015 and .034, respectively (Table 4.25). The values reported in the current study indicated that the TCQ group has a small effect size in both of the time effect and the interaction effect of group by time in the total SGRQ. The ability of the statistical test to find a significant time effect and interaction effect was high, as indicated by a power of .735 and .950, respectively.

Figure 4.32 shows the pattern of change of the total SGRQ score of each study group across time. The TCQ group reported slight improvement in the total SGRQ score over time, whereas the other two groups reported declines in the total SGRQ scores.

The improvement in the TCQ group from T1 to T4 was 5.65%. Both of the exercise group and the control group reported progressive declines in the total SGRQ scores from T1 to T4. The exercise group reported a decline of 12.08% and the control group reported a decline of 11.57% in the total SGRQ scores.

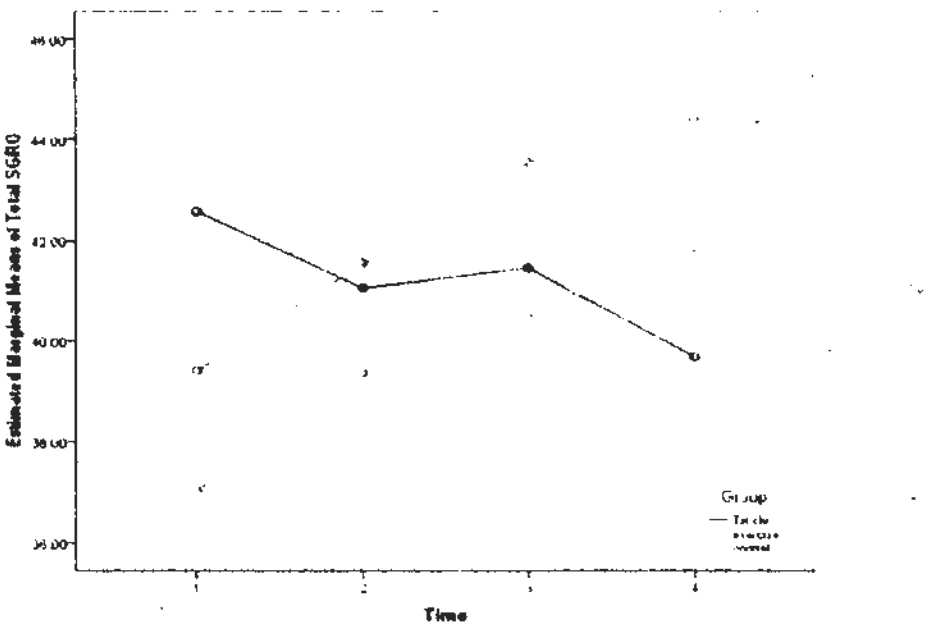


Figure 4.32 Estimated marginal means of total St. George's Respiratory Questionnaire scores

Minimum Clinically Important Difference

MCID is defined as the smallest difference perceived as important by the average client (Jaeschke, 1989; Lacasse et al., 1996). It is used to evaluate the clinical significance of the effects of SGRQ perceived by clients. The threshold for each of the SGRQ domains, as well as for the total SGRQ score, is four units (Jones, 2002). The clinical significance of the intervention effects in this study was also evaluated. Figures 4.33 to 4.36 illustrate the changes in SGRQ-HKC and its three domains from baseline to the sixth month relative to the MCID.

Symptom Domain

TCQ Group

An improvement in self-perceived symptom score by 4.6 units (10.4%) was observed in the TCQ group. The improvement was both statistically and clinically significant because the mean score was improved greater than the MCID threshold for positive clinical significance and the CIs did not include zero (Figure 4.33).

Exercise Group

A slight deterioration in symptom score by 2.3 units (6.3%) was noted in the exercise group. The change was not clinically significant because the mean intervention effect did not exceed the MCID threshold significance and the lower CI around the common effects crossed zero (Figure 4.33).

Control Group

An obvious deterioration in symptom score by 5.2 units (13.8%) was found in the control group. The change was found both statistically significant and equivalent to

clinical MCID because the mean change was greater than the MCID threshold for negative clinical significance and the lower CI included the MCID (Figure 4.33).

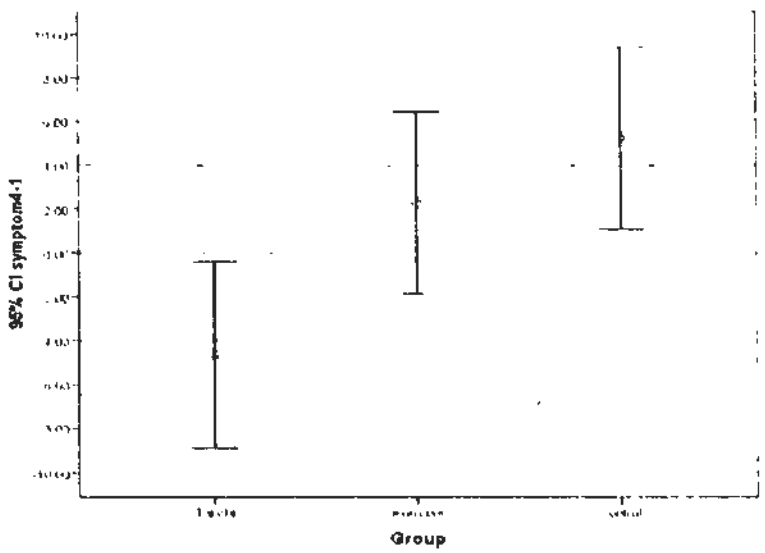


Figure 4.33: MCID: Changes in the symptom scores at 6-month from baseline

° Circles represent the mean; whiskers represent 95% confidence intervals;

..... No change from baseline

_ _ _ _ _ _ (-4) Threshold for positive clinical significance

_ . _ . _ . _ (4) Threshold for negative clinical significance

Activity Domain

TCQ Group

A slight improvement in self-perceived activity score by 2.5 units (4.3%) was observed in the TCQ group. The change was not clinically significant because the mean effect did not exceed the MCID threshold significance and the upper CI around the common effects crossed zero (Figure 4.34).

Exercise Group

Deterioration in activity score by 6.0 units (12.7%) was noted in the exercise group. The change was clinically significant because the mean change was greater than four

units, which exceeded the MCID threshold for negative clinical significance, and the lower CI included the MCID (Figure 4.34).

Control Group

Deterioration in activity score by 4.5 units (8.5%) was found in the control group. The change was found equivalent to clinical MCID because the mean change was greater than the MCID threshold for negative clinical significance and the lower CI included the MCID (Figure 4.34).

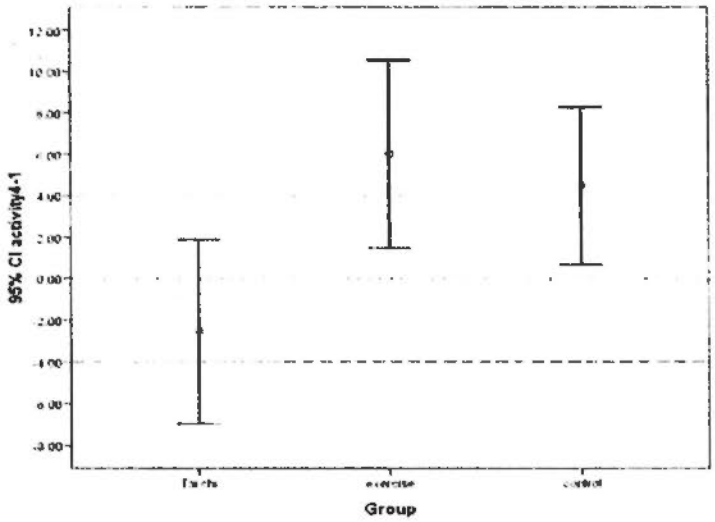


Figure 4.34: MCID: Changes in the activity scores at 6-month from baseline

° Circles represent the mean; whiskers represent 95% confidence intervals;

..... No change from baseline

_ _ _ _ _ _ (-4) Threshold for positive clinical significance

_ . _ . _ . _ (4) Threshold for negative clinical significance

Impact Domain

TCQ Group

A slight improvement in self-perceived impact score by 1.6 units (4.7%) was observed in the TCQ group. The change was not clinically significant because the

mean effect did not exceed the MCID threshold significance and the upper CI around the common effects crossed zero (Figure 4.35).

Exercise Group

Deterioration in impact score by 4.6 units (14.3%) was noted in the exercise group. The change was clinically significant because the mean change was greater than the MCID threshold for negative clinical significance and the lower CI included the MCID (Figure 4.35).

Control Group

Deterioration in impact score by 4.7 units (14.0%) was found in the control group. The change was clinically significant because the mean change was greater the MCID threshold for negative clinical significance and the lower CI included the MCID (Figure 4.35).

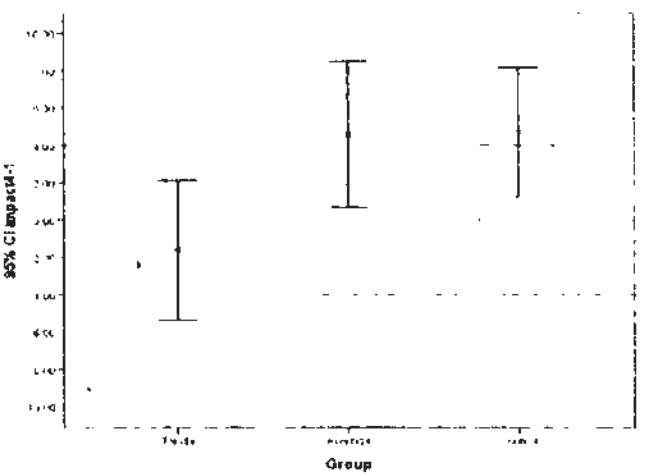


Figure 4.35: MCID: Changes in the impact scores at 6-month from baseline

° Circles represent the mean; whiskers represent 95% confidence intervals;

.....No change from baseline

_ _ _ _ _ _ (-4) Threshold for positive clinical significance

_____ (4) Threshold for negative clinical significance

Total SGRQ

TCQ Group

A slight improvement in self-perceived total SGRQ score by 2.4 units (4.4%) was observed in the TCQ group. The change was not clinically significant because the mean effect did not exceed the MCID threshold significance and the upper CI around the common effects crossed zero (Figure 4.36).

Exercise Group

Deterioration in impact score by 4.6 units (12.1%) was noted in the exercise group. The change was clinically significant because the mean change was greater than the MCID threshold for negative clinical significance and the lower CI included the MCID (Figure 4.36).

Control Group

Deterioration in impact score by 4.7 units (11.6%) was found in the control group. The change was clinically significant because the mean change was greater than the MCID threshold for negative clinical significance and the lower CI included the MCID (Figure 4.36).

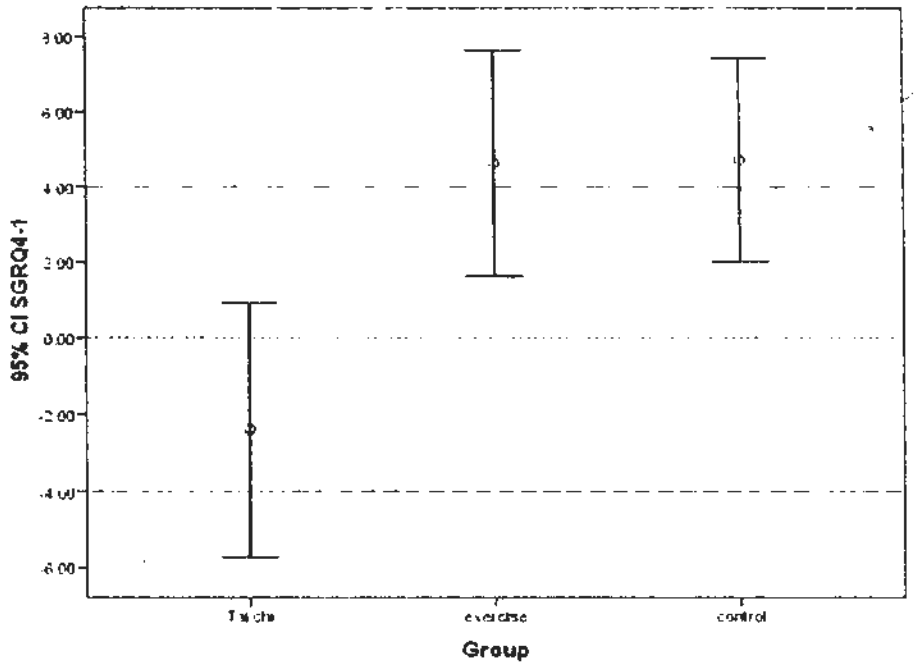


Figure 4.36: MCID: Changes in the total St. George's respiratory questionnaire (SGRQ) scores at 6-month from baseline

° Circles represent the mean; whiskers represent 95% confidence intervals;

..... No change from baseline

_ _ _ _ _ _ (-4) Threshold for positive clinical significance

_ . _ . _ . _ (4) Threshold for negative clinical significance

In summary, the HRQL of the three group participants had statistically significant interaction effects for group by time in all of the three domains, including the symptom, activity, and the impact domains, as well as the total SGRQ scores. The participants in the TCQ group showed greatest improvement in the HRQL among the three groups across time, whereas the exercise group and the control group showed deterioration in HRQL across time.

Therefore, Hypothesis 8 is rejected, and it was concluded that TCQ training is able to improve HRQL in clients with COPD compared to the other two groups. The significant effect of TCQ in the improvement of HRQL in COPD clients has been published in an internationally refereed journal (Chan, Lee, Suen, & Tam, 2010).

Although all findings in the TCQ group were statistically significant, they were not clinically significant, except for the symptom domain. In contrast, the exercise group demonstrated clinically significant deterioration in all findings except the symptom domain. Worsening health status was found in all aspects of the SGRQ, which was clinically significant in the control group.

Changes in the Perceived Social Support

Perceived social support was measured by using MSPSS-C, which examines the self-perceived social support from social relationships including family, friends, and significant other. The assumptions of normality of the baseline of these data were confirmed by using P-P plots. The observed values in the P-P plots (Figures 4.37–4.40) were laid approximately along the straight line for the expected values of normality, indicating that the baseline data were normally distributed. SPSS output showed the assumption of homogeneity of variance using Levene's test was not significant ($P > .05$), indicating that variances were homogeneous for all levels of the repeated-measures variables.

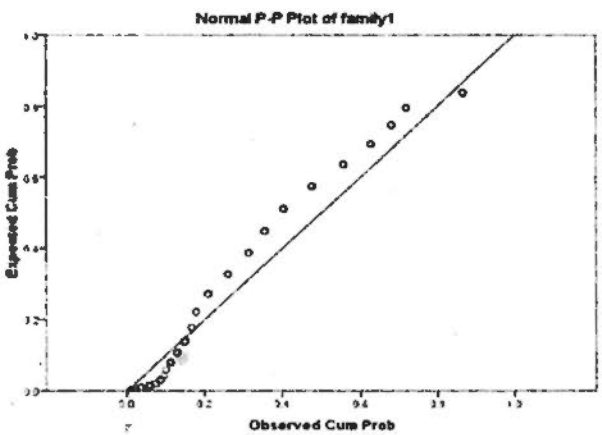


Figure 4.37 Normal P-P plot of perceived social support from family (MSPSS-Family)

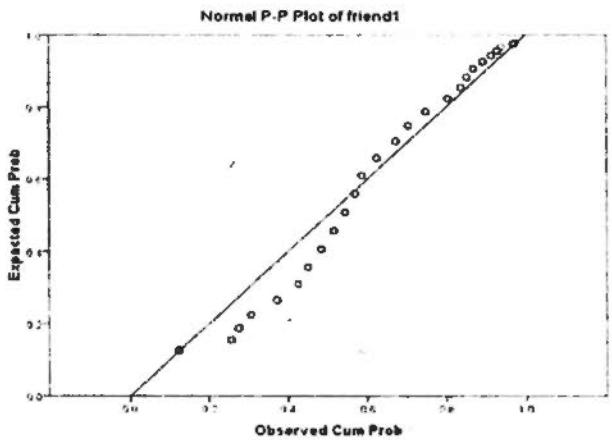


Figure 4.39 Normal Q-Q plot of perceived social support from friends (MSPSS-Friends)

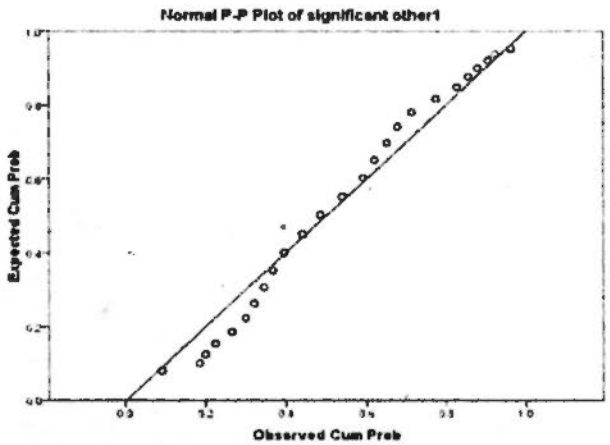


Figure 4.38 Normal P-P plot of perceived social support from significant other (MSPSS-significant other)

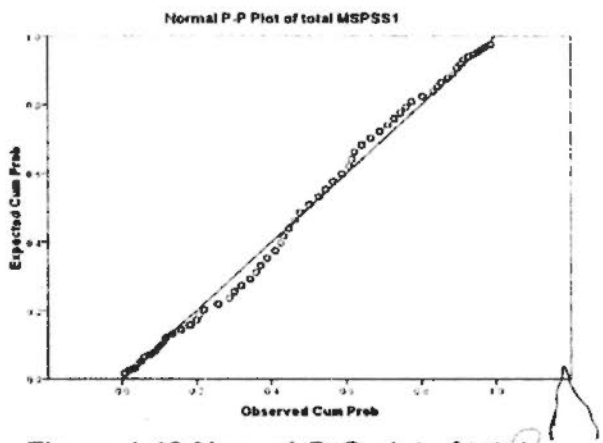


Figure 4.40 Normal Q-Q plot of total perceived social support (Total MSPSS)

The results of means and standard deviations of the MSPSS-C are summarized in Table 4.26. Since the gender of the participants was considered as a covariate and its confounding effect had been controlled using the repeated measures ANCOVA.

Table 4.26 Comparison of MSPSS-C at baseline, 6th week, 3rd month and 6th month among the three study groups.

	TCQ (n=70)		Exercise (n=69)		Control (n=67)	
	M(SD)	Change from last Measurement M (%)	M (SD)	Change from last Measurement M (%)	M (SD)	Change from last Measurement M (%)
Family						
Baseline (T1)	5.38 (1.56)		5.64 (1.44)		5.35 (1.71)	
6-week (T2)	5.52 (1.62)	.14 (2.60)	5.89 (1.36)	.25 (4.43)	5.57 (1.31)	.22 (4.11)
3-month (T3)	5.78 (1.49)	.26 (4.71)	5.86 (1.25)	-.03 (-.51)	5.75 (1.35)	.18 (3.23)
6-month (T4)	5.85 (1.38)	.07 (1.21)	5.77 (1.35)	-.09 (-1.54)	5.64 (1.44)	-.11 (-1.91)
Friend						
Baseline (T1)	3.48 (1.97)		3.25 (1.88)		2.88 (1.93)	
6-week (T2)	3.33 (1.85)	-.15 (-4.31)	3.32 (1.69)	.07 (2.15)	3.46 (1.88)	.58 (20 14)
3-month (T3)	3.66 (1.94)	.33 (9.91)	3.22 (1.65)	- 10 (-3.01)	3.43 (1.99)	-.03 (-.87)
6-month (T4)	4 10 (1.92)	.44 (12.02)	3.32 (1.73)	.10 (3.11)	3.35 (1.84)	-.08 (-2.33)
Significant other						
Baseline (T1)	3.91 (1.99)		3.74 (1.92)		3.55 (1.96)	
6-week (T2)	3.72 (1.97)	- 19 (-4.86)	4.00 (1.90)	26 (6.95)	3.81 (1.90)	.26 (7.32)
3-month (T3)	4.05 (1.97)	.33 (8.87)	3.78 (1.79)	-.22 (-5.50)	3.90 (1.98)	.09 (2.36)
6-month (T4)	4.56 (1.71)	.51(12.59)	3.91 (1.89)	13 (3.44)	3.85 (1.83)	-.05 (-1.28)
MSPSS						
Baseline (T1)	4.26 (1.56)		4.21 (1.39)		3.93 (1.43)	
6-week (T2)	4.19 (1.51)	-.07 (1.64)	4.40 (1.35)	.19 (4.51)	4.28 (1.43)	.35 (8.91)
3-month (T3)	4.50 (1.54)	.31 (7.40)	4.29 (1.25)	- 11 (-2.50)	4.36 (1.47)	.08 (1 87)
6-month (T4)	4.84 (1.42)	.34 (7.56)	4.34 (1.39)	.05 (1.17)	4.28 (1.39)	- 08 (-1.83)

MSPSS-C Multidimensional scale of perceived social support – Chinese version

Changes in the Perceived Social Support from Family

Regarding social support from family members, Mauchly test indicated that the assumption of sphericity had been violated, χ^2 (5) = 125.08, $P < .05$; therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity.

Figure 4.41 shows the pattern of changes of the perceived social support from family members among the three groups across the four study endpoints. The TCQ group illustrated a continuous increasing trend (7.38%) from T1 to T4. The exercise group demonstrated improvement at T2, then declined at T3 and T4. The control group demonstrated improvement at T2 and T3, and then decreased at T4. However, the differences were not statistically significant.

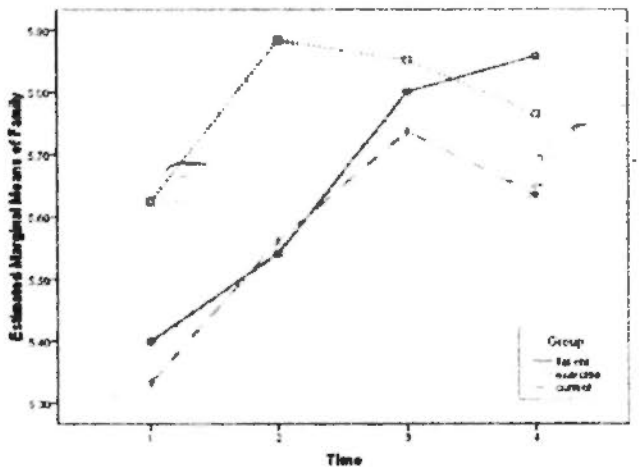


Figure 4.41 Estimated marginal means of perceived social support from family

In the within-subject comparison, there was no significant interaction effect (F (4.23, 426.85) = .70, P = .60) and no significant difference in time effects (F (2.11, 426.85) = .62, P = .55) among the three study groups, indicating no intervention effect on the perceived social support from family members.

In the between-group comparison, there were also no significant group differences among the three groups (F (2, 202) = .58, P = .56) (Table 4.27).

Table 4.27 Within-subjects effects and between-subjects effects for MSPSS-C outcome variables using repeated measures ANCOVA

Outcome variable	Effect	*df*	*F*	*P*	Partial eta squared
Family	Time	2.11, 426.85	616	.549	
	Interaction	4.23, 426.85	697	.602	
	Group	2, 202	575	.564	
Friend	Time	2.28, 459.98	1.336	264	
	Interaction	4.55, 459.98	2.333	047*	.023
	Group	2, 202	1.125	.327	
Significant other	Time	2.11, 426.44	655	.528	
	Interaction	4.22, 426.44	1.927	.101	
	Group	2, 202	456	634	
Total MSPSS	Time	2.13, 429.83	1.107	.334	
	Interaction	4.26, 429.83	2.280	.056	
	Group	2, 202	.609	.545	

MSPSS-C Multidimensional scale of perceived social support – Chinese version; *p < 05

Changes in the Perceived Social Support from Friends

Regarding social support from friends, Mauchly test indicated that the assumption of sphericity had been violated, χ^2 (5) = 89.97, P < .05; therefore, degrees of freedom were corrected using Greenhouse-Geisser correction.

Figure 4.42 illustrates the pattern of changes in the perceived social support from friends across the four study endpoints. TCQ showed improvement from T2 to T4. The result of the exercise group showed no obvious changes from T1 to T4. The control group demonstrated improvement in the first time segment (T1 to T2), but

then slightly decreased from T2 to T4. Overall, the TCQ group demonstrated the greatest improvement (17.62%) in the perceived social support from friends among the three groups over six months.

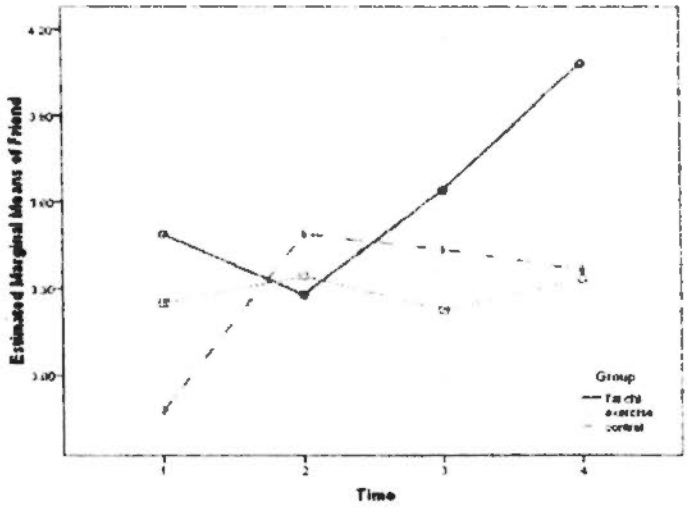


Figure 4.42 Estimated marginal means of perceived social support from friends

In the within-subject comparison, there was significant interaction effect for group by time (F (4.55, 459.98) = 2.33, P = .047), indicating significant intervention effect on the perceived social support from friends. There was no significant difference for time effect (F (2.28, 459.98) = 1.37, P = .26).

In the between-group comparison, there were no significant group differences among the three groups (F (2, 202) = 1.13, P = .33) (Table 4.27).

Effect size. The effect size for interaction indicated by partial eta squared was .023. The value reported for the TCQ group has a small effect size in improving the self-perceived social support from friends among the three study groups across time, with a power of .720.

Changes in the Perceived Social Support from Significant Other

Regarding perceived social support from significant other, Mauchly test indicated that the assumption of sphericity had been violated, χ^2 (5) = 122.95, $P < .05$; therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity.

Figure 4.43 illustrates the pattern of changes in the perceived social support from significant other for the three study groups across the six-month study period. Although the results were insignificant, a rising trend of the perceived social support from significant other was observed in the TCQ group (16.6%). The exercise group and the control showed no obvious changes from T1 to T4.

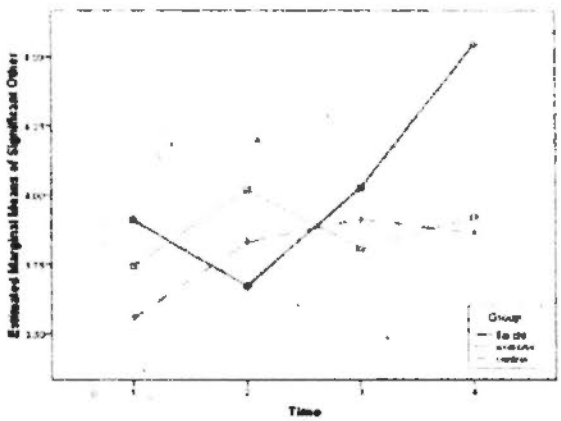


Figure 4.43 Estimated marginal means of significant other

In the within-subject comparison, there was no significant difference in the interaction effect for group by time (F (4.22, 426.44) = 1.93, P = .10), indicating no intervention effect on the perceived social support from significant other. There was

also no significant time effect among the three study groups (F (2.11, 426.44) = .66, P = .53).

In the between-group comparison, there were no significant group differences among the three groups (F (2, 202) = .46, P = .63).

Changes in the Total MSPSS

Regarding total MSPSS, Mauchly test indicated that the assumption of sphericity had been violated, χ^2 (5) = 116.55, P < .05; therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity.

Figure 4.44 shows the pattern of changes in the total MSPSS of the three study groups across six months. Again, the TCQ group displayed a greater improvement when compared to the other two groups. The improvement was prominent from T2 to T4 (16.6%). The exercise group did not show any differences from baseline (T1) to the sixth month (T4). The control group showed a slight increase from T1 to T2, and showed no obvious changes from T2 to T4.

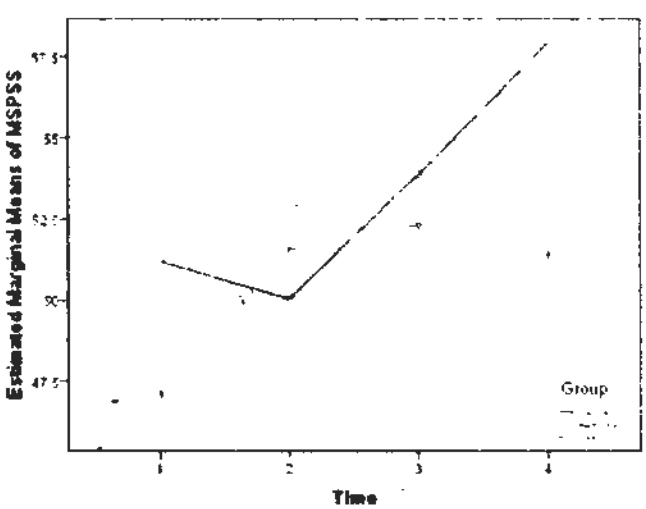


Figure 4.44 Estimated marginal means of total multidimensional scale of perceived social support (Total MSPSS).

In the within-subjects comparison, there was also no significant difference among the three groups across time (F (2.13, 429.86) = 1.12, P = .33) and no significant group by time interaction effect (F (4.256, 429.86) = 2.29, P = .06), indicating no intervention effect on the perceived social support from significant others.

In the between-group comparison, there were no significant group differences among the three groups (F (2, 202) = .61, P = .55).

Hypothesis 9 is rejected because participants in the TCQ group demonstrated increased self-perceived social support from friends when compared to the exercise group and the control group.

GEE Models

Further data analysis was performed to examine the association between social support and each of the outcome variables using GEE models. GEE models account for intracorrelated repeated-measures data and are able to fit various types of data with the use of appropriate link-function. Table 4.28 illustrates the results using GEE models, indicating social support was not associated with any of the outcome variables including lung functions, 6MWT, and HRQL.

Table 4.28 Generalized estimating equations (GEE) models for examining of the association between outcome variables and social support.

	β (95% CI)	p-value
FVC		
Social support (Family)	-.005 (-.010, .001)	.077
Social support (Significant Other)	-.004 (-.008, .000)	.074
Social support (Friend)	-.003 (-.007, .002)	.204
Social support (Total MSPSS)	-.002 (-.004, .000)	.053
FEV_1		
Social support (Family)	-.002 (-.005, .000)	.066
Social support (Significant Other)	-.001 (-.004, .001)	.154
Social support (Friend)	-.002 (-.003, .000)	.117
Social support (Total MSPSS)	-.001 (-.002, .000)	.056
6MWD		
Social support (Family)	.213 (-.413, .840)	.505
Social support (Significant Other)	.078 (-.477, .633)	.782
Social support (Friend)	.206 (-.380, .793)	.490
Social support (Total MSPSS)	.078 (-.159, .314)	.519
SGRQ		
Social support (Family)	-.063 (-.248, .121)	.502
Social support (Significant Other)	.106 (-.044, .255)	.166
Social support (Friend)	.054 (-.099, .208)	.488
Social support (Total MSPSS)	.024 (-.041, .089)	.472

β Coefficient

SECTION IV

Program Evaluation

The attendance rate in the TCQ programme was high at 83 percent. The attendance rate refers to the participants' attendance to the TCQ classes twice a week. The compliance rate of the daily TCQ practice was 74% in the TCQ group, whereas the compliance rate of daily breathing and walking exercise was 69% in the exercise group. The compliance rate refers to the subjects in compliance with the prescribed dose of daily self practice. The TCQ skill performance of the subjects was evaluated by the TCQ instructor at the end of program using a three-point Likert scale (3 = TCQ skills well mastered; 1 = TCQ skills not yet mastered). The overall mean was 2.42 out of 3.00, suggesting that most of the subjects were able to master TCQ forms in three months.

The TCQ program was also evaluated by the subjects in the TCQ group using a five-point Likert scale questionnaire (5 = most satisfied; 1 = least satisfied). It measured perceived effects of the TCQ exercise and the satisfaction level of the TCQ class participants. A total of 53 subjects in the TCQ group completed the program evaluation questionnaire. Results are illustrated in Tables 4.29–4.30.

Table 4.29 Self perceived effects of Tai chi Qigong (n = 53)

	Mean (standard deviation)
Respiratory functions	3.92 (.96)
Exercise capacity	3.98 (.98)
Broaden social network	3.42 (1.24)

5 = most effective; 1 = lease effective

Table 4.30 Satisfactory levels on the TCQ program arrangement (n = 53)

	Mean (standard deviation)
Date arrangement	4.40 (.88)
Time arrangement	4.51 (.85)
Venue	4.55 (.89)
Duration of program	4.13 (1.13)
Performance of TCQ instructor	4.75 (.68)
Appropriate intensity of TCQ forms	4.30 (.89)
Program schedule	4.51 (.78)
Overall satisfaction	4.57 (.80)

5 = most satisfied; 1 = least satisfied

The participants perceived positive effects of the TCQ exercises on promoting their respiratory functions (mean = 3.92) and increasing their exercise capacity (mean = 3.98). Attending the TCQ program also broadened their social network (mean = 3.42).

The mean satisfactory levels in the program arrangement in terms of date, time, venue, and duration ranged from 4.13 to 4.40. The highest satisfaction rate was on the performance of the TCQ instructor (mean = 4.75). The evaluation on the appropriateness of intensity of the TCQ forms and the program schedule was 4.30 to 4.51. The overall satisfactory mean score was 4.57. Because the mean scores for all the evaluated items were above 4 out of 5 (Table 4.29), the results demonstrated the participants' high satisfaction level. In addition, 92.5% of subjects in this group

stated that they would continue practicing TCQ after the completion of the program (Figure 4.45).

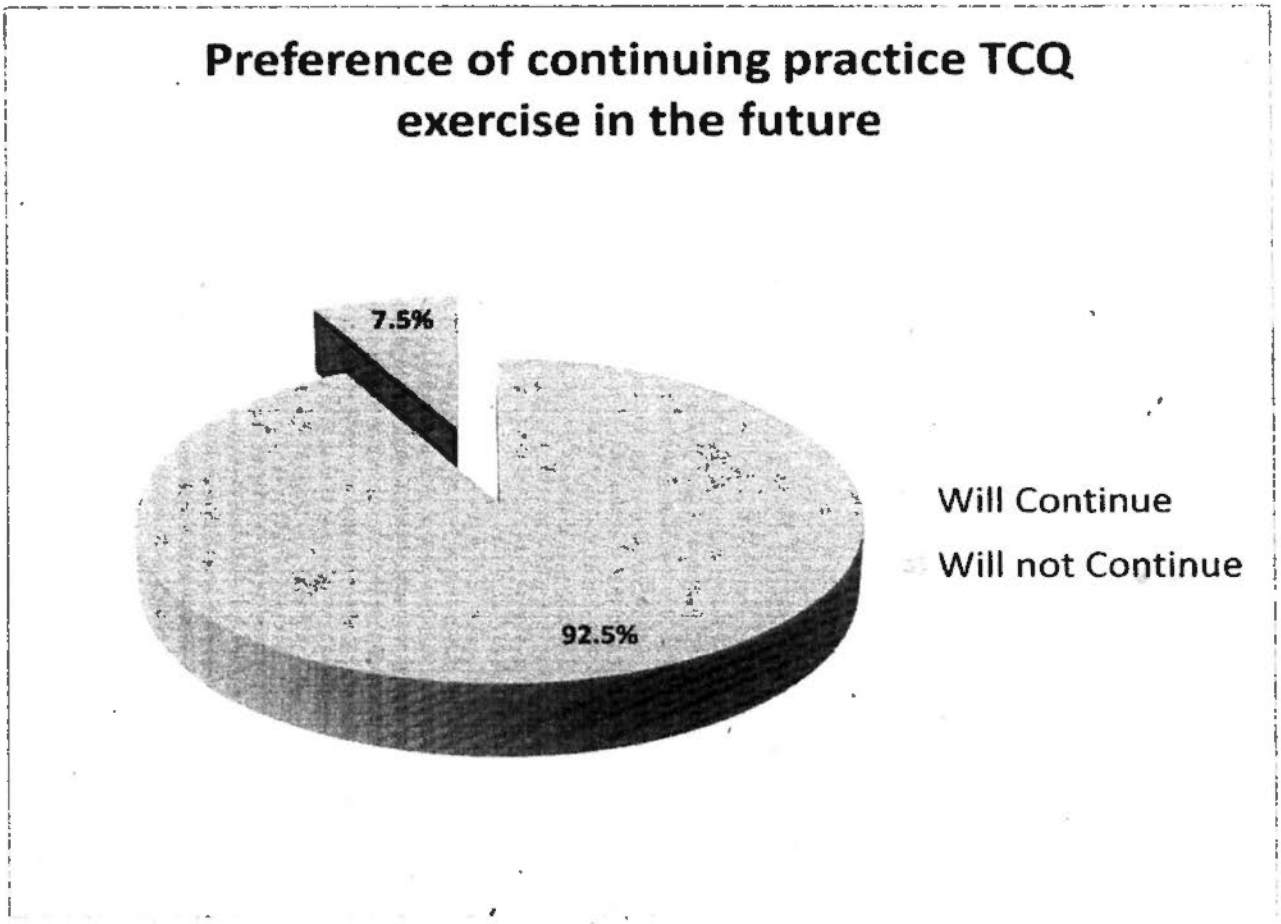


Figure 4.45 Preference of continuing practice TCQ exercise in the future

Summary

This chapter presents the results of sample recruitment, sample characteristics, and the effects of a TCQ program in improving physiological and psychosocial health among the clients with COPD. A total of 206 subjects participated in this study. Of the 206 subjects, 158 completed the study program at the third month, with an attrition rate of 23.8%. A total of 128 subjects received the follow-up assessment at the sixth month. There were no significant differences in terms of participants' characteristics and baseline of various outcome variables between participants who completed and those who did not complete the study, except for 6MWT. The dropout subjects walked a shorter distance than those who completed the program. To preserve the value of randomization, an intention-to-treat analysis was applied to handle the missing data.

Of these 206 participants, 70 were assigned to the TCQ group, 69 were assigned to the exercise group, and 67 were assigned to the control group. There were no statistically differences in the demographic data among the three study groups, except for gender. This was because fewer females participated in this study. Therefore, gender was considered as confounding factor and was controlled as covariate during the data analysis process. The three groups were homogeneous in majority of the baseline characteristics, except for the acute exacerbation rate in the preceding six weeks. This difference was also handled during the statistical analysis procedure.

The physiological outcome measures included spirometry, 6MWT, Borg scale of dyspnoea and fatigue levels, the SaO_2 level, the acute exacerbation rate, the hospital

admission rate, and the frequency of extra usage of short-acting β2 agonist inhalers. The psychosocial health included the HRQL using SGRQ-HKC and the perceived social support using MSPSS-C.

With the confounding effect of gender being controlled, the overall results revealed that participants in the TCQ group experienced greater improvement in the physiological health and psychosocial health across the six-month study period compared to the exercise and control groups.

The physiological health in the TCQ group was improved in terms of lung functions, exercise capacity, and reduced frequency of acute exacerbations. Findings revealed significant interaction effect of group by time in spirometry, 6MWT, dyspnoea, and acute exacerbation rates, indicating group differences across time, with the TCQ group showing the greatest improvement among the three groups. The exercise group showed comparatively stable lung functions and exercise capacity during the six-month study period. The control group showed progressive deterioration in their lung functions.

The psychosocial health was improved in terms of HRQL and perceived social support from friends (who were the TCQ group members). Findings indicated significant group by time interaction effects, revealing group differences across time, with the TCQ group having statistical improvement in symptom, activity, impact and the total SGRQ, as well as showing improvement in the self-perceived social support from friends. TCQ was found to produce medium effect size in improving psychosocial health in COPD clients. However, significant social support from

friends was not associated with any of the outcome variables of the current study. The exercise group showed a gradual decline in HRQL in the aspects of activity and impact of the SGRQ. The control group showed worsening of psychosocial health in all aspects of SGRQ. There were no significant changes in the perceived social support both in the exercise and control groups.

Finally, results revealed that the TCQ program could only demonstrate group effect on FVC in the lung function tests and the 6MWT. The group effect on the psychosocial health was not significant. Results from the TCQ program evaluation showed high satisfaction rate on the TCQ program. The participants stated the TCQ program was enjoyable and expressed their desire to continue practicing TCQ in the future.

CHAPTER 5

DISCUSSION

COPD affects every aspect of a patient's life. Progressive decline in physical and psychosocial health reduces the patient's ability to perform daily activities and normal household tasks. Reduced functional ability can lead to social isolation and affects HRQL. The study was set to evaluate the effectiveness of a TCQ program in improving physiological and psychosocial health of COPD clients. The strengths of this study include the randomized design, the blinding of RAs who measure outcome variables, and the adoption of a six-month follow-up in a population likely to have many reasons for dropping out (Guell et al., 2000). Over a six-month study period, the TCQ group was compared with an exercise group whose members took part in breathing and walking exercises and a control group of COPD clients who maintained their usual daily activities. The key findings in this study indicate TCQ training was associated with statistical improvements in physiological health and psychosocial health in clients with COPD. Improvements were seen in lung functions in terms of FEV_1 and FVC in the TCQ group. No statistically significant changes of lung functions were recorded in the exercise group; however, deteriorations in the control group were noted. Improvement was also noted in 6MWT in the TCQ group; however, no significant differences were noted in either the exercise group or the control group. For the HRQL assessed by SGRQ, findings revealed significant group and time interactions, with TCQ group showing greater improvement across the six-month study period when compared with the exercise and control groups. For MSPSS, significant improvement in perceived social support from friends was observed in the TCQ group, but no significant changes were noted in the other two groups.

This chapter has six sections. The first section explains the baseline characteristics of the participants. The second section discusses the effect of interventions on the physiological health and psychosocial outcomes of the current findings and previous studies. The third section discusses the beneficial effect of the TCQ program on clients with COPD. The fourth section discusses the effects of breathing and walking exercises on COPD clients from the current findings and previous research. The fifth section focuses the discussion on the issues of attrition and of compliance in both the TCQ group and the exercise group. The final section discusses the strengths and limitations of the study. Recommendations for future studies are also made accordingly.

SECTION I

Baseline Measurements

This section describes the demographic data and clinical characteristics of the sample, including age, gender, marital status, educational level, employment status, financial status, living condition, religion, exercise habit, nutritional status, body mass index, duration of COPD, smoking habit, drinking habit, medical history, number of drugs being taken, and general condition. These details enabled the investigator to assess whether any favorable outcomes could be attributed to intervention effects or, alternatively, result from individual differences.

Among the 206 subjects, there were only 19 females in this study, wherein there was only one female in the TCQ group, creating significant group difference in gender (P = .021). Therefore, gender was considered as confounding factor and was controlled statistically. The gender difference in this study was similar to previous studies (Katsura, Yamada, Wakabayashi, & Kida, 2005; Lindsay et al., 2005; Miravitlles et al., 2006; Pinto-Plata et al., 2004). COPD is more common in men especially in China (WHO, 2007). Over 50% of Chinese men smoke, whereas smoking rates among Chinese women are much lower. As smoking is the major risk factor attributed to the disease, men have a higher prevalence rate than women. Apart from the gender difference, the demographic data indicated a high degree of homogeneity among the three groups. The mean age of the TCQ group, the exercise group, and the control group were 71.7, 73.6, and 73.6 respectively. Majority of the subjects were married and lived with their families. Education level in average was at primary level or above. The mean duration of COPD was approximately 10 to 12 years, with approximately 16% of subjects at mild stage, 42% at moderate stage, and another

42% at severe stage of COPD. The most common coexisting disease was hypertension, followed by heart disease and diabetes mellitus.

With regard to the clinical baseline measurement, there were no significant differences in terms of lung functions, exercise capacity, Borg scales, oxygen saturation, hospital admission rates, HRQL, and perceived social support. The only difference at baseline among the three groups was the exacerbation rate in the preceding six weeks. Participants in the TCQ group reported a higher rate than the exercise and control groups; thus, the TCQ group was not found to be well in terms of prognosis at baseline. The changes in the number of acute exacerbation attacks among the three groups at each study endpoint from baseline were compared.

SECTION II

Effects of Interventions on Physiological Health

The present findings indicate that there was a significant difference in the change of the physiological outcome measures among the three study groups across the six-month study period. The study findings show statistically significant improvement among the subjects in the TCQ group in physiological health in terms of lung functions, exercise capacity, reducing the acute exacerbation rates; however, findings are not significant in terms of hospital admissions, dyspnoea, fatigue, and oxygen saturation.

Lung Functions

As part of the ageing process, the FEV_1 begins to decline from the age of 35 (Vestbo, 2007). The mean values of FEV_1 in healthy men and women decline approximately 30 and 25 ml per year, respectively (Welsh, Ramsey, Accurso, & Cutting, 2001). The lung function impairment that usually characterizes COPD is the accelerated decline of FEV_1 in the middle-aged or elderly, with an excess of the normal annual decline of 15 to 20 ml per year. The FEV_1 of some smokers may decline by 80 to 100 ml per year (Vestbo, 2007).

Pulmonary function tests in COPD clients typically show airflow obstruction with decreased FEV_1 and FEV_1/FVC ratio. Clients also have minimal response to inhaled bronchodilators. This is in line with the lung functions of the sample in this study. The lung functions of the sample at baseline are illustrated in Table 5.1. Baseline findings reveal that the study participants show a decline in level of respiratory functions. All participants were COPD sufferers, as evidenced by the FEV_1/FVC

ratio less than 70% (mean = 48.0%), and they demonstrated minimal response to inhaled bronchodilators. The mean FEV_1%pred was 53.8%. Of the 206 participants, 15.6% were at mild stage of COPD, 41.7% were at moderate stage, and 42.7% were at severe stage (Table 5.2).

Table 5.1 Baseline characteristics of spirometry

N = 206	FVC	FEV_1	FEV_1%pred	FEV_1: FVC ratio
Mean	1.88 Litre	.90 Litre	53.84%	47.98%
Standard deviation	.58	.39	23.66	13.67

FVC forced vital capacity; *FEV_1* Forced expiratory volume in one second; *FEV_1%pred* FEV_1 percent predicted normal value

Table 5.2 Classification of severity of COPD based on ATS guideline (2004)

Stage	No. of subjects	percentage
Mild	32	15.6
Moderate	86	41.7
Severe	88	42.7
Total	206	100

ATS American Thoracic Society

In the current study, distinct and significant differences among the TCQ group, the exercise group, and the control group are notable for the main outcome variables. These differences appear to be directly attributable to the use of TCQ exercise as intervention. The three groups are well matched at baseline. An acceptable compliance with interventions is evident in both of the TCQ group (74%) and the exercise group (69%). Participants in the control group demonstrated a decline in FEV_1 gradually from T1 (baseline) to T4 (six-month). The decline of FEV_1 was 50 ml in six months. Participants in the exercise group demonstrated relatively stable lung functions with slight improvement in FEV_1 from T1 to T4 by 30 ml in six

months. The participants in the TCQ group demonstrate a prominent improvement in FEV_1. The increase of FEV_1 was 70 ml in three months and 100 ml in six months. This result is encouraging as COPD has been previously being stated as a no-cure disease, and the disease management in the PRP aims to slow down lung function deterioration (Department of Health, 2008) rather than modify lung functions.

Historically, accelerated decline in lung function has been recognized as a natural process of COPD (Bridevaux et al., 2008). In the present study, the FEV_1 and FVC improved significantly in the TCQ group and improved slightly in the exercise group; however, there was a decline of lung functions in the control group. The results provide evidence that TCQ could benefit clients with COPD in improving their lung functions. Although the exercise group did not show an obvious improvement in lung functions, unlike the TCQ group; however, they showed a slowing down of the process of decline in lung functions. The control group showed a gradual decline in the lung functions over time, which is similar to previous studies (Vestbo, 2007). TCQ exercise was shown to improve FEV_1 as early as at the sixth week after TCQ practice, and which continued to improve till the end of study. An improvement of 100 ml at the sixth month is likely to be of clinical benefit in clients with COPD (Stockley, Chopra, & Rice, 2006). FVC also showed a similar improvement on TCQ exercise. Thus, it could be concluded that regular exercise is able to maintain lung functions and slow down the decline of disease progression in GOPD clients. To the researcher's knowledge, this is the first local study to show that TCQ exercise could improve lung functions in clients with COPD. Therefore, COPD clients should be advised to perform regular exercises, and TCQ exercise should be highly recommended for these clients.

Exercise Capacity

From the previous studies, Tai chi has been proven to have beneficial effects on health promotion in different health conditions. Little attention has been given to its value in enhancing the exercise capacity in COPD clients. This is the first study to investigate this area of study in Hong Kong. This study adopted the 6MWT as a measure of exercise tolerance in clients with COPD. A previous study for checking the reliability of the 6MWT was performed in a group of healthy elderly aged 60 to 70 years (n = 12); the test and retest results showed the walking distances in six minutes ranged from 525 to 570 meters (Kervio, Carre, & Ville, 2003). In the current study, the baseline of the mean walking distances of the participants (standard deviation) in six minutes was 290 (73) meters, which was considered very low exercise capacity among the elderly. This baseline result matches studies in which COPD clients had a mean walking distance of 296 meters (Guell et al., 2000) and a median distance of 311 meters (van Stel, Bogaard, Rijssenbeek-Nouwens, & Colland, 2001).

Significant improvement was observed in the TCQ group from T1 to T4 (51 meters). Findings revealed the exercise group and the control group remained relatively stable in exercise tolerance during the six-month study period. The observed increase in 6MWT was not an isolated outcome; rather, it paralleled improvements in FVC and FEV_1, and HRQL in particular. Therefore, improvements could be attributed to adaptation to the practice of TCQ exercise.

Previous studies have proven improvements caused by endurance exercises among COPD clients after PRPs (Camp, Appleton, & Reid, 2000; Hui & Hewitt, 2002). As reported by Hernandez et al. (2000), COPD clients recorded improved exercise capacity, dyspnoea, and HRQL in a home-based program using shuttle walking as an exercise. However, in the current study, no significant difference in walking distance was noted in the breathing and walking exercise group. This might be due to the intensity of walking in the exercise group because the exercise was self-paced instead of maximal shuttle walking. Self-paced walking is a submaximal level of functional capacity activity. Self-paced walking is used in this study because most ADL are performed at submaximal levels of exertion (ATS, 2002), and most clients do not achieve maximal exercise capacity during walking exercise unless they are closely supervised. Unsupervised rehabilitation programs might not achieve maximum effect.

Findings in this study are similar to previous studies (Puente-Maestu et al., 2003; Wijkstra et al., 1994) that rehabilitation at home showed no objective improvement in exercise capacity. Self-reported adherence to the compliance of daily exercise among participants in this study was relatively good in the TCQ group (74%) and was acceptable in the exercise group (69%). The fact that the exercise group was unable to improve objective measures of exercise tolerance provides further evidence that unsupervised exercise programs are less effective in inducing or maintaining objective improvements in exercise tolerance (Puente-Maestu et al., 2003).

Physiologic Parameters: Level of Dyspnoea, Fatigue, and Oxygen Saturation

Besides walking distance, measurements of dyspnoea and fatigue ratings, and oxygen saturation (SaO_2) were obtained. On physical examination, COPD clients might appear normal, or display varying degrees of dyspnoea and decreased oxygen saturation, depending on the severity of their disease (Hadden & Hertz, 2007). Using Borg scale (Borg, 1982), findings revealed that the sample in this study had mild dyspnoea and mild fatigue at baseline with no decreased oxygen saturation. One may criticize that the self-paced walking testing cannot reflect the physiological responses. In this study, there were increased dyspnoea level and fatigue level, as well as increased heart rate, after the 6MWT from baseline for all groups (Table 5.3), indicating the level of walking did impose exertion on the participants.

Table 5.3 Physiological data at rest and post-6MWT at baseline, 6th week, 3rd month and 6th month

		At rest	Post-6MWT	At rest	Post-6MWT	At rest	Post-6MWT	At rest	Post-6MWT
		Baseline	Baseline	6-week	6-week	3-month	3-month	6-month	6-month
Tai chi	Dyspnoea	1.06	1.98	.84	1.84	.92	1.86	1.05	1.81
	Fatigue	.99	1.49	1.09	1.72	1.01	1.56	1.14	1.53
	SaO_2 (%)	96	95	95	94	96	94	96	94
	HR	84	91	83	92	84	93	84	93
Exercise	Dyspnoea	.62	1.38	.73	1.74	.83	1.70	.82	1.57
	Fatigue	.88	1.38	.86	1.38	.80	1.42	.79	1.52
	SaO_2 (%)	95	94	95	94	96	94	96	94
	HR	84	91	84	93	86	93	84	91
Control	Dyspnoea	.81	1.51	1.13	2.02	1.12	2.06	.94	1.84
	Fatigue	.70	1.31	.97	1.78	1.05	1.66	.95	1.43
	SaO_2 (%)	95	95	95	95	96	94	95	94
	HR	84	91	85	92	85	94	85	93

6MWT six-minute walk test; *SaO_2* Oxygen saturation

In this study, a low-intensity TCQ exercise program and the breathing and walking exercises mainly focused on improving the lung functions and exercise tolerance. There were no significant differences in physiologic parameters such as post-6MWT dyspnoea, fatigue, and SaO_2 from baseline to the sixth month. As suggested by Strijbos et al. (1996), improved neuromuscular coordination and desensitization to dyspnoea explain the increased exercise tolerance. According to previous studies (Agle, Baum, Chester, & Wendt, 1973; Hass & Cardon, 1969), exercise training could lead to an improved neuromuscular coordination, contributing to an improved ability to perform ADL, especially in those clients who lead a sedentary life. The improved exercise capacity with no changes in physiologic parameters suggests that desensitization to dyspnoea played a major role in improving exercise level, which is compatible to a previous study (Strijbos et al., 1996). In other word, COPD clients were able to walk a longer distance in six minutes without increased dyspnoea, fatigue or desaturation of SaO_2, reflecting their improved exercise tolerance.

COPD Exacerbations and Hospital Admissions

Exacerbations are significant events for clients with COPD. As the severity of COPD progresses, the number of exacerbations usually increases. These events are distressing and disruptive to the clients, affecting their QOL and daily activities. Frequent exacerbations often lead to a progressive deterioration of their condition and account for a high proportion of hospital admission rates (Barnett, 2006; Bellamy & Booker, 2005).

Stockley (2006) suggested that exacerbation frequency was an important determinant of health status in COPD and, hence, an important outcome measure for evaluating

the efficacy of therapeutic interventions. In addition, acute exacerbation is the most common cause of hospitalizations in clients with COPD (Fein, Karpel, & Anzueto, 2007). Exacerbations are associated with accelerated deterioration of the disease. Interventions that limit exacerbations may have advantages to clients with COPD and reduce the admissions (White, 2007).

Evidence suggests that COPD admission was higher than general admission rates (Chen, 2005). A local study reported over 50% of COPD clients being readmitted at least once within a year (Lau, Yam, & Poon, 2001). Another study in the United States reported that the readmission rates for COPD patients were 2.3% in seven days, 8% in one month, and 18.3% in three months after discharge. In the baseline of the current study, 21.2% of participants (n = 44) had experienced acute exacerbations and 8.7% (n = 18) had been admitted to hospital due to their respiratory problems in the preceding six weeks. The results are similar to those reported locally and internationally.

Results in this study revealed that the acute exacerbation rate in the TCQ group was noted to decrease obviously as early as at the sixth week after practicing TCQ exercise, and continued to decrease gradually from T2 (the sixth week) to T4 (the sixth month). There were no obvious changes in the exacerbation rates in the exercise group and the control group. With the higher frequency of acute exacerbation attack at baseline, the TCQ was still able to achieve a better improvement among the three study groups.

Regarding the hospital admission rate, there were no obvious changes in the number of hospital admissions in the TCQ group and the exercise group. However, the hospital admission rate in the control group was noted to increase substantially during the period of T3 to T4 (from the third month to the sixth month).

Therefore, to prevent acute COPD exacerbations, clients should be encouraged to keep active and maintain regular exercise, and to avoid becoming too tired and breathless. Regular exercise, particularly TCQ as a low-intensity exercise, should be recommended to clients. TCQ exercise can improve symptom control, limit exacerbations, slow down deterioration, and enhance self-efficacy in disease management, thereby reducing hospital admissions. For the decreased exacerbations, but no reduction in the number of admissions in the TCQ group, it might due to the varied reasons for admission. The reasons for hospital admissions were complex. They might be due to physiological deteriorations, psychological impairment, or other unrelated issues. Nonetheless, detail reasons for hospital admissions were not investigated in this study, thereby, the non-COPD related admissions were not excluded which might lead to the overestimated hospital admission rates.

The TCQ program was found to achieve a medium effect size in accounting for the difference among the study groups in terms of the physiological study variables of lung functions and exercise capacity. The findings matched with the original estimated effect size, which was based on the experience of previous Tai chi studies (Y.K. Lee, 2007; Taylor-Piliae et al., 2004).

Effects of the Interventions on Psychosocial Health

Psychological well being is an important factor in rehabilitation for chronic illness. Poor psychological well being adversely affects the physical capacity and functioning of COPD clients (D.T.F. Lee, I.F.K Lee, Mackenzie, & Ho, 2002). Therefore, positive findings on psychological health are important in the overall rehabilitation of clients with COPD. The following section discusses the psychosocial health of COPD clients, including the HRQL and their perceived social support.

Health-related QOL

The impacts of COPD on HRQL of clients have been extensively explored. A study in the United States and Europe (n = 3265) reported that 61% of clients with COPD stated that their health is fair to very poor (Rennard et al., 2002). A total of 59% of clients reported that COPD affects their normal physical exertion. Although COPD is a disease that affects many retired clients, 25% of clients over the age of 65 expressed work loss secondary to COPD.

This study adopted the SGRQ-HKC to measure the HRQL of COPD clients. The SGRQ is one of the most widely used diseases-specific health status measures for COPD. It has been tested in a group of healthy subjects (n = 74) and the mean scores for the symptom, activity, impacts, and total scores are 12, 9, 2, and 6, respectively (Jones, 2003). In this study, the COPD participants reported a low level of HRQL. The baseline of the above SGRQ measures were 41, 52, 33, and 40, respectively, indicating their HRQL was affected by the disease in terms of symptoms, activity,

and impact of the COPD. These findings concur with the existing evidence that COPD affects HRQL (Rennard et al., 2002).

Previous studies have shown that the beneficial effects on HRQL are gained during inpatient pulmonary rehabilitation; however, the effects decrease and cannot be sustained after discharge (Green, Singh, Williams, & Morgan, 2001; Ketelaars, Abu-Saad, Schlosser, Mostert & Wouters, 1997). This might because patients revert to their pre-rehabilitation sedentary lifestyles after being discharged from hospitals. The other reason might because of the severely impaired health status in clients with COPD that impede their ability to achieve a higher response to rehabilitation program. Ketelaars et al. (1997) suggested that COPD clients might need different care after the inpatient rehabilitation program.

Strijbos et al. (1996) compared 12 weeks of outpatient rehabilitation with 12 weeks of home-based rehabilitation and a control group received no rehabilitation. Both treatment groups improved equally in both maximal and functional exercise capacities. The improvement was better maintained at 18 months in the home-based rehabilitation. The authors claimed that this might because the home-based group spent more time performing the exercises than those of the hospital-based group. However, no valid measures of HRQL were used in their study. Subjects were only asked to classify their situation as better, equal, or worse compared with the first visit.

Lacasse, Guyatt, and Goldstein (1997) stressed that exercise training should be a mandatory component of any rehabilitation program that seeks to improve functional

exercise capacity and HRQL. From a previous systematic review (Puhan et al., 2005), there exists only weak evidence of high-intensity exercise being superior to low-intensity exercise. High-intensity exercise is defined as exercise at 60% to 90% of the maximum exercise capacity (Puhan et al., 2005). Clients with moderate to severe COPD are often unable to sustain high-intensity exercise. Therefore, the low-intensity TCQ exercise with 3.1 MET (Chao et al., 2002) was adopted as intervention for the COPD clients in this study. Results revealed that this intensity of TCQ exercise was well tolerated and enjoyed by the participants. The perceived positive effects provoked demands from the COPD clients to continue the TCQ exercise program upon completion of the trial.

The results show statistically significant improvement of all domains of the SGRQ-HKC in the TCQ group when compared to the exercise group and the control group across the six-month study period. Subjects in the TCQ group were able to improve their HRQL, which covered a wide range of disturbances of physiological and psychosocial functions, with no significant declines. Nonetheless, a worsening trend in HRQL was found in both the exercise group and the control group. In view of the progressive decline of physiological and psychosocial functions in COPD clients in the literature, regular TCQ exercises could help clients to improve their functional capacity and slow down the disease progression.

Minimum Clinical Important Difference

For the SGRQ, a decrease of more than four units in the SGRQ score is indicative of clinically significance with positive functional change (Jones, 2005). The current study reported a statistical significant improvement in HRQL in the TCQ group that

matched with the physiological improvements in lung functions and exercise tolerance. However, apart from the symptom domain, the statistically significant results were not clinically significant. The statistical but not clinically significant result in MCID is similar to the results reported by Lacasse et al. (2006), who reviewed the effects of pulmonary rehabilitation on COPD clients in six RCTs. SGRQ was used in the studies to assess HRQL. The results were all statistically significant, except in the symptom domain. However, no effects exceeded the MCID, suggesting clinically insignificant effects. This is in contrast with studies that used the chronic respiratory disease questionnaire (CRQ) in 11 RCTs. Lacasse et al. (2006) reported that all domains showed not only statistical, but also clinical significance on the effects of respiratory rehabilitation. In this study, wide CIs around the treatment effect were noticed. Lacasse et al. (2006) suggested that wide CIs might be explained by small sample sizes. Hence, future studies may increase the sample size and include both CRQ and SGRQ to compare differences in the MCID for both questionnaires.

Although such results of HRQL are clinically insignificant, the positive effects perceived by subjects motivated them to continue their TCQ exercise upon completion of the trial. As studies have shown that the low intensity of TCQ is suitable for cardiopulmonary clients (Chao et al., 2002), TCQ is a suitable daily exercise for ventilation and activity capability promotion, and can be used as an alternative exercise in pulmonary rehabilitation for COPD clients.

Social Support

Social support is another resource that may be used by clients with chronic illnesses. Symptom management and social support play an important role in optimizing HRQL (McCathie, Spence, & Tate, 2002). Subjective perceived social support affect overall function among older COPD clients, and is important in improving health management and in adherence to the demanding treatment regimen of these clients (Marino, Sirey, Raue, & Alexopoulos, 2008). Hence, interventions should include efforts to strengthen social networks (Kara & Mirici, 2004) to increase self-efficacy and treatment compliance.

In the current study, MSPSS-C was adopted for the measurement of social support. Baseline findings showed that the participants perceived best social support from family with the mean item score of 5.45, which fell well above the midpoint of 3.5, suggesting the participants perceived themselves to be well supported by their family members. The mean item score of perceived social support from significant other was 3.74, which fell around the midpoint of 3.5, indicating the participants perceived themselves to be fairly supported by their significant others. The perceived social support from friends was the lowest among the three categories, with the mean item score of 3.21, which fell below the midpoint of 3.5, suggesting the participants perceived themselves having a limited social support network from friends.

Baseline findings showed that the source of social support of the participants mainly came from their family members. This concurred with previous local studies in Chinese elderly that reported the social support for Chinese older adults mainly came from family members, especially in the absence of immediate kin and friends (Cheng et al., 2009; Chi & Chou, 2001). The high average mean for family support in the

current study is also congruent with the local studies of Jiang et al. (2002) on Chinese COPD clients. Similar observation was also found in other studies in clients with COPD. Cicutto, Brooks and Henderson (2004) also revealed that the most important contribution in social support for COPD clients comes from family members. This could be explained in the Chinese tradition that people tend to maintain strong and cohesive bond between family members, indicating they have a limited social network size.

No prior study has examined the effect of TCQ on social support among COPD clients. In the current study, the effectiveness of TCQ in promoting perceived social support of clients was investigated. Arrangements were made for all subjects in the current study to attend regular weekly gatherings. During the first three months, subjects in the three study groups did not show any changes in their perceived social support from family, friends, and significant others. However, increased self-perceived social support from friends was noted in the TCQ group at the sixth month's follow-up assessment. This might be because majority (93%) of the participants in this group continued their daily TCQ practice in groups informally after the completion of the three-month TCQ program, and some of the participants in this group eventually became friends. Notably, some participants came to the research center together during the six-month follow-up assessment. This provides evidence that their social network had broadened after participating in the TCQ program, and explains why they experienced an improved level of satisfaction in perceived social support from friends at the study endpoint. On the other hand, social support may have influenced the participants' motivation to continue the TCQ exercise. Encouragement from their social support may have therefore, influenced

the positive clinical and statistical significance for the TCQ group in addition to the TCQ program implemented.

The exercise group and the control group did not show any significant changes in the perceived social support throughout the six-month study period. From the informal observation during the community activity classes, the participants did interact with one another; however, the interaction was limited to casual and superficial conversations. Expression in whatever form showing support and caring was rarely noticed. After the three-month class was completed, the participants did not have any continued interactions. Findings revealed that even though the community activities had created an environment for sharing of interest, such sharing was superficial, and the strength was not sufficient to facilitate the development of social support among the participants.

SECTION III

Effects of TCQ on Health Promotion

In the current study, results suggested that a three-month TCQ training program improved lung functions, exercise capacity, HRQL, and perceived social support from friends in the clients with COPD. The use of TCQ training program and the selection of clients with COPD had significant results. The TCQ training improved walking speed, but did not improve dyspnoea and fatigue level, and oxygen saturation. This has been discussed in previous section that it could be due to improved neuromuscular coordination and desensitization to dyspnoea, which explained the increased exercise tolerance with no changes in physiologic parameters (Strijbos et al., 1996). In the physical training prescription, frequency, duration, and intensity of exercise are fundamental factors for physical health promotion.

TCQ is an exercise that adopts the Chinese philosophy for health promotion and health maintenance so it can be considered as the most desirable choice of exercise for people with COPD. TCQ is a gentle self-healing exercise that integrates the three body regulators (i.e. slow body movements, mind concentration, and harmonized breathing) into a whole (Khor, 2002; Kuramoto, 2002; Shinnick, 2006). These three components work in an integrated manner and contribute to the effectiveness of TCQ in promoting the circulation of *Qi* in the meridians, regulating functions of internal organs and improving the physiological functions of the body (Taylor-Piliae, 2003). TCQ emphasizes the coordination of movement and breathing. It consists of meditation and movement exercise that are self-practice. It aims to improve the smooth flow of *Qi*, alleviates the imbalance of *Qi*, and promotes the overall health.

The deep breathing in TCQ coordinates with the movement is thought to increase the flow of *Qi* and lung capacity (Sum & Li, 1999).

Practicing TCQ in a supportive atmosphere can foster feelings of self-efficacy (Jin, 1992). Through continuous practice, the participants gradually develop mastery. This mastery, in a broad sense, could increase their confidence in disease management and treatment compliance. In addition to continuous practice, the successful completion of the TCQ program might have further fostered the sense of self-worth (Questad & Alquist, 1994). The ability to accomplish the TCQ program enhanced participants' internal appreciation of their own achievement and had a positive effect on self-efficacy. In other word, through the TCQ program, participants could become more independent in terms of self-care and decrease the feeling of physical and psychological dysfunction due to the disease.

When comparing to a previous study involving general exercise activity of moderate-intensity activities practiced three or more times per week that needed one year to detect substantial improvement in physical functioning (Stewart, King, & Haskell, 1993), the current study found significant improvements within three months on a low-intensity TCQ program conducted twice a week. The results also showed the benefits on physiological and psychosocial health, which were substantial after another three months of self-practice, suggesting that additional health gains could be derived from a longer period of practice. TCQ appeared to be more beneficial than the popular breathing and walking exercises often used as pulmonary rehabilitation intervention in COPD clients. In addition, the potential for TCQ to be considered favorably in the selection of health promotion programs for COPD included the fact

that the costs associated with TCQ intervention were low. The main direct cost was for the TCQ instructor. As TCQ is already offered through many local community services, the need for instructor training is minimal. TCQ is therefore considered an efficient and cost-effective health service in the community.

Social support is a high-level functioning factor for improving psychosocial health. Previous studies have reported positive effects of group exercise on psychological health for clients with similar diseases (Galantino et al., 2005; Holahan & Moos, 1982). According to Galantino et al. (2005), group intervention provides a psychological and socialization context for support. It could be a potentially cost-effective strategy to improve HRQL for persons with chronic illnesses. This matches with the TCQ group intervention in this study. Although individual exercise can result in psychological enhancement, group dynamics further improves such opportunities. The apparent interdependence of positive physical changes and enhanced psychological coping leads to improved HRQL. TCQ would help subjects to improve the concept of self, which would increase the individual's intention to adopt a particular course of health or illness-related action (Tones & Green, 2004). Self-concept can be viewed as actual achievement and competency, and thus increase self-esteem, self-confidence, and self-image. Therefore, the reason for TCQ group reported better health outcomes is not difficult to explain.

The group TCQ program is believed to create a supportive atmosphere for sharing of interests and beliefs, which can then foster social support among the participants. The participants in the TCQ group who completed the TCQ program chose to continue meeting informally and practice TCQ together. Though the outcome of perceived

social support was insignificant during the first three months, it became substantial at the sixth month. The result indicates that social support needed time to build up rapport and trusted relationships among the participants. This might also explain their increased self-perceived social support from friends at the sixth-month follow-up assessment.

TCQ is therefore an appropriate exercise to help maintaining the lung functions, and can enhance breathing efficiency during exercise. The increased exercise capacity without increased dyspnoea level during exercise makes it a promising exercise for COPD clients. It is more effective and economical in improving the physical and psychosocial health status among the clients with COPD.

Overall, TCQ is a low-impact and low-intensity exercise therapy with advantages for the management of COPD in the community (Blair & Garcia, 1996). TCQ is an easy, safe (Birdee et al., 2009), and effective exercise for COPD clients. The low dropout rate in the TCQ program (14.3%) may relate to the fact that TCQ is a simple exercise to learn. Given that COPD clients can easily incorporate TCQ into their daily lives, the beneficial effects of training can be long term and contribute to the usefulness of TCQ on COPD clients in the community. A finding of this study is that physical functioning, an important index of HRQL, can be enhanced through TCQ. Given that the sample consisted of inactive individuals with chronic illness, favorable treatment effects are likely to be of great interest not only to clients with COPD but also to healthcare providers and practitioners. Figure 5.1 summarizes the flow of the effectiveness of TCQ in COPD clients. Daily practice of TCQ could desensitize dyspnoea, increase exercise capacity, and improve physical health, thus decreasing

exacerbations. Ultimately, TCQ improves HRQL and increases the social support network of COPD clients.

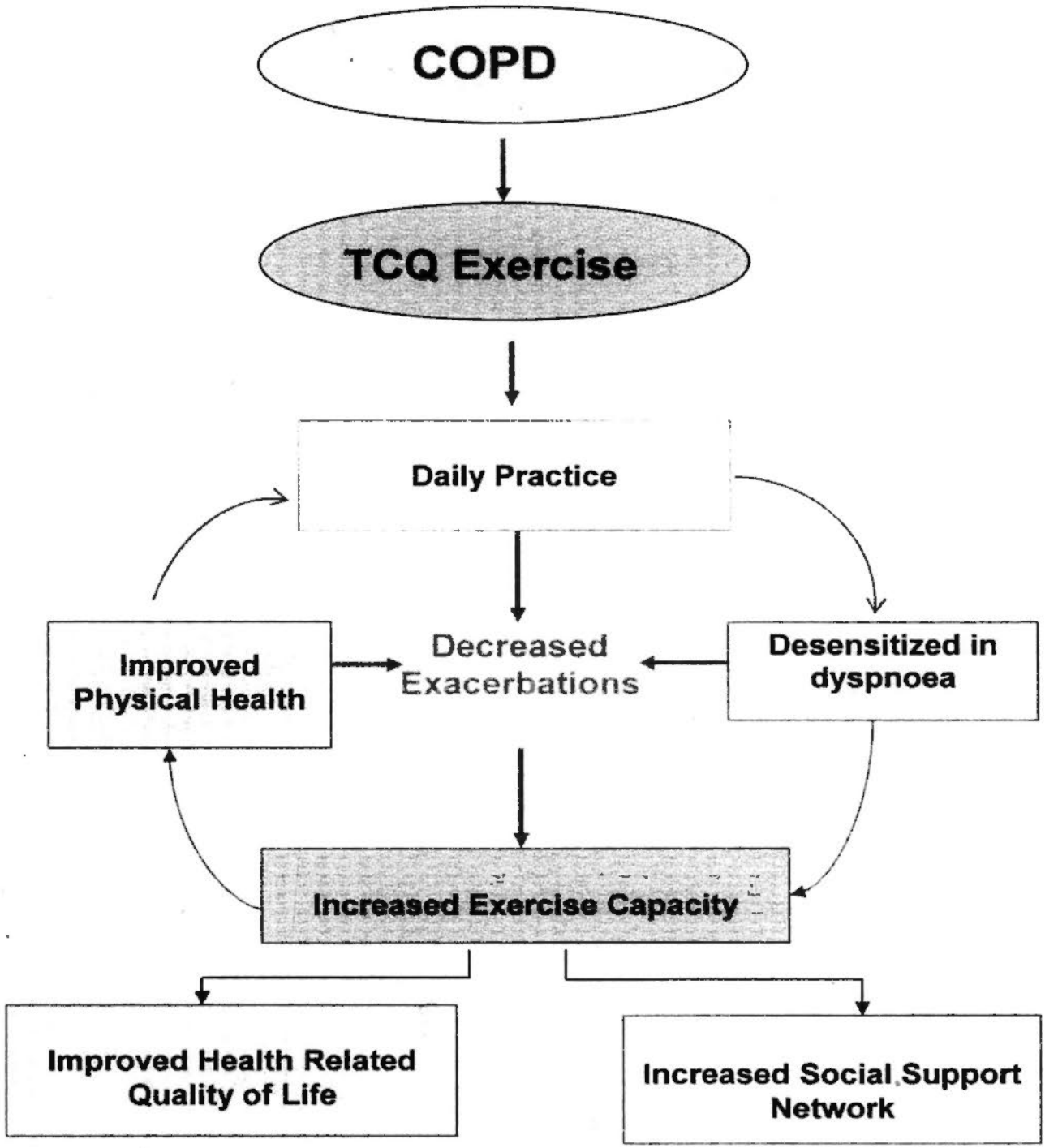


Figure 5.1 Effects of TCQ on promoting physiological health and psychosocial health

SECTION IV

Effects of Breathing and Walking Exercise on Health Promotion

For the exercise group in this study, breathing and walking exercise was adopted as an active control intervention. Participants in the exercise group demonstrated a stable lung function without decline in the six-month study period. Insignificant results were observed in 6MWT, Borg score of dyspnoea and fatigue levels, oxygen saturation level, acute exacerbations, and hospital admissions. Although no significant improvement was shown in physiological functional health status, subjects in this group were able to maintain their lung functions at a comparatively stable level. In view of the progressive decline of lung functions in the control group from the figures reported in Chapter 4, regular exercise could certainly help clients to maintain their physical function, slow down the disease progression, and postpone disability in COPD clients.

For HRQL, marked deterioration was observed in the exercise group. This is contrary to previous findings that breathing exercise and regular walking improve exertion dyspnoea and HROL (Fagger, Stahle, & Larson, 2008; Heppner et al., 2006; Nield et al., 2007). As reported by Hernandez et al. (2000), COPD clients recorded improved exercise capacity, dyspnoea, and HRQL in a home-based program using shuttle walking as an exercise. However, in the current study, deterioration was noted in the activity domain, impact domain, and the total SGRQ, which exceeded the MCID. These discrepancies might be attributable to the differences in the intensity of the intervention. Regular walking in the exercise group was self-paced, a submaximal level of functional capacity activity, instead of maximal shuttle walking. Self-paced walking was used in this study because most ADL are performed at submaximal

levels of exertion (ATS, 2002) and subjects might not achieve maximal shuttle walking during walking exercise unless they are closely supervised. In contrast, Cahalin et al. (2002) reported that while DB has potential beneficial effects on pulmonary functions, adverse effects also existed, such as decreased efficiency of breathing and increased dyspnoea.

Another factor might be attributed to the self-reported compliance. There is a possible bias that participants might present a better image to others and might provide the researchers with a desirable result (Chan, 2009). Some clients might be reluctant to disclose adherence problems or might have problems recalling their compliance behavior (Dobbels et al., 2010). Thus, self-report tends to underestimate non-adherence, and the degree of accuracy of filling the self-recorded diary can be doubtful. This self-reported compliance might therefore reduce the validity of the outcome measurements. Arguably, self-report compliance errors are random in nature, and would cancel out each other, thereby presenting no threat to the study. Because the TCQ group attended the TCQ program twice a week and was closely supervised by the TCQ instructor, their compliance could be identified from their mastery of the TCQ skills; overstating their compliance rate was highly unlikely.

SECTION V

Attrition and Compliance

Attrition is an important concern when conducting an intervention study. Attrition refers to the differential loss of participants from the study groups during the period of intervention and data collection. Excessive attrition may induce bias by changing the composition of the sample and affect the internal validity of the study (Portney & Watkins, 2000).

Before the implementation of the TCQ program, careful planning and discussion was made between the researcher and the TCQ instructor in order to develop a program with a realistic and achievable goal. Because TCQ does not require special equipment, clients could join and continue the program conveniently. This characteristic made the exercise more feasible because the elderly COPD clients generally do not have good financial support. Any special requirement associated with the exercise program might become an obstacle for participation (L.K. Lee, 2007). Moreover, the participants indicated that the program was enjoyable because it provided them with the opportunity to interact with other clients with similar condition and achieve the same goal together. These characteristics contributed to the feasibility of the TCQ program for the COPD clients in the community.

In addition, an experienced TCQ instructor in teaching the clients with chronic illness was the key factor that contributed to the feasibility of the TCQ program. The TCQ movements were tailor-made for clients with COPD and did not present an over-demand on the skills or capabilities of the clients. The easily accessible venues

in the community were reserved for the program at a regular time, facilitating participation of the clients.

Over a three-month intervention, the dropout rate was 14.3% (n = 10) in the TCQ participants. This was relatively low when compared to previous studies which ranged from 19.5% to 27.3% (Chan et al., 2004; Cheung, et al., 2005; L.Y.K. Li, 2007). The relatively high compliance rate of TCQ participation reported in this study could be because of the low-intensity program implemented and a tailor-made exercise to this group of population. Failure to complete the study was attributed to hospital admissions, joint pain, traveling, rather than to dissatisfaction with the program. Another 14.3% (n = 10) dropout occurred in the follow-up assessment at the sixth month because of the same reasons. This attrition rate remains lower that than previous studies (Cambach et al., 1997). The attendance rate of the participants in the TCQ sessions was 83%. The reasons for the absence were mainly because of hospitalizations or conflicts with the medical follow-up appointments. The favorable attendance rate provides evidence to support the strengths of the implemented TCQ program. In addition, participants who completed the study showed the desire that the program could be continued, which is consistent with the findings of F. Li et al. (2001).

Several strategies were implemented to enhance adherence. First, convenient venues in the community with easy access were selected. Second, an experienced TCQ instructor was invited to coach the TCQ classes. Her teaching strategies were tailor-made to the clients with COPD to ensure the achievable techniques and that the program would not place undue demand on the participants. Third, a DVD and TCQ

picture were given to each participant in the TCQ group to facilitate self-practice at home. Securing the completion and adherence of the participants to the TCQ program is a challenging issue in the research arena as these can enhance the validity of the study findings. The strategies adopted in the current study have demonstrated a promising effect on promoting adherence and provide valuable implications to future researchers.

Regarding the exercise group and the control group, the attrition rate was 27.5% (n = 19) and 28.4% (n = 19), respectively, at the third month. This result is concurred with previous studies in COPD rehabilitation programs (Hernandez et al., 2000; Ketelaars et al., 1997). Further lost of participants at the sixth month follow-up was noticed in these two groups, with 5.8% (n = 4) and 22.4% (n = 15), respectively. The main reason of the higher attrition rate in these two groups compared to the TCQ group was "no interest to continue." The higher attrition rate in the control group was also due to "no perceived improvement noted." The non-adherence participants in the control group verbalized no subjective improvement after participating in the study, and the participants showed interest in joining the TCQ program. Future study should schedule a wait-list plan for the control group to let these participants join the TCQ class after completion of the study to attract subjects to remain in the study and minimize the dropout rate. In fact, it was the researcher's ethical and moral obligations to offer the same TCQ intervention to the control groups after the study. The wait-list plan not being conducted in this study was due to the time constraint in completing the study. Nevertheless, a TCQ DVD was given to all participants in the other two control groups at the end of the study, for their self learning and self-practicing.

Intention-to-treat analysis was used in this study to minimize bias and provide a more practical implication of clinical relevance (Montori & Guyatt, 2001). If dropouts and non-adherence to the study protocol were excluded, the unbiased purpose of randomization would be weakened. Participants who drop out from study tend to be worse off compared to those who complete an intervention, even after controlling for known predictive factors (Greenspan, Wolf, Kelley, & O'Grady, 2007). Hence, the participants remaining in the study would be expected to have a better outcome than those who dropped out. Such a situation might account for the greater significance in physical health with the complete-case analysis. Thus, the use of a complete-case analysis instead of intention-to-treat analysis would result in an outcome suggesting greater success than anticipated. Finally, an intention-to-treat analysis provides the researcher a more realistic result of an intervention. In fact, not every individual will fully comply to or complete a treatment regimen. Thus, an intention-to-treat model takes into account issues of noncompliance (Greenspan et al., 2007).

SECTION VI

Strengths and Limitations

This section discusses the strengths and limitations of the current study. Based on the findings, recommendations and implications for future researches are provided with an aim toward enhancing the quality of care delivered to the clients with COPD. A summary of the key findings of the thesis and suggestions for advancing the care and research for this group of population are presented.

Strengths of the Study

The current study is scientifically rigorous in examining the therapeutic effect of TCQ in the population with COPD by implementing a number of research strategies to overcome the common methodological flaws in previous studies and to achieve a more rigorous evaluation.

First, a RCT was adopted. This approach is a powerful method design that can strengthen the internal and external validity of study to assess cause-and-effect relationship among the study interventions and the outcomes (Portney & Wilkin, 2000). Randomization of sampling in the study is the most effective method of controlling individual extraneous variables. It eliminates the possible selection bias and enhances the comparable groups. The other strength is the involvement of two independent control groups, including an active control group and a usual-care control group. Random assignment of the two control groups allows a more stringent evaluation of the effects of the treatment through between-group comparison, and increases the internal validity of the result. The active control group attempted to test the hypothesis that TCQ achieves better results than conventional exercise.

Incorporating all these characteristics into the study design allows a rigorous control of the study.

Second, the study integrates a baseline measurement and repeated post-intervention measurements to allow a more rigorous evaluation of the effectiveness of the TCQ program. Performing the baseline measurement strengthens the study validity in order to detect any initial difference between groups (Polit & Beck, 2008). The design of repeated measure provides the researcher a more stringent evaluation of the effects of the TCQ program and allows the detection of both temporary and continual intervention effects.

Third, because blinding the client was not feasible in the current study, a single-blind design was implemented in which the RAs were blinded to the study. This strategy is essential in eliminating the researcher bias in data collection arising from the knowledge of the intervention groups' status or the investigators' expectation (Polit & Beck, 2008). In addition, considerable effort has been made to maintain the uniformity of the outcome measurement. Interrater reliability test among the RAs was performed in an attempt to ensure consistency in the data collection process. Spirometry was supervised by the same researcher for all subjects throughout the study to ensure proper assessment techniques and to avoid measuring discrepancy.

Finally, the confounding effect of the demographic data of the participants is also an important attribute in this study. By controlling the confounding effect in gender, the current findings can be regarded as more capable in ascertaining the causal effect of

TCQ on functional health. Such statistical method strengthens the internal validity of the study and allows a stronger claim on the effects of TCQ on COPD clients.

Limitations of the Study

The present study was carried out according to the planned protocol and achieved the results expected. However, the present study has several limitations that require particular attention in future studies.

First, because of the overall study schedule, the TCQ program had to be limited to three months. TCQ is a complex exercise routine that requires considerable practice to attain proficiency. A previous six-month study on Tai chi reported improvement in HRQL among elderly subjects, and the improvement became substantial at the sixth month (Y.K. Lee, 2007). Another six-month Tai chi study reported improvements in self-reported measures in physical functioning (Li et al., 2001), and a 12-month Tai chi training study was proven effective in enhancing cardiorespiratory functions among the elderly (Lan, Lai, Chen, & Wong, 1998). The TCQ program of this trial was three months; hence, conclusions regarding the effectiveness of TCQ exercises over longer periods could not be drawn. The small improvement shown in the activity and impact domains of the SGRQ in this study may increase over a longer study period. Moreover, the fact that no significant changes in dyspnoea and fatigue scores may also be due to the short study period, potential long-term effect of TCQ could become apparent if the duration of the study is extended. A longer follow-up on the COPD subjects would also be more informative, especially because deterioration in HRQL was identified as early as at three months in the exercise group and the control group. This deterioration may become more marked over a

longer period, while some improvement or maintenance is exhibited by the TCQ group. In addition, the majority of the TCQ subjects (92%) showed interest in continuing the TCQ exercises, and there was satisfactory compliance rate (74%) of daily self-practice. Future studies should therefore look into longer periods of follow-up assessment to assess clients' long-term compliance and to monitor the effectiveness of TCQ practice during the progression of the disease.

Second, the excessive attrition rate recorded in the control group could be attributed to a certain degree in maintaining the sample representativeness due to the attrition rate for the control group (28.4%) at the third month, and further loss of 23.9% at the sixth-month follow-up. Although the participants who completed the program and the participants who dropped out were comparable, the high attrition might have affected the validity of study results. In fact, the continued and the discontinued participants did not show any significant differences at baseline characteristics with regard to both demographic data and the outcome measures. Thus, logically, the attrition occurred at random, rather than for biased reasons. Moreover, the study adopted intention-to-treat analysis to preserve the value of randomization. Thus, the impact of high attrition rate in the control group should not be a serious concern on the evaluation of the effectiveness of TCQ exercise. However, future studies should plan attractive placebo activities in the usual care control group in order to retain participants and minimize attrition.

Third, the study was limited by the inability to adopt a double-blind method. Blinding the participants from the information about their group status was not possible because such information might have affected their behavior and threatened

the internal validity (Portney & Watkin, 2000). Because TCQ has a long history of its well-known benefits on health, the absence of blinding might have affected the self-reported outcomes of the participants (Jin, 1992) and the resulting bias would be more prominent when the assessments were subjective in nature (Portney & Watkins, 2000). Ideally, a double-blind method is most preferable in eliminating the associated bias. However, for the practical reason, blinding the participants was not feasible in the current study. To combat the limitations, a single-blind method was adopted in which the RAs for data collection were blinded to the participants' group allocation. The bias that might have occurred during the data collection process could be minimized. Furthermore, this study incorporated not only subjective outcome measures but also objective physiological outcome measures; thus, blinding the RAs could considerably lessen the impact of the bias that might have occurred during data collection.

Fourth, the current study had inadequate monitoring of the integrity of the intervention. "Integrity of intervention refers the extent to which the intervention is conducted in the way proposed in the original plan" (Yu, 2004, p. 371). The current study relied on self-recorded diary of the participants. Because the participants were elderly with mean age greater than 70, they might have been forgotten to record the frequency of practice because of decline of memory. Another factor might be attributed to the self-reported compliance. There is a possible bias that participants might present a better image to the researcher and might provide the researcher with a desirable result (Chan, 2009). Some clients might be reluctant to disclose adherence problems (Dobbels et al., 2010). As a result, the degree of accuracy of dose of intervention can be doubtful. Thus, the self-evaluation of the elderly

participants would be overestimated or underestimated. This self-reported data might reduce the validity of the outcome measurements. Even if the self-reported compliance to the intervention was reliable, there would also be the possibility that the participants had performed the intervention incompletely or incorrectly during their home practice. Considerable efforts had been placed to combat this situation. For the TCQ group, participants attended the TCQ program twice a week and were closely supervised by the TCQ instructor, their compliance and skills could be identified from their mastery of the TCQ skills; overstating their compliance rate was highly unlikely. For the exercise group, the techniques on breathing exercise of the participants were evaluated regularly at baseline, the sixth week, the third month, and the sixth month by the researcher to ensure proper skills were performed. Moreover, given that the self-report compliance errors were random in nature among the study groups, this would cancel out each other and thus might minimize the threat to the study.

Fifth, the TCQ group was supervised by a TCQ instructor during every TCQ session twice a week, whereas the exercise group was advised to do self-directed exercises with no supervision, which may tend to yield positive results in supervised TCQ exercise. Self-directed exercise was scheduled for the exercise group because the type of exercise is based on a familiar activity, breathing, and walking exercise. It was taught by a qualified nurse and was easy for subjects to carry out. The 13 forms of TCQ, unlike the conventional exercise, must be taught step by step. Therefore, a course of 12 sessions for the TCQ group was a minimum. In addition, the ultimate goal of the study was to teach the participants TCQ in three months, such that they could practice on their own once they learned the skills. In addition, although this

study adopted a RCT design to evaluate the effect of TCQ against an exercise group and a usual care control group, the participants in the exercise group and the control group only gathered once a week in non-health-related activities in the community centers, while the TCQ group had two sessions per week. The researcher could not exclude the possibility that the symptomatic changes that had been identified could be related to the more frequent social contact with the TCQ instructor. Although the intervener-participant contact appeared to be a nonspecific factor, this might have been a therapeutic ingredient (Yu, 2004). The degree of social interaction in the non-health-related community activities might not have been the same as those in the TCQ session. Based on the fact that health behavior is determined by psychological and social elements (Lundin, 1995), future study may incorporate a similar weighed placebo-controlled study for a more thorough evaluation of the effects of TCQ against the placebo effect.

Sixth, the self-paced 6MWT might not place adequate exertion on the individual subjects as reflected from the low post-6MWT Borg scales. A treadmill test would be a good assessment in physical capacity for future studies.

Seventh, owing to the small number of female participants enrolled in this study, gender differences on the TCQ effects could not be examined. The uneven gender distribution was because more men than women suffer from COPD in Hong Kong. Future studies may recruit more female subjects, if available, so that gender differences on the therapeutic effects of TCQ can be evaluated.

Finally, since the three groups were homogeneous in majority of the measured characteristics, control for confounding effect of baseline variables were not done, future study may consider regression analysis to control for possible confounding baseline data.

Summary

This chapter discussed the findings of the study. Physiological and psychosocial health is an area of concern in clients with COPD. With reference to the baseline data of the participants, its significance lies on the fact that majority of the COPD clients have deteriorating physical and psychosocial distress. Their HRQL is also compromised. The effects of TCQ in improving these health outcomes were discussed and compared to the existing body of knowledge. TCQ adopts the philosophy of TCM and carries unique characteristics that are highly relevant for health promotion among the clients with chronic illnesses. It is a nondemanding and cost-effective means of managing the physiological and psychosocial problem among the COPD clients. This study confirms that TCQ exercise is an effective management for clients with COPD. The addition of TCQ exercise significantly improved lung functions, increased exercise capacity, enhanced QOL and increased self-perceived social support from friends. A modest reduction in exacerbations was also seen. Breathing and walking exercise did not show significant improvement in physiological health status; however, the current study showed that regular exercise could maintain physiological function at a comparatively stable level and slow down disease progression. The insignificant results of Borg scale and hospital admission rates in this study may be due to the short study period that is unable to reflect the potential long-term effect of TCQ on health outcomes. Benefits of practicing TCQ on

clients with COPD should be further investigated with a longer follow-up period in order to detect further improvements in physiological as well as psychosocial status.

CHAPTER 6

Conclusions and Recommendations

This chapter discusses the new knowledge generated by this study. Based on the findings, recommendations and implications for clinical practice are proposed, aiming to enhance the quality of care delivered to the clients with COPD. The integration of TCQ training into the mainstream healthcare services is also recommended. The chapter ends with suggestions for advancing the care and research in the healthcare system for this group of population.

Contribution of the New Knowledge Generated by this Study

This is one of the few studies that provided scientific evidence regarding the health benefits of TCQ to the clients with COPD. This study utilized wide range of indicators reflecting the holistic approach of client care. COPD clients have strong needs of physiological and psychosocial support, and this study has paid particular attention to fulfill. Findings from this study enhance the understanding of the effects of TCQ practice on the study population. The current study has demonstrated that TCQ has a positive effect in improving the physiological and psychosocial health over the six-month study period. It provides evidence to support the feasibility of learning and practicing TCQ among the COPD clients. Findings have also shown that TCQ could enhance ability of COPD clients to achieve an effective health promotion strategy. This study advocates planning and implementing the TCQ program in the community healthcare system that aim to improve the physiological and psychosocial well being in clients with COPD.

With the new knowledge and experience generated from the study, the physiological and psychosocial benefits of TCQ on COPD clients contribute to advance clinical practice and research. This study has added value to evidence-based practice for clients with COPD in the community and provides practical indication for health professionals to implement the TCQ program in the community healthcare system.

Recommendations and Implications for Clinical Application

This was the first study that used the 13-form TCQ in Hong Kong population with COPD. From the results of this study, TCQ appeared to satisfy the basic principles of rehabilitation for the COPD clients. The study provided new evidence that TCQ could be beneficial for tertiary prevention of clients with COPD. It demonstrated the significant effect of a TCQ program in improving physiological and psychosocial well being in clients with COPD. In this study, TCQ improved lung functions in terms of FVC and FEV_1, increased exercise capacity, improve HRQL, and increased perceived social support network in clients with COPD. TCQ can be recommended as an adjunctive intervention to standard medical treatment. In addition, TCQ is a safe and feasible intervention that causes no harm to the clients. It promotes clients' self-efficacy for disease management and self-care. Integrating TCQ into clients' daily activity provides a good opportunity for them to actively and independently participate in their own care.

This study also provided evidence supporting TCQ to be considered as pulmonary rehabilitation for COPD clients. Given that TCQ is a low-technology and gentle exercise, it is particularly appropriate and favorable for clients with COPD as they

are usually being diagnosed at their later years of life and their physical functions have deteriorated due to the normal aging process and disease progress.

Furthermore, because TCQ is invigorating, rather than exhausting (L.Y.K. Li, 2007), it is more desirable for older people with chronic illness. TCQ itself does not have any adverse consequence to the practitioners. Although COPD is said to be an incurable disease (HKDH, 2010), TCQ can work in conjunction with the therapeutic treatment regimens and act as an alternative choice of exercise for health promotion and health maintenance. With the current evidence on its physiological and psychosocial health benefits, TCQ can be considered a promising exercise option for this particular group of population.

Feasibility of Implementing a TCQ Program in the Community

To determine the clinical significance of a TCQ program, the issues of effectiveness, appropriateness, and feasibility should be considered carefully. Existing evidence demonstrates that the TCQ program is effective in improving physiological and psychosocial health in clients with COPD. Analysis of TCQ also strongly supports the appropriateness of TCQ for clients with COPD. The last issue to be considered is the feasibility to implement the TCQ program into real practice. This section examines the feasibility of implementing a TCQ program in the community.

Findings in the current study reveal an acceptable compliance rate and a desirable attendance rate for the TCQ group. No injury or discomfort related to the TCQ program was reported. TCQ was well tolerated and enjoyed by the participants. Participants were able to master the learned TCQ skills within the three-month

intervention period. Participants also expressed their desires to continue practicing TCQ upon completion of the program. Practicing TCQ could be seen as an achievable task for the COPD clients. With reference to the feedback from the participants, the TCQ program was supported to be feasible in the community settings.

The findings are most relevant in providing guidance for the development of community intervention. In order to increase the application of TCQ in the context of care for the COPD clients, establishing a TCQ training program to deliver exercise training to COPD clients in the community is expected to have a beneficial effect on their health outcomes. The suggestion is based on the observation that COPD clients have limited physical mobility that prevents them from attending the outpatient training program. Their compromised activity level should not limit their access to this intervention.

Integrating TCQ Training into Community Healthcare Team

The next recommendation concerns the integration of TCQ training as an adjunctive non-pharmacological intervention into the community healthcare team in the context of care for clients with COPD. This recommendation is suggested because the current study findings have confirmed that TCQ is an effective intervention in enhancing the physiological and psychosocial health outcomes of COPD clients. Its effects in improved lung functions, exercise capacity, and HRQL are particularly impressive. Besides, it is also a suitable and feasible intervention that causes no harmful effects to the COPD clients. Effective management of chronic illness emphasizes the importance of clients' responsibility on their own self-care (Bennett,

Cordes, Westmorelan, Castro, & Donnelly, 2000). Integrating TCQ into the care of COPD clients as a self-regulatory skill provides a good opportunity for these clients to independently and actively participate in their own care. TCQ is regarded as an entirely appropriate approach and complements the TCM philosophy in improving better health outcomes for COPD clients. In order to increase the application of TCQ in the context of care for the COPD clients, it should be incorporated as a multidisciplinary community-based intervention.

Current healthcare practice advocates the use of a multidisciplinary disease management program to enhance the health outcomes. In Hong Kong, this type of intervention has also received more emphasis and has recently emerged as a model of care to enhance the health outcomes of patients (A. Lee, 2008). In view of incorporating TCQ as an element of disease management program that would enhance the health outcomes of COPD clients, the clinical applicability of this intervention should be considered. In order to widen the application of TCQ to COPD clients, TCQ could also be integrated as an element of multidisciplinary community-based intervention. Multidisciplinary-based intervention that includes supporting services in disease management such as counseling, nursing care, patient education, drug education, and exercise regimen has been incorporated into the model of care in the healthcare reform (Health and Food Bureau, 2010). However, the Health Protection Scheme recently proposed by the government has made no provision for rehabilitation especially in the context of community interventions (Health and Food Bureau, 2010). Thus, TCQ training should be considered integrating into the healthcare reform scheme as an element of a multidisciplinary community-based intervention. Figure 6.1 demonstrates the suggested model of

disease management of COPD in the community. With regard to the impressive research evidence that suggests the beneficial effects of multidisciplinary intervention in reducing morbidity and mortality in COPD patients (Camback et al., 1997), the adoption of this model of care to the primary healthcare system of Hong Kong should be considered. TCQ training could be integrated as collaborative care spearheaded by the community rehabilitation team.

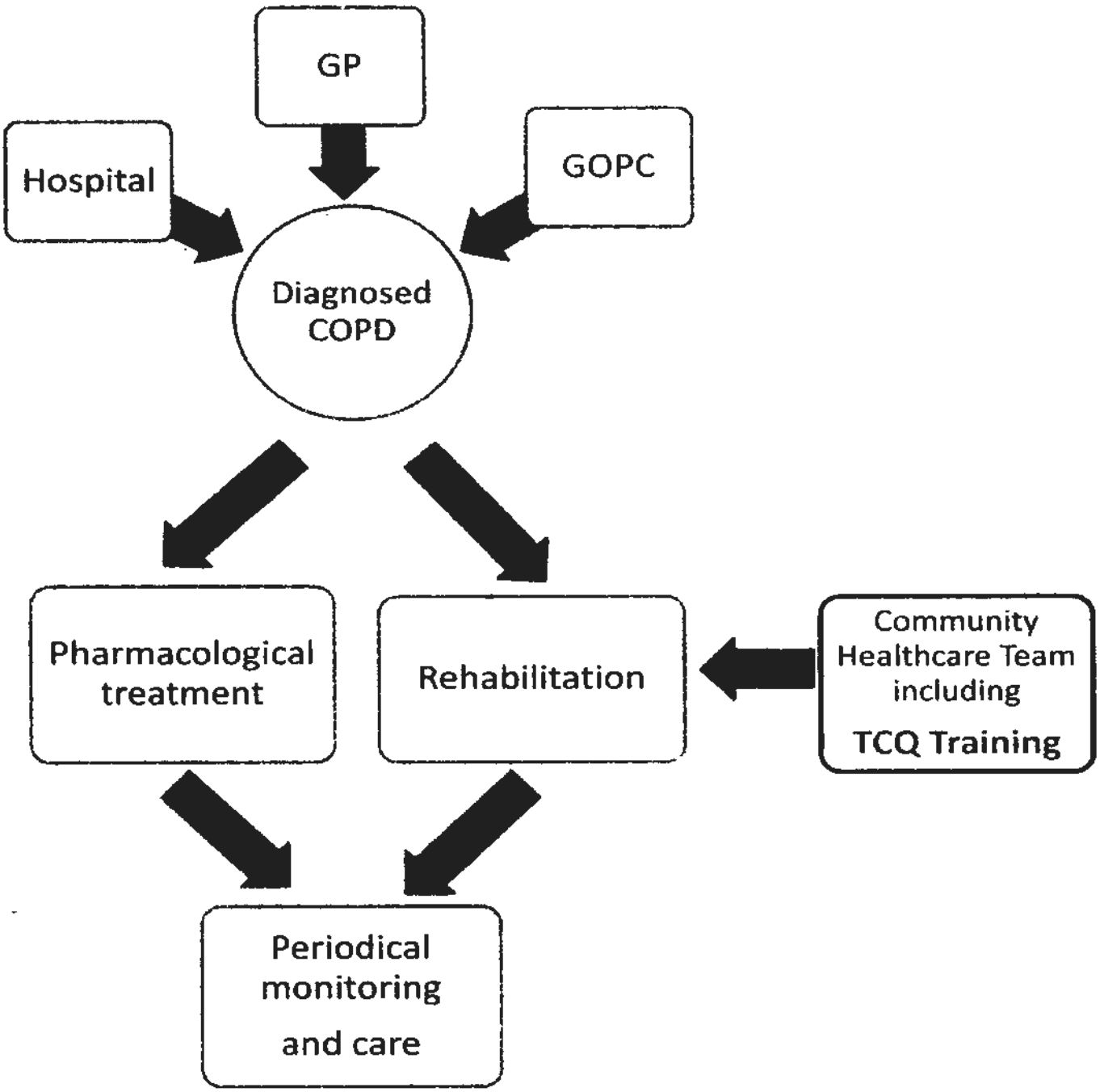


Figure 6.1 Model of Management of COPD in the Community

Promoting Successful Implementation of TCQ Training

To promote TCQ as a component of a community healthcare team intervention for COPD clients, the compliance of the clients with regular self-practice is crucial to enhance the positive treatment effect of the intervention. Strategies have been successfully implemented in this study to facilitate adherence of the participants to the TCQ practice. To secure the adherence to the TCQ practice, tailoring the TCQ forms for clients with COPD is necessary. The selected 13-form breath-regulating TCQ was tailored for COPD clients' specific capabilities, needs, and interests. Moreover, to prevent the elderly from discontinuing TCQ practice because of forgetfulness of the TCQ movements, a DVD and pictures of TCQ forms were provided to them to facilitate their self-practice.

In addition, a number of other strategies (D.S.F. Yu, 2004), to promote the long-term compliance of the participants to TCQ self-practice could be incorporated into the training program. Firstly, to attribute TCQ as a long-term compliance exercise, healthcare professionals should advise clients to incorporate the TCQ practice as a lifestyle activity, rather than to regard it as a therapy for combating the symptoms of their disease. Secondly, group-based TCQ training can provide the client with peer support and enhance their compliance, and further increase adherence behavior to non-pharmacological intervention (Fraser, & Spink, 2002). Health professionals can facilitate the attending clients to build up social relationship with one another, such as encouraging them to share their experience in coping with the disease and helping them to identify common interest. Thirdly, encouraging close family members or friends to join the TCQ training would be beneficial (Y.K. Lee, 2007; D.S.F. Yu, 2004). Family and friends support serve to reinforce proper technique, and motivate

clients to practice regularly, and promote the feeling of closeness. All of these strategies could be incorporated in the TCQ training program with the aim to secure the compliance of COPD clients to regular TCQ self-practice.

Incorporating TCQ into Healthcare System

The value of the TCQ intervention has been widely advocated for various chronic illnesses, and is commonly practiced in the community. Its use as a therapeutic intervention is emerging in the clinical arena; however, it is still not commonly used in the community settings. In order to promote the successful incorporation of TCQ training as a non-pharmacological intervention in the healthcare system for the care of COPD clients, support from the medical and administrative personnel is crucial. An effort should be made to direct their attention to the accumulated body of research evidence that advocates the health benefits of TCQ for respiratory care. Such knowledge should also be integrated into the development of the related practice guidelines and care protocols. Healthcare reform at administrative level is advised to respond promptly to the emerging evidence. Furthermore, to promote a successful implementation of the TCQ program, a policy incorporating all these recommendations should be established.

Incorporating TCQ training into the healthcare system does not require expensive facilities. TCQ instructors are readily available in the community with reasonable payment. Because a number of Tai chi or TCQ classes are already implemented in the community, to implement a tailor-made TCQ program for the COPD clients in the existing community centers should present no additional problems. An additional advantage of TCQ is that it can be practiced everywhere, both indoors and outdoors;

therefore, easily accessible venue is also not a problem. Finally, the health professionals and the community personnel should have the specific knowledge and skills in the planning and coordination work of running a TCQ program, making the implementation not too difficult.

Summary

COPD is a chronic progressive disease. For clients with COPD, physiological functional health is impaired by deteriorated lung functions and exercise capacity. Because of decreased activity level, HRQL of clients is affected and the need for social support is increased. The goal of the treatment intervention is to increase activity level and exercise endurance, and reduce symptoms. This study confirms that TCQ is an effective management for clients with COPD. The addition of TCQ significantly improves lung functions, increases exercise capacity, enhances QOL, and increases self-perceived social support from friends. Its effectiveness, appropriateness, and feasibility for the clients with COPD make it a promising exercise option for this particular population. Implementing a TCQ program for the COPD clients requires an experienced TCQ instructor, tailor-made TCQ movements, easily accessible venue in the community, careful planning, and coordination work.

With the adoption of a stringent research design, the current findings add new knowledge to the physical effect and psychosocial effect of TCQ among the clients with COPD who have not yet been studied. Findings from this study provide evidence of the benefits of TCQ as an exercise for improving physiological and psychosocial health. Elderly COPD clients demonstrated ability to master the skill and showed no significant complication in practicing TCQ. Evaluation of its effect

over a longer period is also suggested for obtaining a more comprehensive picture of the health benefit of TCQ. Experience gained from this study give valuable insight to future researchers when pursuing research work on TCQ, particularly for the clients with chronic respiratory illnesses. These findings also provides useful guidance to health professionals when planning and organizing activities that aim to improve the physiological and psychosocial well being of clients with COPD. TCQ program for COPD clients should be planned as part of the primary health care. Financial reform should also consider resource allocation in implementing the model of COPD management.

References:

Agle, D.P., Baum, G.L., Chester, E.H., & Wendt, M. (1973). Multidisciplinary treatment of chronic pulmonary insufficiency: Psychologic aspects of rehabilitation. *Psychosomatic Medicine*, 35(1), 41-49.

Ai, A.L. (2006) Qigong. In M.S. Micozzi, *Fundamentals of complementary and integrative medicine* (pp. 418-435). Washington: Saunders.

Allison, P. (2001). *Missing data*. Thousand Oaks, CA: Sage.

American Thoracic Society. (1999a) Pulmonary rehabilitation-1999. *American Journal of Respiratory and Critical Care Medicine*, 159, 1666-1682

American Thoracic Society (1999b). Dyspnoea: Mechanisms, assessment, and management: A consensus statement. *American Journal of Respiratory and Critical Care Medicine*, 159, 321-340.

American Thoracic Society (2002). ATS statement: Guidelines for the six-minute walk test. *American Journal of Respiratory Critical and Care Medicine*, 166, 111-7.

American Thoracic Society (2004). *Standards for the diagnosis and management of patients with COPD*. Retrieved December 12, 2009 from http://www.thoracic.org/search.cfm?q=COPD

American Thoracic Society (2006). American Thoracic Society / European Respiratory Society statement on pulmonary rehabilitation. *American Journal of Respiratory and Critical Care Medicine*, 173, 1390-1413.

Andenaes, R., Moum, T., Kalfoss, M.H., & Wahl, K.A. (2006). Changes in health status, psychological distress, and quality of life in COPD patients after hospitalization. *Quality of Life Research*, 15, 249-257.

Anderson, K.L., & Burckhardt, C.S. (1999). Conceptualization and measurement of quality of life as an outcome variable for health care intervention and research. *Journal of Advanced Nursing*, 29(2), 298-306.

Anthonisen, N.R., Connett, J.E., Kiley, J.P., Altose, M.D., Bailey, W.C., Buist, A.S. et al. (1994). Effects of smoking intervention and the use of an inhaled anticholinergic bronchodilator on the rate of decline of FEV_1: The lung health study. *The Journal of the American Medical Association*, 272(19), 1497-1505.

Audette, J.F., Jin, Y.S., Newcomer, R., Stein, L., Duncan, G., & Frontera, W.R. (2006). Tai chi versus brisk walking in elderly women. *Age & Ageing*, 35(4), 388-393.

Barnes, P.J., Shapiro, S.D., & Pauwels, R.A. (2003). Chronic obstructive pulmonary disease: Molecular and cellular mechanisms. *European Respiratory Journal*, 22, 672-688.

Barnett, M. (2006). *Chronic obstructive pulmonary disease in primary care.* Chichester: John Wiley & Sons.

Beaton, D.E., Boers, M., & Wells, G.A. (2002). Many faces of the minimal clinically important difference (MCID): A literature review and directions for future research. *Current Opinion in Rheumatology*, 14, 109-114.

Behrendt, C.E. (2005). Mild and moderate-to-severe COPD in nonsmokers: Distinct demographic profiles. *Chest*, 128, 1239-1244.

Bellamy, D., & Booker, R. (2005). *Chronic obstructive pulmonary disease in primary care: All you need to know to manage COPD in your practice* (3rd ed.). London: Class Publishing Limited.

Bennet, S.J., cordes, D.K., Westmoreland, G., Castro, R., & Donnelly, E. (2000). Self-care strategies for symptom management in patients with chronic heart failure. *Nursing Research*, 49(3), 139-145.

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(7), 581-586.

Birdee, G.S., Wayne, P.M., Davis, R.B., Phillips, R.S., & Yeh, G.Y. (2009). T'ai chi and qigong for health: Patterns of use in the United States. *The Journal of Alternative and Complementary Medicine*, 15(9), 969-973.

Blackler, L., Jones, C., & Mooney, C. (Eds.) (2007). *Managing chronic obstructive pulmonary disease.* West Sussex: John Wiley & sons.

Blair, S.N., & Garcia, M.E. (1996). Get up and move: A call to action for older men and women. *Journal of the American Geriatrics Society*, 44, 599-600.

Bonifonte, S.P. (2004). *Tai chi for seniors*. New Page Books: Franklin Lakes.

Borg, G.A.V. (1982). Psycho-physical bases of perceived exertion. *Medicine and Science in Sports and Exercise*, 14, 377-81.

Borg, G, & Ottoson, D. (eds.). (1986). *The perception of exertion in physical work.* London: Macmillan.

Bowling, A. (2002). *Research method in health: Investigation health and health services. Buckingham.* Philadelphia: Open University Press.

Boxall, A.M., Barclay, L., Sayers, A., & Caplan, G.A. (2005). Managing chronic obstructive pulmonary disease in the community: A randomized controlled trial of home-based pulmonary rehabilitation for elderly housebound patients. *Journal of Cardiopulmonary Rehabilitation*, 25, 378-385.

Bridevaux, P.O., Gerbase, M.W., Probst-Hensch, N.M., Schindler, C., Gaspoz, J.M, & Rochat, T. (2008). Long-term decline in lung function, utilization of care and qualityof life in modified GOLD stage 1 COPD. *Thorax*, 63, 768-774.

Brown D.R., Wang, Y., Ward, A., Ebbeling, C.B., Fortlage, L., Puleo, E. et al. (1995). Chronic psychological effects of exercise and exercise plus cognitive strategies. *Medicine and science in sports and exercise*, 27(5), 765-775.

Burini, D., Farabollini, B., Iacucci, S., Rimatori, C., Riccardi, G., Capecci, M., et al. (2006). A randomized controlled cross-over trial of aerobic training versus qigong in advanced parkinson's disease. *Europa Medicophysica*, 42(3), 231-238.

Burns, N., & Goves, S.K. (2001). *The practice of nursing research: Conduct, critique & utilization* (4th ed.). Philadelphia: Saunders.

Burrows, B., & Earle, R.H. (1969). Course and prognosis of chronic obstructive lung disease. *The New England Journal of Medicine*, 280, 397-404.

Cahalin, L.P., Braga, M., Matsuo, Y., & Hernandez, E.D. (2002). Efficacy of diaphragmatic breathing in persons with chronic obstructive pulmonary disease: A review of the literature. *Journal of Cardiopulmonary Rehabilitation*, 22, 7-21.

Calverley, P.M.A., Burge, P.S., Spencer, S., Anderson, J.A., & Jones, P.W. (2003). Bronchodilator reversibility testing in chronic obstructive pulmonary disease. *Thorax*, 58, 659-664.

Calverley, P.M., & Koulouris, N.G. (2005). Flow limitation and dynamic hyperinflation: Key concepts in modern respiratory physiology. *European Respiratory Journal*, 25, 186–199.

Cambach, W., Chadwick-Straver, R.V.M., Wagenaar, R.C., van Keimpema, A.R.J. & Kemper, H.C.G. (1997). The effects of a community-based pulmonary rehabilitation programme on exercise tolerance and quality of life: A randomized controlled trial. *European Respiratory Journal*, 10, 104-113.

Camp, P.G., Appleton, J., & Reid, W.D. (2000). Quality of life after pulmonary rehabilitation: Assessing change using quantitative and qualitative methods. *Physical Therapy*, 80(10), 986-995

Cantley, M.E.G. (2001). *Patient responses to COPD symptoms: The relationship of dyspnoea and fatigue to activities of daily living, inhaler use, and self-care capability*. Doctoral thesis, Virginia Commonwealth University, US.

Celli, B.R. (2007). COPD: Clinical presentation and evaluation. In R. Stockley, S. Rennard, K. Tabe, & B. Celli (Eds.), *Chronic obstructive pulmonary disease* (pp. 167-180). Massachusetts: Blackwell.

Celli, B.R., Halbert, R.J., Nordyke, R.J., & Schau, B. (2005). Airway obstruction in never smokers: Results from the third National Health and Nutrition Examination Survey. *American Journal of Medicine*, 118, 1364-72.

Chan, A.W.K., Lee, A., Suen, L.K.P., & Tam, W.W.S (2010). Effectiveness of a Tai chi Qigong program in promoting health-related quality of life and perceived social support in chronic obstructive pulmonary disease clients. *Quality of Life Research*, 19(5), 653-664.

Chan, A.W.K., Lee, A., Suen, L.K.P., & Tam, W.W.S (2011). Tai chi Qigong improves lung functions and activity tolerance in COPD clients: A single blind, randomized controlled trial. *Complementary Therapies in Medicine*, 19 (1), 3-11.

Chan, D. (2009). So why ask me? Are self report data really that bad? In C.E. Lance & R.J. Vandenberg (Eds.), *Statistical and methodological myths and urban legends: Doctrine, verity and fable in the organizational and social sciences* (pp309-335). New York: Routledge.

Chan, K., Qin, L., Lau, M., Woo, J., Au, S., Choy, W., et al. (2004). A randomized, prospective study of the effects of tai chi un exercise on bone mineral density in postmenopausal women. *Archives of Physical Medicine & Rehabilitation*. 85(5), 717-722.

Chan, S.C.C. (2004). Chronic obstructive pulmonary disease and engagement in occupation. *American Journal of Occupational Therapy*, 58(4), 408-415.

Chao, Y.F.C., Chen, S.Y.C., Lan, C., & Lai, J.S. (2002). The cardiorespiratory response and energy expenditure of tai-chi-qui-gong. *The American Journal of Chinese Medicine*, 30(4), 451-61.

Chen, K.M. (2002). Tai chi. In M. Synder, & R. Lindquist, *Complementary /Alternative therapies in nursing* (4th ed.) (pp. 234-241). New York: Springer Publishing Company.

Chen, K.M., Snyder, M., & Krichbaum, K. (2001). Clinical use of tai chi in elderly populations. *Geriatric Nursing*, 22(4), 198-200.

Chen, Y.J. (2005). *The influence of physiological factors, psychological factors, and informal social support on hospital readmission in discharged patients with chronic obstructive pulmonary disease (COPD) in Taiwan*. Doctoral thesis, Case Western Reserve University.

Cheng, S.T., Lee, C.K.L., Chan, A.C.M., Leung, E.M.F., & Lee, J.J. (2009). *Journal of Gerontology: Psychological Sciences*, 64B (6), 713-722.

Cheung, B.M.Y., Lo, J.L.F., Fong, D.Y.T., Chan, M.Y., Wong, S.H.T., Wong, V.C.W., et al. (2005). Randomized controlled trial of qigong in the treatment of mild essential hypertension. *Journal of Human Hypertension*, 19(9), 697-704.

Chi, I., Chou, K.L. (2001). Social support and depression among elderly Chinese people in Hong Kong. *The International Journal of Aging and Human Development*, 52(3), 231-252.

Chin, R.M. (1995). *The energy within: The science behind every oriental therapy from acupuncture to yoga.* New York: Marlowe & Company.

Chou, K.L. (2000). Assessing Chinese adolescents' social support: The multidimensional scale of perceived social support. *Personality and Individual Differences*, 28, 299-307.

Chou, K., Lee, P.W.H., Yu, E.C.S., Macfarlane, D., Cheng, Y., Chan, S.S.C., et al. (2004). Effect of tai chi on depressive symptoms amongst Chinese older patients with depressive disorders: A randomized clinical trial. *International Journal of Geriatric Psychiatry*, 19(11), 1105-1107.

Chow, M. (1984). *Classical Yang style tai chi chuan.* Los Angeles: Wen Lin Associates.

Cicutto, L., Brooks, D., & Henderson, K. (2004). Self-care issues from the perspective of individuals with chronic obstructive pulmonary disease. *Patient Education and Counseling,* 55, 168-176.

Clark, C.J., Cochrane, L.M., Mackay, E., & Paton, B. (2000). Skeletal muscle strength and endurance in patients with mild COPD and the effects of weight training. *European Respiratory Journal,* 15, 92-97.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cohen, J. (1992). Quantitative methods in psychology: A power primer. *Psychological Bulletin*, 112 (1), 155-9.

Cohen, S., & Syme, S.L. (1985). Issues in the application and study of social support. In: S. Cohen, S.L. Syme, (Eds.). *Social Support and Health* (pp. 3-22). Orlando, FL: Academic Press.

CONSORT (2005). *CONSORT Flow Diagram.* Retrieved from http://www.consort-statement.org/consort-statement/flow-diagram

COPD Foundation (2009). *About COPD.* Retireived December 12, 2009, from http://www.copdfoundation.org/patients_caregivers/about_chronic_obstructive_pulmonary_disease

Csaszar, N., Ganju, A., Mirnics, Z.S., & Varga, P.P. (2009). Psychosocial issues in the cancer patient. *Spine*, 34(225), S26-S30.

Dai Y.T., Wu, S.C., & Weng, R. (2002). Unplanned hospital readmission and its predictors in patients with chronic conditions. *Journal of the Formosan Medical Association*, 101, 779-785.

Darren, G., & Mallery, P. (Eds.). (2006). *SPSS for windows Step by step: A simple guide and reference* (6th ed.). New York: Pearson.

Decramer, M., Gosselink, R., Molken, M.R.V., Buffels, J., Schayck, O.V., Gevenois, P.A., et al. (2005). Assessment of progression of COPD: Report of a workshop held in Leuven, 11-12 March 2004. *Thorax*, 335-342.

Department of Health (2003). *Chronic obstructive pulmonary disease*. [Brochure]. Hong Kong: Department of Health.

Department of Health (2003). *The 18 movements of Taiji Qigong*. [VCD]. Hong Kong: Department of Health.

Department of Health (2008). *Chronic obstructive pulmonary disease*. Retrieved from http://www.cheu.gov.hk/eng/resources/exhibition_details.asp?id=2388&HTMLorText=0

Department of Health (2010). *Health Information: Chronic obstructive pulmonary disease*. Retrieved from http://www.cheu.gov.hk/eng/info/otherdiseases_08.htm

Department of Health (2005). *It takes your breath away: The impact of chronic obstructive pulmonary disease*. United Kingdom: Department of Health. Retrieved from http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4115786.pdf

Dobbels, F., Berben, L. De Geest, S. Drent, G. Lennerling, A. Whittaker, C. Kugler, C. et al. (2010). The Psychometric Properties and Practicability of Self-Report Instruments to Identify Medication Nonadherence in Adult Transplant Patients: A Systematic Review. *Transplantation*, Accepted 15 April 2010.

Donesky-Cuenco, D., Janson, S., Neuhaus, J., Neilands, T.B., & Carrieri-Kohlman, V. (2007). Adherent to a home-walking prescription in patients with chronic obstructive pulmonary disease. *Heart & Lung*, 36, 348-363.

Eagan, T., Gulsvik, A., Morkve, O., & Skaug, K. (1999). Hospital admissions due to obstructive lung diseases and pneumonia in two hospital districts. *Tidsskrift for Den Norske Laegeforening*, 119, 4173.

Elinwood, E.M. (2002). *The everything tai chi and qigong book*. Massachusetts: Adams Media Corporation.

Evans, S.E., & Scanlon, P.D. (2003). Current practice in pulmonary function testing. *Mayo Clinic Proceedings*, 78, 758-63.

Faager, G., Stahle, A., & Larsen, F.F. (2008). Influence of spontaneous pursed lips breathing on walking endurance and oxygen saturation in patients with moderate to severe chronic obstructive pulmonary disease. *Clinical Rehabilitation*, 22, 675-683.

Fein, A.M., Karpel, J.P., & Anzueto, A. (2007) Infection management and airflow obstruction. In R. Stocley, S. Rennard, K. Rabe, & B. Celli (Eds.), *Chronic obstructive pulmonary disease* (pp.546-558). Massachusetts: Blackwell.

Feinstein, A.R. (1997). Problems in defining quality of life. In J.A. Levy, C. Jasmin, & G. Bez (Eds.), *Cancers, AIDS, and quality of life* (pp. 11-15). New York: Plenum Press.

Ferguson, G.T., Enright, P.L., Buist, A.S., & Higgins, M.W. (2000). Office spirometry for lung health assessment in adults: A consensus statement from the national health education program. *Chest*, 117(4), 1146-1161.

Fernal, B., & Daniels, F.S. (1984). Electroencephalographic changes after a prolonged running period: Evidence for a relaxation response. *Medicine and Science in Sports and Exercise*, 16, 181.

Ferry, G.D. (1999). Quality of life in inflammatory bowel disease: Background and definitions. *Journal of Pediatric Gastroenterology & Nutrition*, 28(4), S15-S18.

Field, A. (2009). *Discovering statistics using SPSS: (and sex and drugs and rock "n" roll)*. London: SAGE.

Food and Health Bureau (2010). Healthcare reform - progress to date. In *My health my choice: Healthcare reform second stage consultation document* (Chapter 2). Hong Kong Special Administrative Region Government. Retrieved from http://www.myhealthmychoice.gov.hk/pdf/chapter2_eng.pdf

Fontana, J.A. (2000). The energy costs of a modified form of tai chi exercise. *Nursing Research*, 49(2), 91-6.

Fraser, S.N., & Spink, K.S. (2002). Examining the role of social support and group cohesion in exercise compliance. *Journal of Behavioral Medicine*, 25(3), 233-249.

Freemont, A.J., & Hoyland, J.A. (2007). Morphology, mechanisms and pathology of musculoskeletal ageing. *The Journal of Pathology*, 211(2), 252-259.

Freeman, D., & Price, D. (2007). Primary care. In R. Stockley, S. Rennard, K. Tabe, & B. Celli (Eds.). *Chronic obstructive pulmonary disease* (pp. 579-584). Massachusetts: Blackwell.

Friedman, L.M., Furberg, C.D., & DeMets, D.L. (1996). *Fundamentals of clinical trials* (3rd ed.). St Louis: Mosby-Year Book.

Gallagher, B. (2003). Tai chi chuan and qigong: Physical and mental practice for functional mobility. *Topics in Geriatric Rehabilitation*, 19(3), 172-82.

Galantino, M.L., Shepard, K. K., Krafft, L., Laperriere, A., Ducette, J., Sorbello, A., et al. (2005). The effect of group aerobic exercise and t'ai chi on functional outcomes and quality of life for persons living with acquired immunodeficiency syndrome. *Journal of Alternative & Complementary Medicine*, 11(6), 1085-1092.

Garripoli, G. & Friends (1999). *Qigong: Essence of the healing dance*. Florida: Health Communications.

Gary, P.S., Williamson, J.B., Karp, D.A., & Dalphin, J.R. (2007). *The research imagination: An introduction to qualitative and quantitative methods.* Cambridge: Cambridge University Press.

Gatts, S.K., & Woollacott, M.H. (2006). Neural mechanisms underlying balance improvement with short term tai chi training. *Aging-Clinical & Experimental Research*, 18(1), 7-19.

Gemmell, C., & Leathem, J.M. (2006). A study investigating the effects of tai chi chuan: Individuals with traumatic brain injury compared to controls. *Brain Injury*, 20(2), 151-156.

Gigliotti, F, Coli, C. Bianchi, R., Romagnoli, I., Lanini, B., Binazzi, B., et al. (2003). Exercise training improves exertional dyspnoea in patients with COPD: Evidence of the role of mechanical factors. *Chest*, 123, 1794-1802.

Global Initiative for Chronic Obstructive Lung Disease (2009). *Global strategy for the diagnosis, management and prevention of chronic obstructive pulmonary disease. Updated 2009.* Retrieved from http://www.goldcopd.com/

Gore, J.M., Brophy, C.J., & Greenstone, M.A. (2000). How well do we care for patients with end stage chronic obstructive pulmonary disease (COPD)? A comparison of palliative care and quality of life in COPD and lung cancer. *Thorax*, 55, 1000-1006.

Greenspan, A.I., Wolf, S.L., Kelley, M.E., & O'Grady, M. (2007). Tai chi and perceived health status in older adults who are transitionally frail: A randomized controlled trial. *Physical Therapy*, 87(5), 525-535.

Griffiths, T.L., Burr, L., Campbell, I.A., Lewis-Jenkins, V., Mullins, J., Shiels, K., et al. (2000). Results at 1 year of outpatient multidisciplinary pulmonary rehabilitation: A randomised controlled trial. *Lancet*, 355, 362–68.

Guell, R., Casan, P., Belda, J., Sangenis, M., Morante, F., Guyatt, G.H., et al. (2000) Long-term effects of outpatient rehabilitation of COPD: A randomized trial. *Chest*, 117, 976-983.

Guyatt, G.H., Feeny, D.H., & Patrick, D.L. (1993). Measuring health-related quality of life. *Annals of Internal Medicine*, 118 (8), 622-629.

Hadden, H.L., & Hertz, M. (2007). Obliterative bronchiolitis. In R. Stockley, S. Rennard, K. Rabe, & B. Celli (Eds.) (2007). *Chronic obstructive pulmonary disease*. Massachusetts: Blackwell

Halpin, D.M.G. (2003). *COPD*. Philadelphia: Mosby.

Hammond, A., & Freeman, K. (2006). Community patient education and exercise for people with fibromyalgia: A parallel group randomized controlled trial. *Clinical Rehabilitation*, 20(10), 835-846.

Hansel, T.T., & Barnes, P.J. (2004). *An atlas of chronic obstructive pulmonary disease: COPD*. Parthenon: London.

Hart, J., Kanner, H., Gilboa-Mayo, R., Haroeh-Peer, O., Rozenthul-Sorokin, N., & Eldar, R. (2004). Tai chi chuan practice in community-dwelling persons after stroke. *International Journal of Rehabilitation Research*, 27(4), 303-304.

Hartman, C.A., Manos, T.M., Winter, C., Hartman, D.M., Li, B., & Smith, J.C. (2000). Effects of t'ai chi training on function and quality of life indicators in older adults with osteoarthritis. *Journal of the American Geriatrics Society*, 48(12), 1553-1559.

Hass, A., & Cardon, H. (1969). Rehabilitation in chronic obstructive pulmonary disease: A 5-year study of 252 male patients. *The Medical Clinics of North America*, 53(3), 593-606.

Hawkins, J.D., & Hawkins, S.M. (2001). *Walking for fun and fitness* (3rd ed.). Belmont: Wadsworth.

Heppner, P.S., Morgan, C., Kaplan, R.M., & Ries, A.L. (2006). Regular walking and long-term maintenance of outcomes after pulmonary rehabilitation. *Journal of Cardiopulmonary Rehabilitation*, 26, 44-53.

Hernandez, M.T.E., Rubio, T.M., Rulz, F.O., Riera, H.S., Gil, R.S., & Gomez, J.C. (2000). Results of a home-based training program for patients with COPD. *Chest*, 118, 106-114.

Hodgkin, J., Conners, G., & Bell, W. (1993). *Pulmonary rehabilitation: Guidelines to success*. Philadelphia: Lippincott.

Holaham, C.J., & Moos, R.H. (1982). Social support and adjustment: Predictive benefits of social climate indices. *American Journal of Community Psychology*, 10, 403-415.

Hollis, S., & Campbell, F. (1999). What is meant by intention to treat analysis? Survey of published randomized controlled trials. *British Medical Journal*, 319(7211), 670-674.

Holloway, C.M., & Pokomy, M.E. (1994). Early hospital discharge and independence: What happens to the elderly? *Geriatric Nursing*, 15, 24-27.

Hong Kong Lung Foundation (2010). *COPD Hong Kong (GOLD)*. Retrieved January from http://www.hklf.org/HKLF/copdhk_copd_e.htm

Hospital Authority (2009). *Hospital Authority statistical report 2007-2008*. Retrieved from http://www.ha.org.hk/haho/ho/hacp/0708_Full_report_07_08.pdf

House, J.S. (1981). *Work Stress and Social Support*. Redwood: Addison-Wesley.

Hsu, L.M. (1989). Methodological contributions to clinical research: Random sampling, randomization, and equivalence of contrasted groups in psychotherapy outcome research. *Journal of Consulting and Clinical Psychology*, 57(1), 131-137.

Hui, K.P., & Hewitt, A.B. (2002). A simple pulmonary rehabilitation programme improves health outcomes and reduces hospital utilization in patients with COPD. *Chest*, 124(1), 94-97.

Irwin, M.R., Olmstead, R., & Oxman, M.N. (2007). Augmenting immune responses to varicella zoster virus in older adults: A randomized, controlled trial of tai chi. Journal of American Geriatric Society, 55, 511-517.

Irwin, M.R., Pike, J.L., Cole, J.C., & Oxman, M.N. (2003). Effects of a behavioral intervention, tai chi chih, on varicella-zoster virus specific immunity and health functioning in older adults. *Psychosomatic Medicine*, 65, 824-830.

Jaeschke, R., Singer, J., & Guyatt, G.H. (1989). Measurement of health status: Ascertaining the minimal clinically important difference. *Control Clinical Trials*, 10(4), 407-415.

Jahnke, R. Larkey, L. Rogers, C. & Etnier, J. (n.d.). *A comprehensive review of health benefits of qigong and tai chi*. Retrieved from http://www.instituteofintegralqigongandtaichi.org/pdfs/ReviewRJLL0509.pdf

Jiang, S., Chaiwan, S., Panuthai, S., Cheng, Yin, L., & Li, J. (2002). Family support and self-care behavior of Chinese chronic obstructive pulmonary disease patients. *Nursing and Health Sciences*, 4, 41-49.

Jin, P. (1989). Changes in heart rate, noradrenaline, cortisol and mood during tai chi. *Journal of Psychosomatic Research*, 33(2), 197-206.

Jin, P. (1992). Efficacy of Tai chi, brisk walking, meditation, and reading in reducing mental and emotional stress. *Journal of Psychosomatic Research*, 36(4), 361-370

Jones, P.W. (2002). Interpreting thresholds for a clinically significant change in health status in asthma and COPD. *European Respiratory Journal*, 19, 398-404.

Jones, A.Y.M., Dean, E., & Chow, C.C.S. (2003). Comparison of the oxygen cost of breathing exercises and spontaneous breathing in patients with stable chronic obstructive pulmonary disease. *Physical Therapy*, 83(5), 424-431.

Jones, P.W. (2003). *St. George's respiratory questionnaire, Hong Kong / Chinese version*. Respiratory Medicine, St. George University of London.

Jones, P.W. (2005). St. George's respiratory questionnaire: MCID. *Journal of Chronic Obstructive Pulmonary Disease*, 2(1), 75-9.

Kaplan, R.M., Ries, A.L., Prewitt, L.M., & Eakin, E. (1994). Self-efficacy expectations predict survival for patients with chronic obstructive pulmonary disease. *Health Psychology*, 13, 366-368.

Kara, M., & Mirici, A. (2004). Loneliness, depression, and social support of Turkish clients with chronic obstructive pulmonary disease and their spouses. *Journal of Nursing Scholarship*, 36(4), 331-336.

Karlberg, J., & Tsang, K. (1998). *Introduction to clinical trials: Clinical trials research methodology, statistical methods in clinical trials, the ICH GCP guidelines for the improvement of clinical research in Asia.* Hong Kong: Clinical Trials Centre, Faculty of Medicine, the University of Hong Kong.

Katsura, H., Yamada, K., Wakabayashi, R., & Kida, K. (2005). The impact of dyspnoea and leg fatigue Turing exercise on health-related quality of life in patients with COPD. *Respiratory*, 10, 485-490.

Keddissi, J.I., Younis, W.G., Chbeir, E.A., Daher, N.N., Dernaika, T.A., & Kinasewitz, G.T. (2007). The use of Statins and lung function in current and former smokers. *Chest*, 132(6), 1764-1771.

Kervio, G., Carre, F., & Ville, N. (2003). Reliability and intensity of the six minute walk test in healthy elderly. *Medicine & Science in Sports & exercise*. 35(1), 169-174.

Ketelaars, C.A.J., Abu-Saad, H.H., Schlosser, R.M., & Wouters, F.M. (1997). Long-term outcome of pulmonary rehabilitation in patients with COPD. *Chest*, 112, 363-369.

Khor, G. (2002). T*ai chi for fitness over forty: Relaxation exercises for good health.* Sydney: Simon & Schuster.

Klein, P., & Adams, W. (2004). Comprehensive therapeutic benefits of taiji: A critical review. *Physical Medicine & Rehabilitation*, 83(9), 735-45.

Ko, F.W., Lam, R.K., Li, T.S., Fok, J.P., Chan, M.C., & Ng T.K., et al. (2005). Sputum bacteriology in patients hospitalized with acute exacerbations of chronic obstructive pulmonary disease and concomitant pneumonia in Hong Kong. *Internal Medicine Journal*, 35, 661-667.

Ko, C.F., Yu, T.K.K., & Ko, T.P.S. (1996). A survey of hospital readmission in elderly patients. *Hong Kong Medical Journal*, 2, 258-262.

Koff, P.B., Jones, R.H., Cashman, J.M., Voelkel, N.F., & Vandiveier, R.W. (2009). Proactive integrated care improves quality of life in patients with COPD. *European Respiratory Journal*, 33(5), 1031-1038.

Koh, T.C. (1981). Tai chi chuan. *American Journal of Chinese Medicine*, 9(1), 15-22.

Kowk, T., Lau, E., Woo, J., Luk, J.K.H., Wong, E., & Sham, A. (1999). Hospital readmission among older medical patients in Hong Kong, *Journal of the Royal College of Physicians of London*, 33, 153-156.

Kuramoto, A. (2002). Tai chi and qigong. In M.A. Herring & M.M. Roberts (Eds.), *Complementary and alternative medicine: Fast facts for medical practice* (pp.102-107). Malden: Blackwell.

Kutner, N.G., Barnhart, H., Wolf, S.L., McNeely, E., & Xu, T. (1997). Self-report benefits of tai chi practice by older adults. *Journals of Gerontology*, 52B(5), 242-246.

Lacasse, Y., Goldstein, R., Lasserson, T.J., Matin, S. (2006). Pulmonary rehabilitation for chronic obstructive pulmonary disease (review). *Cochrane Database of Systematic Reviews*, issue 4, 1-66.

Lacasse, Y., Guyatt, G.H., & Goldstein, R.S. (1997). The components of a respiratory rehabilitation program: A systematic overview. *Chest*, 111(4), 1077-1088.

Lacasse, Y., Wong, E., Guyatt, G.H., King, D., Cook, D.J., & Goldstein, R.S. (1996). Meta-analysis of respiratory rehabilitation in chronic obstructive pulmonary disease. *The Lancet*, 348, 1115-1119.

Lachin, J.M. (2000). Statistical considerations in the intent-to-treat principle. *Controlled Clinical Trials*, 21, 167-189.

Lan, C., Chou, S.W., Chen, S.Y., Lai, J.S., & Wong, M.K. (2004). The aerobic capacity and ventilatory efficiency during exercise in qigong and tai chi chuan practitioners. The American Journal of Chinese Medicine, 32(1) 141-50.

Lan, C., Lai, J.S., Chen, S.Y., & Wong, M.K. (1998). 12-month Tai Chi training in the elderly: Its effect on health fitness. *Medicine & Science in Sports & Exercise*, 30(3), 345-51.

Larson, J., Kapella, M., Wirtz, S., Covey, M., & Berry, J. (1998). Reliability and validity of the functional performance inventory in patients with moderate to severe chronic obstructive pulmonary disease. *Journal of Nursing Measurement*, 6(1), 55-73.

Lau, A.C.W., Yam, L.Y., & Poon, E. (2001). Hospital re-admission in patients with acute exacerbation of chronic obstructive pulmonary disease. *Respiratory Medicine*, 95, 876-884.

Lee, A. (2008). Model of local primary health care system. In Hong Kong Association Professional and Senior Executive, *Your health, you life – healthcare reform consultation document*. Hong Kong Special Administrative Region.

Lee, A., Lau, F.L., Hazlett, C.B., Kam, C.W., Wong, P., Wong, T.W., et al. (2001) Analysis of the morbidity pattern of non-urgent clients attending accident and emergency departments in Hong Kong. *Hong Kong Medical Journal*, 7, 311-318.

Lee, D.T.F., Lee, I.F.K., Mackenzie, A.E., Ho, R.N.L. (2002). Effects of a care protocol on care outcomes in older nursing home patients with chronic obstructive pulmonary disease. *Journal of American geriatric Society*, 50, 870-876.

Lee, L.Y.K., Lee, D.T.F., & Woo, J. (2007). Effect of tai chi on state self-esteem and health-related quality of life in older Chinese residential care home residents. *Journal of Clinical Nursing*, 16(8), 1580-1582.

Lee, M.S., Lee, M.S., Choi, E.S., & Chung, H. T. (2003). Effects of Qigong on blood pressure, blood pressure determinants and ventilatory function in middle-aged patients with essential hypertension. *The American Journal of Chinese Medicine*, 31(3), 489-97.

Lee, M.S., Lee, M.S., Kim, H.J., & Choi, E.S. (2004). Effects of qigong on blood pressure, high-density lipoprotein cholesterol and other lipid levels in essential hypertension patients. *International Journal of Neuroscience*, 114, 777-786.

Lee, M.S., Lim, H.J., Lee, M.S. (2004). Impact of qigong exercise on self-efficacy and other cognitive perceptual variables in patients with essential hypertension. *The Journal of Alternative and Complimentary Medicine*, 10(4), 675-680.

Lee, Y.K. (2006). *Promoting psychosocial health of elderly residential care home residents: Implementation of a tai chi program.* (Unpublished doctoral dissertation). The Chinese University of Hong Kong, Hong Kong.

Leidy, N.K., & Haase, J.E. (1996). Functional performance in people with chronic obstructive pulmonary disease: A qualitative analysis. *Advances in Nursing Science*, 18(3), 77-89.

Leung, R. (2007). *Exercise Prescription for COPD & Asthma*. Retrieved from www.hkma.org

Li, F., Duncan, T. E., Duncan, S. C., McAuley, E., Chaumeton, N. R., & Harmer, P. (2001). Enhancing the psychological well-being of elderly individuals through Tai Chi exercise: A latent growth curve analysis. *Structural Equation Modeling: A Multidisciplinary Journal*, 8, 53-83.

Li, F., Fisher, K.J., Harmer, P., & Shirai, M. (2003). A simpler eight-form easy tai chi for elderly adults. *Journal of Aging and Physical Activity*, 11(2), 206-218.

Li, F., Harmer, P., McAuley, E, Duncan, T.E., Duncan, S.C., Chaumeton, N., et al. (2001). An evaluation of the effects of tai chi exercise on physical function among older persons: A randomized controlled trial. *Annals of Behavioral Medicine*, 23(2): 139-46.

Li, J.X., Hong, Y., & Chan, K.M. (2001). Tai Chi: Physiological characteristics and beneficial effects on health. *British Journal of Sport Medicine*, 35(3), 148-56.

Lin H.H., Murray, M., Cohen, T., Colijn, C., & Ezzati, M. (2008). Effects of smoking and solid-fuel use on COPD, lung cancer, and tuberculosis in China: A time-based, multiple risk factors, modeling study. *The Lancet*, 372, 1473-1483.

Lindberg, A., Jonsson, A.C., Ronmark, E., Lundgren, R., Larsson, L.G., & Lundack, B. (2005). Prevalence of chronic obstructive pulmonary disease according to BTS, ERS, GOLD and ATS criteria in relation to doctor's diagnosis, symptoms, age, gender, and smoking habits. *Respiration*, 72(5), 471-479.

Lindemann, U., Hammer, W., Muche, R., Nikolaus, T.H., & Becker, C. (2003). Postural control in the elderly: Effect of a twelve week tai chi-qigong intervention in health elderly. *European Journal of Geriatrics*, 5(4), 182-6.

Lindsay, M., Lee, A., Chan, K., Poon, P., Han, L.K., Wong, W.C.W., et al. (2005). Does pulmonary rehabilitation give additional benefit over tiotropium therapy in primary care management of chronic obstructive pulmonary disease? Randomized controlled clinical trila in Hong Kong Chinese. *Journal of Clinical Pharmacy and Therapeutics*, 30, 57-573.

Lokke, A., Lange, P., Scharling, H., Fabricius, P., & Vestbo, J. (2006). Developing COPD: A 25 year follow up study of the general population. *Thorax*, 61, 935-939.

Londorf, D., & Winn, M. (2000). Qigong. In D.W. Novey, *Clinician's complete reference to complementary and alternative medicine* (pp.231-244). St. Louis: Mosby.

Lou, W. & Chi, I., (2001). Health-related quality of life of the elderly in Hong Kong: Impact of social support, In I. Chi, J.E. Lubben, & N.L. Chappell, *Elderly Chinese in Pacific Rim Countries* (pp. 97-113). Hong Kong, University of Hong Kong Press.

Lu, W.X., Zhang, Y.J., Hu, B., Ma, Y., & Zhu, Y.J. (2003). Application of St George's respiratory questionnaire in evaluating the life quality of Chinese clients with obstructive pulmonary disease, *Chinese Journal of Tuberculosis and Respiratory Disease*, 26(4), 195-8.

Lundin, A.P. (1995). Causes of non-compliance in dialysis patients. *Dialysis and Transplantation*, 24, 174-202.

MacNee, W., & Calverley, P.M.A. (2003). Chronic obstructive pulmonary disease-7: Management of COPD. *Thorax*, 58, 261-265.

Man, W.D.C., Mustfa, N., Nikoletou, D., Kaul, S., Hart, N., Rafferty, G.F. et al. (2004). Effect of salmeterol on respiratory muscle activity during exercise in poorly reversible COPD. *Thorax*, 59, 471-476.

Mannerkorpi, K., & Arndorw. M. (2004). Efficacy and feasibility of a combination of body awareness therapy and qigong in patients with fibromyalgia: A pilot study. *Journal of Rehabilitation Medicine*, 36(6), 279-281.

Marino, P., Sirey, J.A., Raue, P., & Alexopoulos, G. (2008). Impact of social support and self-efficacy on functioning in depressed older adults with chronic obstructive pulmonary disease. *International Journal of COPD*, 3(4), 713-718.

Matheson, M.C., Benke, G., Raven, J., Sim, M.R., Kromhout, H., Vermeulen, R., et al. (2005). Biological dust exposure in the workplace is a risk factor for chronic obstructive pulmonary disease. *Thorax*, 60, 645-651.

McCaffrey, R., & Fowler, N.L. (2003). Qigong practice: A pathway to health and healing. *Holistic Nursing Practice*, 17(2), 110-116.

McCathie, H.C., Spence, S.H., & Tate, R.I. (2002). Adjustments to COPD: The importance of psychological factors. *European Respiratory Journal*, 19, 47-53.

McCleary, L. (2002). Equipoise in clinical nursing research. *Canadian Journal of Nursing Research*, 34(3), 49-60.

McGibbon, C.A., Krebs, D.E., Parker, S.W., Scarborough, D.M., Wayne, P.M., & Wolf, S.L. (2005). Tai chi and vestibular rehabilitation improve vestibulopathic gait via different neuromuscular mechanisms: Preliminary report. *BMC Neurology*, 5(3), 1-12.

McGibbon, C.A., Krebs, D.E., Wolf, S.L., Wayne, P.M., Scarborough, D.M., & Parker, S.W. (2004). Tai chi and vestibular rehabilitation effects on gaze and whole-body stability. *Journal of Vestibular Research*, 14(6), 467-478.

McGuire, D.B., Deloney, V.G., Yeager, K.A., Owen, D.C., Peterson, D.E., Lin, L.S., et al. (2000). Maintaining study validity in a changing clinical environment. *Nursing Research*, 49(4), 231-235.

Miravitlles, M., Calle, M, Alvarez-Gutierrez, F., Gobarrt, E., López, F., & Martin, A. (2006). Exacerbations, hospital admissions and impaired health status in chronic obstructive pulmonary disease. *Quality of Life Research*, 15, 471-480.

Montori, V.M., & Guyatt, G.H. (2001). Intention-to-treat principle. *Canadian Medical Association Journal*, 165(10), 1339-1341.

Motivala, S.S., Sollers, J., Thayer, J., & Irwin, M.R. (2006). Tai chi chih acutely decreases sympathetic nervous system activity in older adults. *Journals of Gerontology Series A-Biological Science & Medical Sciences*, 61(11), 1177-1180.

Mulrow, C., & Oxman, A. (Eds.). (1997). *Cochrane Collaboration handbook*. Oxford: Cochrane Collaboration.

Munro, B.H. (2005). *Statistical methods for health care research* (5th ed.). Philadelphia: Lippincott Williams & Wilkins.

Mustian, K.M., Katula, J.A., & Zhao, H. (2006). A pilot study to assess the influence of tai chi chuan on functional capacity among breast cancer survivors. *The Journal of Supportive Oncology*, 4(3), 139-145.

National Institute for Clinical Excellence (2004). *Chronic obstructive pulmonary disease: Management of chronic obstructive pulmonary disease in adults in primary and secondary care, Clinical guideline* 12, p.1-54. Retrieved from http://www.nice.org.uk

National Institutes of Health (2004). *Guidelines for the conduct of research involving human subjects at the National Institutes of Health* (5th ed.). Retrieved from http://ohsr.od.nih.gov/guidelines/GrayBooklet82404.pdf

National Institutes of Health Consensus Development Panel (1996). Physical activity and cardiovascular health. *The Journal of the American Medical Association*, 276(3), 241-246.

Nield, M.A., Hoo, G.W.S., Roper, J.M., & Santiago, S. (2007). Efficacy of pursed-lips breathing: A breathing pattern retraining strategy for dyspnoea reduction. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 27, 237-244.

O'Fallon, J.R. Dubey, S.D., Salsburg, D.S. Edmonson, J.H., Soofer, A., & Colton, T. (1978). Should there be statistical guidelines for medical research papers? *Biometrics*, 34, 687-695.

O'Shea, S.D., Taylor, N.F., & Paratz, J.D. (2007). A predominantly home-based progressive resistance exercise program increases knee extensor strength in the short-term in people with chronic obstructive pulmonary disease: A randomized controlled trial. *Australian Journal of Physiotherapy*, 53, 229-37.

Osman, L.M., Godden, D.J., Friend, J.A.R., Legge, J.S., & Douglas, J.G. (1997). Quality of life and hospital re-admission in patients with chronic obstructive pulmonary disease. *Thorax*, 52, 67-71.

Palange, P., Forte, S., Onorati, P., Manfredi, F., Serra, P., & Carlone, S. (2000). Ventilatory and metabolic adaptations to walking and cycling in patients with COPD. *Journal of Applied Physiology*, 88, 1715-1720.

Pallant, J. (2007). *SPSS survival manual: A step by step guide to data analysis using SPSS for windows* (3rd ed.). New York: Open University Press.

Parry, R. (1997). *Tai chi*. NTC: Chicago.

Patrician, P.A. (2002). Multiple imputation for missing data. *Research in Nursing & health*, 25(1), 76-84.

Pauwels, R.A., Buist, A.S., Calverley, P.M.A., Jenkins, C.R., & Hurd, S.S. (2001). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. *American Journal of Respiratory and Critical Care Medicine*, 163, 1256-1276.

Pauwels, R.A., Lofdahl, C.G., Laitinen, L.A., Schouten, J.P., Postma, D.S., Pride, N.B., et al. (1999) Long-term treatment with inhaled budesonide in persons with mild chronic obstructive pulmonary disease who continue smoking. European Respiratory Society study on chronic obstructive pulmonary disease. *New England Journal of Medicine*, 340, 1948-1953.

Pearson, M.G., Alderslade, R., & Allen, S.C. (1997). Diagnosis and management of stable COPD. *Thorax*, 52 (Suppl. 5), S7-S15.

Pinto-Plata, V.M., Cote, C., Cabral, H., Taylor, J., & Celli, B.R. (2004). The 6-min walk distance: Change over time and value as a predictor of survival in severe COPD. *European Respiratory Journal*, 23, 28–33.

Pippa, L., Manzoli, L., Corti, I., Congedo, G., Romanazzi, I., & Parruti, G. (2007). Functional capacity after traditional Chinese medicine (qi gong) training in patients with chronic atrial fibrillation: A randomized controlled trial. *Preventive Cardiology*, 10(1), 22-25.

Polit, D.F., & Beck, C. (Eds.). (2008). *Nursing Research: Principles and Methods* (8th ed.). Philadelphia: Lippincott William and Wilkins.

Polit, D.F., & Sherman, R.E. (1990). Statistical power in nursing research. *Nursing Research*, 39(6), 365-369.

Portney, L.G., & Watkins, M.P. (2000). *Foundations of clinical research: Applications to practice* (2nd ed.). Upper Saddler River, NJ: Prentice Hall Health.

Puente-Maestu, L., Sanz, M.L., Sanz, P., Cubillo, J.M., Mayol, J., Casaburi, R. (2000). Comparison of effects of supervised versus self-monitored training programmes in patients with chronic obstructive pulmonary disease. *European Respiratory Journal*, 15(3), 517-525.

Puente-Maestu, L., Sanz, M.L., Sanz, P., de Ona, R., Arnedillo, A., & Casaburi, R. (2003). Long-Term effects of a maintenance program alter supervised or self-monitored training programs in patients with COPD. *Lung*, 181, 67-78.

Puhan, M.A., Schunemann, H.J., Frey, M., Scharplatz, M., & Bachmann, L.M. (2005). How should COPD clients exercise during respiratory rehabilitation? Comparison of exercise modalities and intensities to treat skeletal muscle dysfunction. *Thorax*, 60(5), 367-75.

Questad, K.A., & Alquist, A. (1994). Exercise assessment in clinical practice. *Physical Medicine and rehabilitation Clinics of North America*, 5(22), 243-253.

Radbruch, L., Strasser, F., Elsner, F., Goncalves, J.F., Loge, J., Kaasa, S., et al. (2008). Fatigue in palliative care patients – an EAPC approach. *Palliative Medicine*, 22(1), 13-32.

Rennard, S., Decramer, M., Calverley, P.M.A., Pride, N.B., Soriano, J.B., Vermeire, P.A., et al. (2002). Impact of COPD in North America and Europe in 2000: Subjects' perspective of confronting COPD international survey. *European Respiratory Journal*, 20, 799-805.

Riera, H. S., Rubio, T.M., Ruiz, F.O., Ramos, P.C., Del Castillo Otero, D., Hernandez, T.E., et al. (2001). Inspiratory muscle training in patients with COPD: Effect on dyspnoea, exercise performance, and quality of life. *Chest*, 120(3), 748-756.

Ringbaek, T., Brondum, E., Martinez, G., Thogersen, J., & Lange, P. (2010). Long-term effects of 1-year maintenance training on physical functioning and health status in patients with COPD: A randomized controlled study. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 30, 47-52.

Roberts, S.J., Thompson, C.S., & White, R.J. (2001). Effects of a partially supervised home exercise programme on exercise tolerance in chronic obstructive pulmonary diseased (COPD) – A pilot study. *Thorax*, 56(Supple III), piii36.

Rochford, M. (2003). *Total tai chi*. Thunder Bay Press: San Diego.

Sarason, I.G., Levine, H.M., Bashman, R.B., & Sarason, B.R. (1983). Assessing social support: The Social Support Questionnaire. *Journal of Personality and Social Psychology*, 44, 127-139.

Sarvimaki, A., & Stenbock-Hult, B. (2000). Quality of life in old age described as a sense of well-being, meaning and value. *Journal of Advanced Nursing*, 32(4), 1025-1033.

Schnauzer, M. (2006). Qigong: The art of self-healing. *Perspectives in Psychiatric Care*, 42(1), 53-4.

Seemungal, T.A., Donaldson, G.C., Bhowmik, A., Jeffries, D.J., & Wedzicha, J.A. (2000). Time course and recovery of exacerbations in patients with chronic obstructive pulmonary disease. *American Journal of respiratory Critical Care Medicine*, 161, 1608-1613.

Sherbourne, C., & Stewart, A. (1991). The MOS social support survey. *Social Science and Medicine*, 32, 705-714.

Shinnick, P. (2006). Qigong: Where did it come from? Where does it fit in science? What are the advances? *The Journal of alternative and complementary medicine*, 12(4), 351-353.

Simpson, K., Killian, K., McCartney, N., Stubbing, D.G., & Jones, N.L. (1992). Randomised controlled trial of weightlifting exercise in patients with chronic airflow limitation. *Thorax*, 47, 70-75.

Small, S.P., & Graydon, J.E. (1992). Perceived uncertainty, physical symptoms and negative mood in hospitalized patients with chronic obstructive pulmonary disease. *Heart and Lung: The Journal of Critical Care*, 21(6), 568-574.

Small, S. P., & Lamb, M. (1999). Fatigue in chronic illness: The experience of individuals with chronic obstructive pulmonary disease and asthma. *Journal of Advanced Nursing*, 30(2), 469-478.

Social Psychology Network. (2007). *Research randomizer*. Retrieved from http://www.randomizer.org

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, 256-70.

Song, R., Lee, E., Lam, P., & Bae, S. (2003). Effects of tai chi exercise on pain, balance, muscle strength, and perceived difficulties in physical functioning in older women with osteoarthritis: A randomized clinical trial. *Journal of Rheumatology*, 30(9), 2039-2044.

Spencer, S., Calverley, P.M.A., Burge, P.S., & Jones, P.W. (2001). Health status deterioration in patients with chronic obstructive pulmonary disease. *American Journal of Respiratory and Critical Care Medicine*, 163, 122-8.

Stavem, K., Lossius, M.I., Kvien, T.K., & Guldvog, B. (2000). The health-related quality of life of clients with epilepsy compared with angina pectoris, rheumatoid arthritis, asthma and chronic obstructive pulmonary disease. *Quality of Life Research*, 9, 865-871.

Stenlund, T., Lindstrom, B., Granlund, M., & Burell, G. (2005). Cardiac rehabilitation for the elderly: Qi gong and group discussions. *European Journal of Cardiovascular Prevention & Rehabilitation*, 12(1), 5-11.

Stewart, A.L., King, A.C., & Haskell, W.L. (1993). Endurance exercise and health-related quality of life outcomes in 50-60 year old adults. *Gerontologist*, 33, 782-789.

Stockley, R.A., Chopra, N., & Rice, L. (2006). Addition of salmeterol to existing treatment in patients with COPD: A 12 month study. *Thorax*, 61, 122-128.

Strijbos, J.H., Postma, D.S., van Altena, R., Gimeno, F., & Koeter, G.H. (1996) A comparison between an outpatient hospital-based pulmonary rehabilitation program and a home-care pulmonary rehabilitation program in clients with COPD: A follow-up of 18 months. *Chest*, 109, 366-372.

Sum, W.Y., & Li, X.J. (1999). *New-style tai chi ch'uan: The official Chinese system.* Sterling: New York.

Szalai, A. (1980). The meaning of comparative research on the quality of life. In A. Szalai, & F.M. Andrews (Eds.), *The quality of life, comparative studies* (pp. 7-21). London: Sage Publications.

Tabachnick, B.G., & Fidell, L.S. (2007). *Using multivariate statistics* (5th ed.). Boston: Pearson Education.

Taylor-Piliae, R. (2003). Tai chi as an adjunct to cardiac rehabilitation exercise training. *Journal of Cardiopulmonary Rehabilitation*, 23(2), 90-6.

Taylor-Piliae, R.E., & Froelicher, E.S. (2004). The effectiveness of tai chi exercise in improving aerobic capacity: A meta-analysis. *The Journal of Cardiovascular Nursing*, 19(1), 48-57.

Taylor-Pilae, R.E., Haskell, W.L., Waters, C.M., & Froelicher, E.S. (2006). Change in perceived psychosocial status following a12-week tai chi exercise programme. *Journal of Advanced Nursing*, 54(3), 313-329.

Thompson, D.R., & Roebuck, A. (2001). The measurement of health-related quality of life in patients with coronary heart disease. *Journal of Cardiovascular Nursing*, 16(1), 28-33.

Thomas, G.N., Hong, A.W.L., Tomlinson, B., Lau, E., Lam, C.W., Sanderson, J.E., et al. (2005). Effects of tai chi and resistance training on cardiovascular risk factors in elderly Chinese subjects: A 12-month longitudinal, randomized, controlled intervention study. *Clinical Endocrinology*, 63(6), 663-669.

Tiep, B.L. (2007). Editorial: Pursed lips breathing – easing does it. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 27, 245-246.

Tiep, B.L., Burns, M., Kao, D., Madison, R., & Herrera, J. (1986). Pursed lips breathing training using ear oximetry. *Chest*, 90, 218-221.

Tone, K., & Green, J. (2004). *Health Promotion: Planning and Strategies*. SAGE: London.

Tsai, J., Wang, W., Chan, P., Lin, L., Wang, C., Tomlinson, B., et al. (2003). The beneficial effects of tai chi chuan on blood pressure and lipid profile and anxiety in a randomized controlled trial. *The Journal of Alternative and Complimentary Medicine*, 9(5), 747-754.

Tsang, H.W.H., Fung, K.M.T., Chan, A.S.M., Lee, G., & Chan, F. (2006). Effect of a qigong exercise programme on elderly with depression. *International Journal of Geriatric psychiatry*, 21(9), 890-897.

Tsang, H.W.H., Mok, C.K., Au Yeung, Y.T., & Chan, S.Y.C. (2003). The effect of qigong on general and psychosocial health of elderly with chronic physical illnesses: a randomized clinical trial. *International Journal of Geriatric Psychiatry*, 18, 441-9.

Tsang, T., Orr, R., Lam, P., Comino, E.J., & Singh, M.F. (2007). Health benefits of tai chi for older patients with type 2 diabetes: The "move it for diabetes study" – a randomized controlled trial. Clinical interventions in Aging, 2(3), 429-439.

Tsang, W.W.N., & Hue-Chan, C.W.Y. (2004). Effect of 4- and 8-wk intensive tai chi training on balance control in the elderly. *Medicine & Science in Sports & Exercise*, 36(4), 648-57.

Van Stel, H.F., Bogaard, J.M., Rijssenbeek-Nouwens, L.H.M., & Colland, V.T. (2001). Multivariable assessment of the 6-min walking test in patients with chronic obstructive pulmonary disease. *American Journal of Respiratory and Critical Care Medicine*, 163 1567-1571.

Veberke, G., Molenberghs, G., Bijnens, L., & Shaw, D. (1997). *Linear mixed models in practice*. New York: Springer.

Vestbo, J. (2007). The natural history of COPD. In R. Stocley, S. Rennard, K. Rabe, & B. Celli (Eds.), *Chronic obstructive pulmonary disease* (pp.117-123). Massachusetts: Blackwell.

Vestbo, J., & Lange, P. (2002). Can GOLD stage 0 provide information of prognostic value in chronic obstructive pulmonary disease? *American Journal of Respiratory Critical Care Medicine*, 166(3), 329-332.

Vestbo, J., Prescott, E., & Lange, P. (1996). Association of chronic mucus hypersecretion with FEV_1 decline and chronic obstructive pulmonary disease morbidity. *American Journal of Respiratory Critical Care Medicine*, 153, 1530-1535.

Vestbo, J., Sorensen, T., Lange, P., Brix, A., Torre, P., & Viskum, K. (1999). Long-term effect of inhaled budesonide in mild and moderate chronic obstructive

pulmonary disease: A randomized controlled trial. *The Lancet*, 353, 1819-1823.

Vitacca, M., Clini, E., Bianchi, I., & Ambrosino, N. (1998) Acute effect of respiratory muscle stretch gymnastics and diaphragmatic breathing on respiratory pattern: Respiratory muscle conditioning Group. *Internal medicine*, 38(2), 126-132.

Voukelatos, A., Cumming, R.G., Lord, R., & Rissel, C. (2007). A randomized, controlled trial of tai chi for the prevention of falls: The central Sydney tai chi trial. *Journal of the American Geriatrics Society*, 55(8), 1185-1191.

Wang, C., Roubenoff, R., Lau, J., Kalish, R., Schmid, C.H., Tighiouart, H., et al. (2005). Effect of tai chi in adults with rheumatoid arthritis. *Rheumatology*, 44(5), 685-687.

Warrell, D.A., Cox, T.M., Firth, J.D., & Benz, E.J. (2003). *Oxford Textbook of Medicine* (4th ed.) UK: Oxford University Press.

Wedzicha, J.A. (2001). Mechanisms of exacerbations. *Novartis Foundation symposium*, 234, 84-93.

Wedzocha, J.A., Bestall, J.C., Garrod, R., Garnham, R., Paul, E.A., & Jones, P.W. (1998). Randomized controlled trial of PR in severe COPD patients, stratified with the MRC dyspnoea scale. *European Respiratory Journal*, 12, 363-369.

Welsh, M.J., Ramsey, B.W., Accurso, F.J., Cutting, G.R. (2001). Cystic fibrosis. In C.R. Scriver, A.L. Beaudet, W.S. Sly, D. Valle (Eds.). *The metabolic and molecular bases of inherited disease* (pp 5121-5188). New York: McGraw-Hill.

White, P. (2007). Management of COPD in the community. In L. Blackler, C. Jones, & C. Mooney (Eds.). *Management chronic obstructive pulmonary disease* (pp.175-189). West Sussex: John Wiley & Sons.

Wijkstra, P.J., van Altena, R., Kraan, J., Otten, V., Postma, D.S., & Koeter, G.H. (1994). Quality of life in patients with chronic obstructive pulmonary disease improves after rehabilitation at home. *European Respiratory Journal*, 7, 269-273.

Wolf, S.L., Barnhart, H.S., Kutner, N.G., McNeely, E., Coogler, C., Xu, T., et at. (2003). Selected as the best paper in the 1990s: Reducing frailty and falls in older persons: An investigation of tai chi and computerized balance training. *Journal of the American Geriatrics Society*, 51(12), 1794-1803.

Wolf, S.L., O'Grady, M. Easley, K.A., Guo, Y., Kressig, R.W., & Kutner, M. (2006). The influence of intense tai chi training on physical performance and hemodynamic outcomes in transitionally frail, older adults. *Journals of Gerontology Series A- Biological Sciences & Medical Sciences*, 61(2), 184-189.

Woo, J., Hong, A., Lau, E., & Lynn, H. (2007). A randomized controlled trial of tai chi and resistance exercise on bone health, muscle strength and balance in community-living elderly people. *Age & Ageing*, 36(3), 262-268.

Woo, K. (2000). 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(4), 526-533.

World Health Organization (2002a). *WHO strategy for prevention and control of chronic respiratory diseases.* Retrieved January 21, 2010, from http://www.who.int/respiratory/publications/WHO_MNC_CRA_02.1.pdf

World Health Organization (2002b). *Active ageing: A policy framework. Second World Assembly on Ageing.* Madrid, Spain. Retrieved from http://whqlibdoc.who.int/hq/2002/WHO_NMH_NPH_02.8.pdf

World Health Organization (2006). *World health statistics 2006.* Retrieved from http://www.who.int/whosis/whostat2006.pdf

World Health Organization (2007). *Global surveillance prevention and control of chromic respiratory diseases: A comprehensive approach.* Retrieved from http://www.who.int/gard/publications/GARD%20Book%202007.pdf

World Health Organization (2009). *Chronic obstructive pulmonary disease (COPD).* Retrieved from http://www.who.int/mediacentre/factsheets/fs315/en/index.html

World Medical Association (2008). *World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects.* Retrieved from http://www.accreditgcp.com/download/Helsinki.pdf

Wu, G. (2002). Evaluation of the effectiveness of tai chi for improving balance and preventing falls in the older population – A review. *Journal of the American Geriatrics Society*, 50(4), 746-754.

Yang, Y., Verkuilen, J., Rosengren, K.S., Mariani, R.A. Reed, M., Crubisich, S.A., et al. (2007). Effects of a taiji and qigong intervention on the antibody response to influenza vaccine in older adults. *American Journal of Chinese Medicine*, 35(4), 597-607.

Yates, B.C. (1995). The relationships among social support and short- and long-term recovery outcomes in men with coronary heart disease. *Research in Nursing & Health*, 18, 193-203.

Young, D.R., appel, L.J., Jee, S., & Miller, E.R. (1999). The effects of aerobic exercise and tai chi on blood pressure in older people: Results of a randomized trial. *Journal of the American Geriatrics Society*, 47(3), 277-284.

Yu, D.T.W., Scudds, R.J., & Scudds, R.A. (2004). Reliability and validity of a Hong Kong Chinese version of the St George's respiratory questionnaire in patients with COPD. *Hong Kong Physiotherapy journal*, 22, 33-9.

Yu, S. F. (2004). *Effects of progressive muscle relaxation training on psychological and health-related quality of life outcomes in elderly patients with heart failure.* (Unpublished doctoral dissertation). The Chinese University of Hong Kong, Hong Kong.

Zhang, J. Ishikawa-Takata, K, Yamazaki, H, Morita, T., & Ohta, T. (2006). The effects of tai chi chuan on physiological function and fear of falling in the less robust elderly: An intervention study for preventing falls. *Archives of Gerontology and Geriatrics*, 42(2), 107-116.

Zimet, G.D., Dahlem, N.W., Zimet, S.G., Farley, G.K. (1988). The multidimensional scale of perceived social support. *Journal of Personality Assessment*, 52(1), 30-41.

ZuWallack, R. (2007). Pulmonary rehabilitation. In R. Stockley, S. Rennard, K. Tabe, & B. Celli (Eds.). *Chronic obstructive pulmonary disease* (pp. 585-594). Massachusetts: Blackwell.

調息呼吸太極氣功十三式

The 13-Movements of Breathing Regulating Tai chi Qigong

1. Commencing Form and Regulating Breathing	第一式	起勢調息
2. Expanding Your Chest	第二式	開闊胸懷
3. Circling Arms Separate the Clouds	第三式	輪臂分雲
4. Swinging Arms at Stationary Position	第四式	定步倒卷肱
5. Rowing a Boat in the Middle of the Lake	第五式	湖心划船
6. Holding a Ball in Front of the Shoulders	第六式	肩前托球
7. Twisting Waist and Pushing Palms	第七式	轉腰推掌
8. Riding Horse and Swaying Arms	第八式	馬步雲手
9. Undulating Waves	第九式	推波助浪
10. Dove Spreading Wings	第十式	飛鴿展翅
11. Punching with Outstretched Arms	第十一式	伸臂衝拳
12. Wild Goose Flying	第十二式	大雁飛翔
13. Pressing Palms in Calmness	第十三式	按掌平氣


調息呼吸太極氣功十三式
The 13 Movements of
Breath Regulating Tai chi Qigong
DVD
香港中文大學
The Chinese University of Hong Kong
公共衛生及基層醫療學院
School of Public Health and Primary Care
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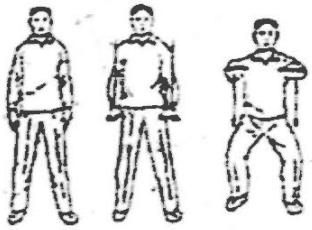
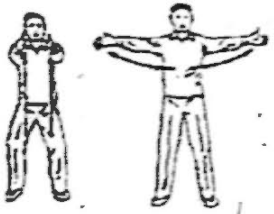
調息呼吸太極氣功十三式

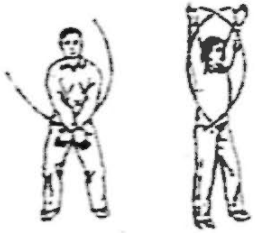
呼吸原則：起吸落呼、開吸合呼、屈吸伸呼



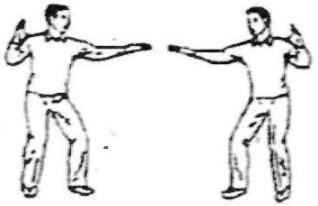
第１式：起勢調息



第２式：開闔胸懷

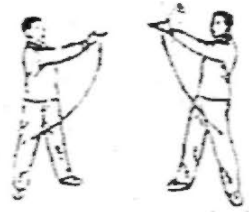


第３式：輪臂分雲

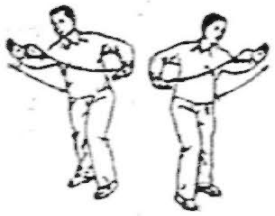


第４式：定步倒卷肱

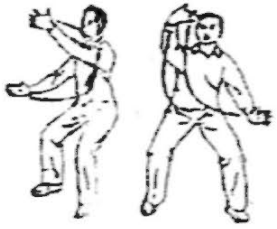
第５式：湖心划船



第６式：肩前托球

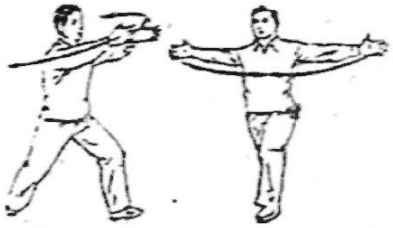


第７式：轉腰推掌

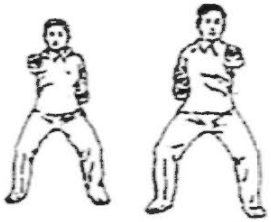


第８式：馬步雲手

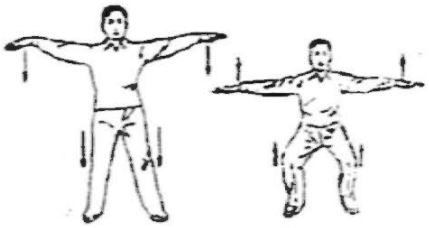
第９式：推波助浪



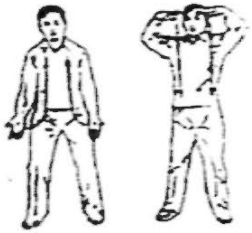
第１０式：飛鴿展翅



第１１式：伸臂衝拳



第１２式：大雁飛翔



第１３式：按掌平氣

編號：_____

請每天練習太極氣功，練習後請在日期上" √ "

Please put a " √" on the day after practicing TCQ

2008 年 12 月						
星期日	星期一	星期二	星期三	星期四	星期五	星期六
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

請每天練習太極氣功，練習後請在日期上" √ "

Please put a " √" on the day after practicing TCQ

2009 年 1 月						
星期日	星期一	星期二	星期三	星期四	星期五	星期六
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

School of Public Health
The Chinese University of Hong Kong

Tai chi Qigong Program Evaluation Form

No : _____ Date : _____

Please circle the appropriate numbers and write down your comments to enhance our service

Part 1 :

1. Do you think Tai chi Qigong (TCQ) can achieve the following objectives?
2.

	5:Most appropriate				1:Least appropriate	
a) Promote your respiratory functions	5	4	3	2	1	N/A
b) Enhance your exercise capacity	5	4	3	2	1	N/A
c) Broaden your social network	5	4	3	2	1	N/A

Other comments : _____

Part 2 :

	5:Most appropriate				1:Least appropriate	
1. Do you satisfy with the date arrangement of the TCQ program?	5	4	3	2	1	N/A
2. Do you satisfy with the time arrangement of the TCQ program?	5	4	3	2	1	N/A
3. Do you satisfy with the venue of the TCQ program?	5	4	3	2	1	N/A
4. Do you satisfy the 3-month duration of the TCQ program? If not, please suggest: _____	5	4	3	2	1	N/A
5. Do you satisfy the performance of TCQ Instructor?	5	4	3	2	1	N/A
6. The TCQ forms are appropriate and you are able to master ?	5	4	3	2	1	N/A
7. Do you satisfy with the schedule arrangement of the TCQ program?	5	4	3	2	1	N/A
8. Overall, do you satisfy joining this TCQ program?	5	4	3	2	1	N/A

9. Other comments : _____

10. Will you continue to practice TCQ in the future? ☐Yes ☐No, Reason : _____

11. Please provide your valuable suggestion for improvement of the TCQ program:

_____

Thank you for your invaluable comments. All data will be kept confidential.

香港中文大學醫學院

太極氣功班活動評估

編號：_____ 日期：_____

請圈上合適的數字及寫下意見，有關資料有助提高服務質素：

第一部份： **5 為最能達到 1 為最不能達到**

3. 你認為太極氣功班能否達到下列的目的？

目的 1) 有助促進你的呼吸功能	5	4	3	2	1	不適用
目的 2) 有助提升你的活動能力	5	4	3	2	1	不適用
目的 3) 有助擴濶社交圈子	5	4	3	2	1	不適用

其他意見：_____

第二部份： **5 為最能達到 1 為最不能達到**

12. 你是否滿意是次的太極氣功班的日期安排？	5	4	3	2	1	不適用
13. 你是否滿意是次的太極氣功班的時間安排？	5	4	3	2	1	不適用
14. 你是否滿意是次的太極氣功班的場地安排？	5	4	3	2	1	不適用
15. 你是否滿意是次的太極氣功班為期三個月的安排？	5	4	3	2	1	不適用

如不滿意，請建議_____

16. 你是否滿意是次太極氣功班的導師的表現？	5	4	3	2	1	不適用
17. 你覺得是次太極氣功班的招式的難度是否合適？	5	4	3	2	1	不適用
18. 你是否滿意是次的太極氣功班的程序安排？	5	4	3	2	1	不適用
19. 整體而言，你是否滿意參與是次太極氣功班？	5	4	3	2	1	不適用

20. 其他意見：_____

21. 你會否繼續練習太極氣功？ □會 □不會，原因：_____

22. 你認為此活動需要改善的地方是：_____

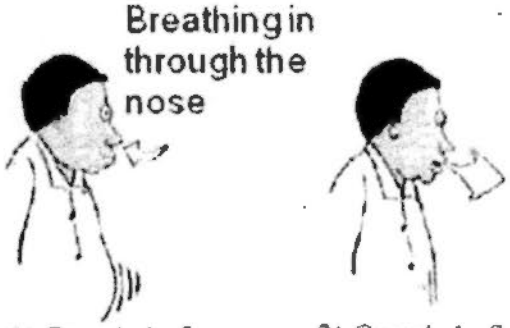
感謝你的寶貴意見，所有資料均會保密處理

Breathing Exercise

1. Pursed-lip breathing

To improve the obstructed airway, and decrease dyspnoea

Relax your shoulders, breathing out all the air in slow motion



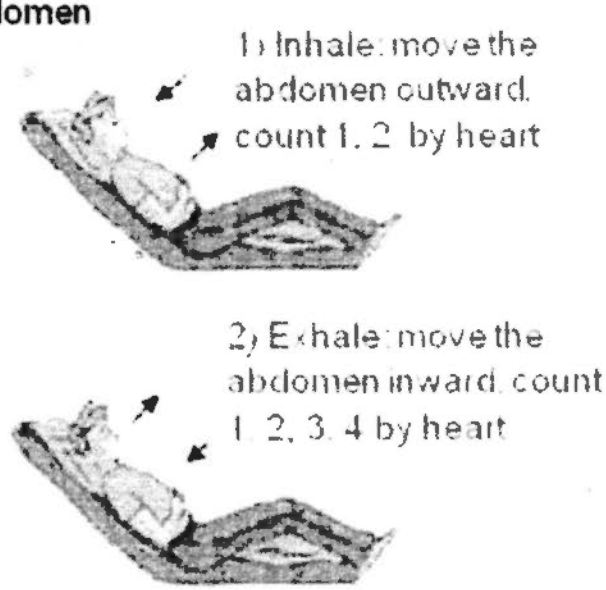
1) Count 1, 2 by heart

2) Count 1, 2, 3, 4 by heart

2. Diaphragmatic breathing

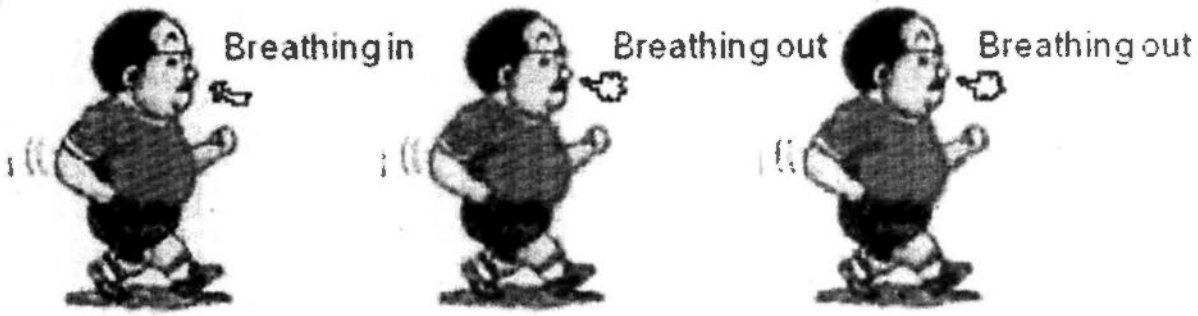
To increase breathing efficacy, relieve dyspnoea.

Relax yourself and put your hand on the abdomen



Walking coordinating with breathing exercise

When walking, use pursed-lip breathing and diaphragmatic breathing.
The walking steps should coordinate with breathing pattern
Follow the ratio of 1 : 2
E.g., 1st step breathing in, 2nd and 3rd steps breathing out



>> Breathing in >>> Breathing out >>> Breathing out >> Repeat

(Dr. Leung, 2007)

胸肺物理治療

1.噘唇呼吸法

用以改善氣管收窄，減輕氣促。

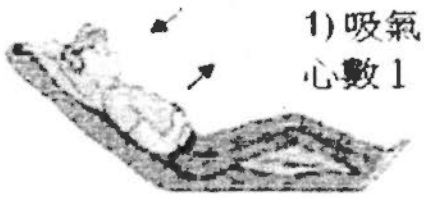
注意放鬆肩膊，動作要緩慢，將空氣儘量呼出。

1) 心數1、2　　2) 心數1、2、3、4

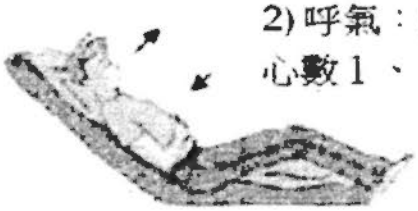
2. 橫隔膜呼吸法

能提高呼吸效率，舒緩氣促。

將手放在腹部，儘量放鬆。



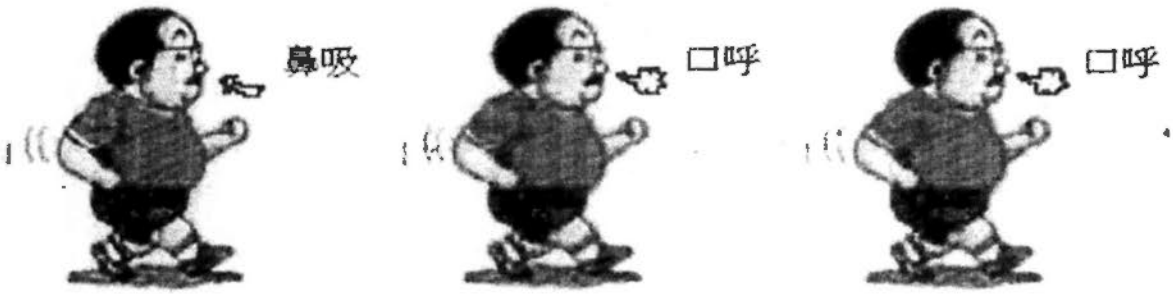
1) 吸氣：腹部微升起，心數1、2



2) 呼氣：腹部微收，心數1、2、3、4

運動協調呼吸法

步行時，利用噘唇呼吸法及橫隔膜呼吸法，步伐要配合呼吸節奏，應按1：2的比例。例：第一步：吸氣，第二、三步呼氣



>> 吸氣 >>> 呼氣 >>> 呼氣 >>重覆

(Dr. Leung, 2007)

編號：_____

請每天呼吸運動後，請在日期上”√”

Please put a ”√” on the day

after practicing breathing and walking exercise

2008 年 12 月						
星期日	星期一	星期二	星期三	星期四	星期五	星期六
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

請每天呼吸運動後，請在日期上”√”

Please put a ”√” on the day

after practicing breathing and walking exercise

2009 年 1 月						
星期日	星期一	星期二	星期三	星期四	星期五	星期六
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

主觀感覺評估氣喘程度

0	沒有氣喘 /疲勞的感覺
0.5	極之輕微（僅僅察覺到）
1	非常輕微
2	輕微
3	有點兒辛苦
4	辛苦
5	非常辛苦
6	
7	極度辛苦
8	
9	
10	極度辛苦，實在無法堅持下去

(Borg, 1982)

The Borg Scale

0	Nothing at all
0.5	Very, very slight (just noticeable)
1	Very slight
2	Slight (light)
3	Moderate
4	Somewhat severe
5	Severe (heavy)
6	
7	Very severe
8	
9	
10	Very, very severe (maximal)

(Borg, 1982)

ST. GEORGE'S RESPIRATORY QUESTIONNAIRE
ORIGINAL ENGLISH VERSION

ST. GEORGE'S RESPIRATORY QUESTIONNAIRE (SGRQ)

This questionnaire is designed to help us learn much more about how your breathing is troubling you and how it affects your life. We are using it to find out which aspects of your illness cause you most problems, rather than what the doctors and nurses think your problems are.

Please read the instructions carefully and ask if you do not understand anything. Do not spend too long deciding about your answers.

Before completing the rest of the questionnaire:

Please tick in one box to show how you describe your current health:

Very good	Good	Fair	Poor	Very poor
☐	☐	☐	☐	☐

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St. George's Respiratory Questionnaire
PART 1

Questions about how much chest trouble you have had over the past 4 weeks.

Please tick (✓) *one box for each question*:

	most days a week	several days a week	a few days a month	only with chest infections	not at all
1. Over the past 4 weeks, I have coughed:	☐	☐	☐	☐	☐
2. Over the past 4 weeks, I have brought up phlegm (sputum):	☐	☐	☐	☐	☐
3. Over the past 4 weeks, I have had shortness of breath:	☐	☐	☐	☐	☐
4. Over the past 4 weeks, I have had attacks of wheezing:	☐	☐	☐	☐	☐

5. During the past 4 weeks, how many severe or very unpleasant attacks of chest trouble have you had?

Please tick (✓) *one*:

- more than 3 attacks ☐
- 3 attacks ☐
- 2 attacks ☐
- 1 attack ☐
- no attacks ☐

6. How long did the worst attack of chest trouble last?
(Go to question 7 if you had no severe attacks)

Please tick (✓) *one*:

- a week or more ☐
- 3 or more days ☐
- 1 or 2 days ☐
- less than a day ☐

7. Over the past 4 weeks, in an average week, how many good days (with little chest trouble) have you had?

Please tick (✓) *one*:

- No good days ☐
- 1 or 2 good days ☐
- 3 or 4 good days ☐
- nearly every day is good ☐
- every day is good ☐

8. If you have a wheeze, is it worse in the morning?

Please tick (✓) *one*:

- No ☐
- Yes ☐

St. George's Respiratory Questionnaire
PART 2

Section 1

How would you describe your chest condition?

Please tick (✓) *one*:

- The most important problem I have ☐
- Causes me quite a lot of problems ☐
- Causes me a few problems ☐
- Causes no problem ☐

If you have ever had paid employment.

Please tick (✓) *one*:

- My chest trouble made me stop work altogether ☐
- My chest trouble interferes with my work or made me change my work ☐
- My chest trouble does not affect my work ☐

Section 2

Questions about what activities usually make you feel breathless <u>these days</u>.

Please tick (✓) in ***each box*** that applies to you ***these days***:

	True	False
Sitting or lying still	☐	☐
Getting washed or dressed	☐	☐
Walking around the home	☐	☐
Walking outside on the level	☐	☐
Walking up a flight of stairs	☐	☐
Walking up hills	☐	☐
Playing sports or games	☐	☐

St. George's Respiratory Questionnaire
PART 2

Section 3

Some more questions about your cough and breathlessness <u>these days</u>.

	Please tick (✓) in ***each box*** that applies to you ***these days***: True	False
My cough hurts	☐	☐
My cough makes me tired	☐	☐
I am breathless when I talk	☐	☐
I am breathless when I bend over	☐	☐
My cough or breathing disturbs my sleep	☐	☐
I get exhausted easily	☐	☐

Section 4

Questions about other effects that your chest trouble may have on you <u>these days</u>.

	Please tick (✓) in ***each box*** that applies to you ***these days***: True	False
My cough or breathing is embarrassing in public	☐	☐
My chest trouble is a nuisance to my family, friends or neighbours	☐	☐
I get afraid or panic when I cannot get my breath	☐	☐
I feel that I am not in control of my chest problem	☐	☐
I do not expect my chest to get any better	☐	☐
I have become frail or an invalid because of my chest	☐	☐
Exercise is not safe for me	☐	☐
Everything seems too much of an effort	☐	☐

Section 5

Questions about your medication, if you are receiving no medication go straight to section 6.

	Please tick (✓) in ***each box*** that applies to you ***these days***: True	False
My medication does not help me very much	☐	☐
I get embarrassed using my medication in public	☐	☐
I have unpleasant side effects from my medication	☐	☐
My medication interferes with my life a lot	☐	☐

St. George's Respiratory Questionnaire
PART 2

Section 6

These are questions about how your activities might be affected by your breathing.

Please tick (✓) in ***each box*** that applies to you ***because of your breathing***:

	True	False
I take a long time to get washed or dressed	☐	☐
I cannot take a bath or shower, or I take a long time	☐	☐
I walk slower than other people, or I stop for rests	☐	☐
Jobs such as housework take a long time, or I have to stop for rests	☐	☐
If I walk up one flight of stairs, I have to go slowly or stop	☐	☐
If I hurry or walk fast, I have to stop or slow down	☐	☐
My breathing makes it difficult to do things such as walk up hills, carrying things up stairs, light gardening such as weeding, dance, play bowls or play golf	☐	☐
My breathing makes it difficult to do things such as carry heavy loads, dig the garden or shovel snow, jog or walk at 5 miles per hour, play tennis or swim	☐	☐
My breathing makes it difficult to do things such as very heavy manual work, run, cycle, swim fast or play competitive sports	☐	☐

Section 7

We would like to know how your chest <u>usually</u> affects your daily life.

Please tick (✓) in ***each box*** that applies to you ***because of your chest trouble***:

	True	False
I cannot play sports or games	☐	☐
I cannot go out for entertainment or recreation	☐	☐
I cannot go out of the house to do the shopping	☐	☐
I cannot do housework	☐	☐
I cannot move far from my bed or chair	☐	☐

St. George's Respiratory Questionnaire

Here is a list of other activities that your chest trouble may prevent you doing. (You do not have to tick these, they are just to remind you of ways in which your breathlessness may affect you):

Going for walks or walking the dog

Doing things at home or in the garden

Sexual intercourse

Going out to church, pub, club or place of entertainment

Going out in bad weather or into smoky rooms

Visiting family or friends or playing with children

Please write in any other important activities that your chest trouble may stop you doing:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Now would you tick in the box (one only) which you think best describes how your chest affects you:

It does not stop me doing anything I would like to do ☐

It stops me doing one or two things I would like to do ☐

It stops me doing most of the things I would like to do ☐

It stops me doing everything I would like to do ☐

Thank you for filling in this questionnaire. Before you finish would you please check to see that you have answered all the questions.

聖佐治胸肺科問卷

這份問卷設計的目的在於了解更多你的氣喘情況 / 毛病 / 問題及它如何影響你的生活，藉以找出你最大的問題。

答題時，無須花時過久選擇答案。

在完成問卷的其餘部份之前：

	很好	好	一般	差	很差
請 "✓" 一個可形容你現在的健康的方格：	☐	☐	☐	☐	☐

編號：_____

日期：_____

甲部

這些問題是有關你在過去六星期內出現呼吸問題的次數。
請於每題中選出一個最適當的答案，並於❑內加上✓號。

	每星期差不多每天	每星期有幾天	每月有幾天	每當肺部受感染時	沒有
一. 於過去六星期內，我咳嗽的頻密程度是：	❑	❑	❑	❑	❑
二. 於過去六星期內，我有痰的日子是：	❑	❑	❑	❑	❑
三. 於過去六星期內，我感到氣促的次數：	❑	❑	❑	❑	❑
四. 於過去六星期內，我遇上「牽蝦」（嚴重氣喘）發作的日子：	❑	❑	❑	❑	❑

五. 於過去六星期內，你有多少次嚴重的呼吸問題發作？

超過三次❑　三次❑　二次❑　一次❑　沒有❑

六. 最嚴重的一次呼吸問題發作維持了多久？

(若題五選擇答案 '沒有' ，不用作答此題)

一星期或以上❑　三天或以上❑　一至兩天❑　少於一天❑

七. 於過去六星期內每星期你平均有多少天安好（有很少呼吸症狀）？

沒有❑　一至兩天❑　三至四天❑　幾乎每天❑　每天❑

八. 假如你有氣喘，是否在早上起床時較為嚴重？

不是❑　是❑

乙部

(九) 你會怎樣形容你的呼吸情況？

(請選擇最適當的答案，並在❑內加上✓號。

- 是我最要緊的問題 ---------- ❑
- 給我構成甚多問題 ---------- ❑
- 給我構成一些問題 ---------- ❑
- 沒有構成問題 ---------- ❑

(十) 若你曾有受薪工作，請在以下✓最適當的答案。

- 我的呼吸問題令我要停止工作 ---------- ❑
- 我的呼吸問題影響我的工作或令我要轉換工作 ---- ❑
- 我的呼吸問題不影響我的工作 ---------- ❑

(十一)在近期有甚麼活動常導致你感到氣促。

(請在每一項中選擇是或否，並於❑內加上✓號)

	是	否
• 坐或躺臥 ----------	❑	❑
• 梳洗或更衣 ----------	❑	❑
• 在家中步行 ----------	❑	❑
• 在戶外走平路 ----------	❑	❑
• 上一層樓梯 ----------	❑	❑
• 行上山 ----------	❑	❑
• 做運動或比賽----------	❑	❑

(十二)以下問題是關於近期咳嗽和氣喘的情況。

(請在每一項中選擇是或否，並於❑內加上✓號)

	是	否
• 我的咳嗽令我感到不適 ----------	❑	❑
• 我的咳嗽令我感到疲倦 ----------	❑	❑
• 說話時，我感到氣促 ----------	❑	❑
• 彎腰時，我感到氣促 ----------	❑	❑
• 我的咳嗽或呼吸問題影響我的睡眠 ----------	❑	❑
• 我容易感到極之疲倦 ----------	❑	❑

(十三)以下問題是關於近期你的呼吸問題對你構成的其他影響。

(請在每一項中選擇是或否，並於❑內加上✓號)

	是	否
• 在公眾場合中，我的咳嗽或呼吸問題令我感到尷尬----	❑	❑
• 我的呼吸問題令家人，朋友及鄰居感到討厭 --------	❑	❑
• 當我上氣唔接下氣時，我便會驚惶失措 ----------	❑	❑
• 我覺得不能控制自己的呼吸問題 ----------	❑	❑
• 我不期望自己的呼吸情況會好轉 ----------	❑	❑
• 我因自己的呼吸問題而變得虛弱或無能力 ----------	❑	❑
• 運動對我來說是不安全的----------	❑	❑
• 一切對於我來說都感到吃力 ----------	❑	❑

(十四)以下問題是關於藥物治療的情況。若你沒有使用藥物治療，請跳去第六節。(請在每一項中選擇是或否，並於❑內加上✓號)

	是	否
• 我的藥物對我幫助不大 ----------	❑	❑
• 在公眾場所用藥令我感到尷尬 ----------	❑	❑
• 我對所用的藥物有不良的副作用 ----------	❑	❑
• 我的藥物對我的生活造成很多干擾 ----------	❑	❑

(十五)以下問題是關於你的活動如何被你的呼吸問題困擾。

(請在每一項中選擇是或否，並於❑內加上✓號)

	是	否
• 我梳洗或更衣需時良久----------	❑	❑
• 我不能洗澡或淋浴，或需時良久 ----------	❑	❑
• 我步行較其他人慢，或需要中途休息 ----------	❑	❑
• 工作時，例如料理家務，需時良久或要中途休息----------	❑	❑
• 若我要上一層樓梯，要慢慢步上或停下來 ----------	❑	❑
• 若我匆忙或行快一點，要停下來或慢下來 ----------	❑	❑
• 我的呼吸問題令我難做到，例如：行山，挽東西上樓梯，輕便的園藝如除草，跳舞，打保齡球或打高爾夫球等 --------	❑	❑
• 我的呼吸問題令我難做到，例如：挽重物，在花園翻泥，緩步跑或以每小時五英里的速度步行，打網球或游泳等 -------	❑	❑
• 我的呼吸問題令我難做到，例如：十分粗重的工作，跑步，踏單車，快速地游泳或做劇烈運動 ----------	❑	❑

(十六)以下問題目的是想知道你的呼吸問題如何影響你的日常生活。

(註：因呼吸問題導致你不能做某些事才在「是」的❑內加上✓號)

	是	否
• 令我不能做運動或比賽 ----------	❑	❑
• 令我不能外出消遣或娛樂----------	❑	❑
• 令我不能外出購物 ----------	❑	❑
• 令我不能做家務 ----------	❑	❑
• 令我不能走動離開我的床或椅子太遠 ----------	❑	❑

(十七)以下有一系列其他活動可能因你的胸肺問題令你做不到。

(你不用在每項中作出回應，只在於提醒你怎樣被呼吸問題影響自己)。

例：

- 外出散步或拖狗
- 在家中作事或園中工作
- 行房
- 外出消遣，去教堂或去娛樂場所
- 在天氣差的日子出外或進入煙霧瀰漫的房間
- 探訪親友或和小孩子玩耍

請在下面填上其他因你的胸肺問題導致你做不到的重要活動：

_____

_____

_____

_____

請在以下選出一項答案最能描述胸肺問題對你的影響：

- 它不阻礙我做任何我喜歡做的事 ---------- ❑
- 它阻礙我做一至兩件我喜歡做的事---------- ❑
- 它阻礙我做很多我喜歡做的事 ---------- ❑
- 它阻礙我做一切我喜歡做的事 ---------- ❑

— 完 —

Multidimensional Scale of Perceived Social Support (Zimet, Dahlem, Zimet & Farley, 1988)

Instructions: We are interested in how you feel about the following statements. Read each statement carefully. Indicate how you feel about each statement.

Circle the "1" if you **Very Strongly Disagree**
Circle the "2" if you **Strongly Disagree**
Circle the "3" if you **Mildly Disagree**
Circle the "4" if you are **Neutral**
Circle the "5" if you **Mildly Agree**
Circle the "6" if you **Strongly Agree**
Circle the "7" if you **Very Strongly Agree**

1.	There is a special person who is around when I am in need.	1	2	3	4	5	6	7	SO
2.	There is a special person with whom I can share my joys and sorrows.	1	2	3	4	5	6	7	SO
3.	My family really tries to help me.	1	2	3	4	5	6	7	Fam
4.	I get the emotional help and support I need from my family.	1	2	3	4	5	6	7	Fam
5.	I have a special person who is a real source of comfort to me.	1	2	3	4	5	6	7	SO
6.	My friends really try to help me.	1	2	3	4	5	6	7	Fri
7.	I can count on my friends when things go wrong.	1	2	3	4	5	6	7	Fri
8.	I can talk about my problems with my family.	1	2	3	4	5	6	7	Fam
9.	I have friends with whom I can share my joys and sorrows.	1	2	3	4	5	6	7	Fri
10.	There is a special person in my life who cares about my feelings.	1	2	3	4	5	6	7	SO
11.	My family is willing to help me make decisions.	1	2	3	4	5	6	7	Fam
12.	I can talk about my problems with my friends.	1	2	3	4	5	6	7	Fri

The items tended to divide into factor groups relating to the source of the social support, namely family (Fam), friends (Fri) or significant other (SO).

Subject No: _____ Date: _____

Multidimensional Scale of Perceived Social Support

(Chinese Version; MSPSS-C)

以下係描述你而家朋友同屋企人的句子，請圈出適當的數字，表示你對句子的同意程度。

		十分不同意						十分同意
1.	當你有需要嘅時候，總有一個好朋友喺你身邊。	1	2	3	4	5	6	7
2.	你有一個好朋友，無論開心或者唔開心，你都可以同佢分享。	1	2	3	4	5	6	7
3.	你屋企人真係好肯幫你。	1	2	3	4	5	6	7
4.	屋企人俾到你情緒上所需要嘅幫助同支持。	1	2	3	4	5	6	7
5.	你有一個真係俾到安慰你嘅朋友。	1	2	3	4	5	6	7
6.	你 'D' 朋友真係好肯嘗試幫你。	1	2	3	4	5	6	7
7.	如果有咩事發生，你係可以倚靠你 'D' 朋友嘅。	1	2	3	4	5	6	7
8.	你可以同屋企人講你自己嘅問題。	1	2	3	4	5	6	7
9.	你有 'D' 朋友，無論開心或者唔開心，你都可以同佢哋分享。	1	2	3	4	5	6	7
10.	你生命中有個好朋友，佢會關心你嘅感受。	1	2	3	4	5	6	7
11.	你屋企人願意幫你手做決定。	1	2	3	4	5	6	7
12.	你可以同你 'D' 朋友講自己嘅問題。	1	2	3	4	5	6	7

Demographic Data Sheet

Participant No: ____ Age: ____ Gender: ____ Date: _____

Please put a √ in the appropriate box. May √ more than one box if need

Marital Status:

- ☐ Married
- ☐ Single
- ☐ Divorced / Separated
- ☐ Widowed

Education Level:

- ☐ Illiterate
- ☐ Primary or below
- ☐ Secondary
- ☐ Tertiary or above

Current Work Status:

- ☐ Retired or Housewife
- ☐ Unemployed
- ☐ Part-Time
- ☐ Full-Time

Financial Support:

- ☐ Self support
- ☐ Family members
- ☐ Social assistance / allowance

Received Personal Income per Month (include all sorts of incomes, e.g. rent, given by children, etc.)(HK$):

$ _____

Living Condition:

- ☐ Living alone
- ☐ Living with family members
- ☐ Living with friends
- ☐ Others, please specify _____

Type of Housing:

- ☐ Public housing
- ☐ Private flat
- ☐ Village house
- ☐ Other: _____

Religious Belief:

- ☐ No
- ☐ Yes, please specify _____

Duration of COPD: _____ Years

Time Spending on Outdoor Activities per week: _____ Hours

Experience of practicing Tai chi or Qigong

- ☐ None
- ☐ _____ Years
- ☐ Quitted for _____ years

  Reason for quitting _____

  _____

Smoking History:

☐ Never smoked → Years of secondhand smoking _____
☐ Quit smoking Years of smoking _____ Quitted for _____ years
☐ Still smoking Years of smoking _____ No of cigarettes / day _____

Drinking Habit:

☐ No
☐ Quit drinking Years of drinking _____ Quitted for _____ years
☐ Still drinking Years of drinking _____ Type & amount of alcohol _____

Medical History:

☐ Heart disease, please specify: _____

☐ Hypertension
☐ Diabetes Mellitus
☐ Others, please specify: _____

資料統計表格

編號：_____ 年齡：_____ 性別：_____ 日期: _____

請在適當欄位加上√，如有需要可√多項

婚姻狀況：
☐ 已婚
☐ 未婚
☐ 離異 / 分居
☐ 鰥寡

教育程度：
☐ 從未入學
☐ 小學或以下
☐ 中學
☐ 大學或以上

就業狀況：
☐ 退休
☐ 家庭主婦
☐ 失業
☐ 兼職
☐ 全職

財政援助：
☐ 自己
☐ 家人
☐ 高齡 / 傷殘津貼 / 綜援

每月收入(包括所有收入，例如收租、子女供養等) (港幣$)：$_____

家居狀況：
☐ 獨居
☐ 與家人同住
☐ 與朋友同住
☐ 其他：請註明：_____

房屋種類：
☐ 公共屋邨
☐ 私人樓宇
☐ 村屋
☐ 其他：_____

宗教信仰:
☐ 沒有
☐ 有，請註明 _____

耍太極或氣功的經驗：
☐ 沒有
☐ _____年
☐ 已沒有練習_____年
原因：_____

每週室外活動時間：_____小時

診斷慢性阻塞性肺病患病年期: _____年

吸煙習慣：

☐ 從不吸煙 → ☐ 二手煙 _____ 年
☐ 已戒煙　　曾吸煙 _____ 年　　已戒煙 _____ 年
☐ 仍有吸煙　　已吸煙 _____ 年　　每天吸煙 _____枝

嗜酒習慣：

☐ 從不飲酒
☐ 已戒酒　　曾飲酒 _____ 年　　已戒酒 _____ 年
☐ 仍有飲酒　　已飲酒 _____ 年　　酒的種類及飲酒量_____

過往病歷：

☐ 心臟病，請註明_____
☐ 血壓高
☐ 糖尿病
☐ 其他病歷（請註明）：_____

_____

香港中文大學醫學院
Faculty Of Medicine
The Chinese University Of Hong Kong

醫院管理局
新界東醫院聯網
Hospital Authority
New Territories East Cluster

Joint The Chinese University of Hong Kong – New Territories East Cluster Clinical Research Ethics Committee
香港中文大學–新界東醫院聯網 臨床研究倫理 聯席委員會

Flat 3C, Block B, Staff Quarters, Prince of Wales Hospital, Shatin, HK
Tel : (852) 2632 3935 Fax : (852) 2646 6653 Website : http://www.crec.cuhk.edu.hk

To: Ms. Aileen Wai Kiu CHAN
Student, (PhD in Social Medicine)
The Chinese University of Hong Kong

19 September 2007

Renewal of Ethics Approval

CREC Ref. No.:	**CRE-2006.361**
Date of Renewal:	**18 October 2007***
Protocol Title:	**Evaluation of A Tai Chi QiGong Program on Respiratory Functions and Activity Tolerance in Clients with Chronic Obstructive Pulmonary Disease**
Investigator(s):	**Aileen Wai Kiu CHAN**
Supervisor(s):	**Prof. Albert LEE and Prof. Lorna SUEN**

I write to inform you that ethics approval has been renewed for the captioned study in accordance with document(s) stated as per the approval letter dated 18 October 2006.

This ethics approval* will be valid for 12 months starting from the date of renewal. Application for further renewal can be made by submitting the Ethics Renewal and Research Progress Report Form to the CREC (Download the electronic form template from the http://www.crec.cuhk.edu.hk or http://ntec.home/Research%20Ethics/main.asp). It will be much appreciated if the completion of the project will be reported to the Committee in due course.

The Joint CUHK-NTEC Clinical Research Ethics Committee serves to confirm that research complies with the Declaration of Helsinki, ICH GCP Guidelines, local regulations, HA and University policies.

(Prof. Joseph Lau)
Secretary, Joint CUHK-NTEC
Clinical Research Ethics Committee

JL/ei

香港中文大學醫學院
Faculty Of Medicine
The Chinese University Of Hong Kong

醫院管理局
新界東醫院聯網
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Flat 3C, Block B, Staff Quarters, Prince of Wales Hospital, Shatin, HK
Tel : (852) 2632 3935 Fax : (852) 2646 6653 Website : http://www.crec.cuhk.edu.hk

To: Ms. Aileen Wai Kiu CHAN
Student, (PhD in Social Medicine)
The Chinese University of Hong Kong

16 September 2008

Renewal of Ethics Approval

CREC Ref. No.:	**CRE-2006.361**
Date of Renewal:	**18 October 2008***
Protocol Title:	**Evaluation of A Tai Chi QiGong Program on Respiratory Functions and Activity Tolerance in Clients with Chronic Obstructive Pulmonary Disease**
Investigator(s):	**Aileen Wai Kiu CHAN**
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I write to inform you that ethics approval has been renewed for the captioned study in accordance with the approval letter dated 19 September 2007.

This ethics approval* will be valid for 12 months starting from the date of renewal. Application for further renewal can be made by submitting the Ethics Renewal and Research Progress Report Form to the CREC (Download the electronic form template from the http://www.crec.cuhk.edu.hk or http://ntec.home/Research%20Ethics/main.asp). You are kindly requested to report to the Committee upon completion of the project.

The Joint CUHK-NTEC Clinical Research Ethics Committee is organized and operates according to ICH-GCP and the applicable laws and regulations.

Ms. Claudia Lam
CREC Officer
Joint CUHK-NTEC
Clinical Research Ethics Committee

CL/ol

Subject No.: _____

The Chinese University of Hong Kong
School of Public Health

Client Informed Consent

You are being invited to participate in a research study, "*Evaluation of a Tai chi Qigong program on respiratory functions and quality of life in clients with Chronic Obstructive Pulmonary Disease (COPD)*". The study will examine the effectiveness of Tai chi Qigong which is a form of meditative exercises. We wish to determine if such exercises could help to promote your respiratory functions and improve your quality of life. The research is conducted by Ms Aileen Chan, PhD candidate of Social Medicine, School of Public Health, the Chinese University of Hong Kong (CUHK), supervised by Professor Albert Lee, Head of Family Medicine, CUHK. Findings from this study will allow health care professionals to better understand the effectiveness of Tai chi Qigong on health promotion in clients with COPD.

Procedures
Prior to the commencement of the study, we will conduct a preliminary assessment on you in order to understand the medical history of your illness. You will be randomly assigned to either one of the three groups, Tai chi Qigong group, breathing exercise group or the routine activity group.

If you are allocated to the Tai chi Qigong group, you will receive Tai chi Qigong exercise training, which consists of two 60-minute sessions each week for 3 months. If you are allocated to the exercise group, you will be taught the breathing techniques and the coordination of breathing and walking exercise. You are advised to perform outdoor walking daily for three months. If you are allocated in the routine activity group, you need to maintain your routine activities during the 3 months study period. Both of the exercise group and routine activity group will be arranged to join community activities weekly for three months. All participants will then be given a DVD at the end of study, which teaches you the modified 13 forms of Tai chi Qigong.

You are expected to come at 6 weeks and at 3 months. You will need to answer two questionnaires and receive a physical check-up which includes Spirometry, 6-minute-walk test and Oximetry.

All participants receive a follow assessment at 6 months after beginning of study, to compare the study outcomes with the previous outcomes.

Discomforts / Study Withdrawal
Side effects arising from Tai chi Qigong are rare. Normal reactions include dyspnoea, tiredness may occur, which are easily resolved by resting. Your participation is entirely voluntary. Though you are highly encouraged to complete the whole program, you may choose not to enter, or to withdraw from the study at any time without any impact on the care you are receiving. If you have any concerns regarding this study, you may direct your questions to Ms Aileen Chan at 9621-5386.

Confidentiality
The information obtained by this study will become part of the research project and will be subjected to confidentiality and privacy regulations of the GOPC and the CUHK. Information of a sensitive personal nature will be stored in a locked file cabinet and only be identified by a code number. The findings arising from this research study may be published in local/international journals or presented in conferences but under no circumstances will your name be revealed.

Authorization:
I have read the above information, or the above information was read to me by a research assistant. I understand the purpose and nature of the study. I know that participating in this study is voluntary, and that I can withdraw from this study at any time without any impact on the care that I am receiving. I hereby give may consent to be a participant in this study.

Name _____ Signature _____ Date _____

Witness:
Name _____ Signature _____ Date _____

中文大學公共衛生學院

參加者同意書

現誠意邀請閣下參與由香港中文大學醫學院公共衛生學院博士研究生陳惠嬌護士，指導教授為家庭醫學主管李大拔教授，共同進行的研究；這項研究的題目為「評估太極氣功對慢性呼吸道阻塞病人的呼吸功能及生活質素的效果」。我們希望這項研究結果可以讓醫護人員更了解太極氣功的功效，有助促進你的呼吸功能及提升生活質素。

研究程序

參與研究前，你需要接受身體評估以助我們了解你的健康狀況；我們的研究助理會為你作常規檢查，你會被隨機分配進入太極組、呼吸運動組或常規組。

如果你被安排進入太極組，你會接受每週兩次，每次六十分鐘，為期三個月的太極氣功班。如你被安排進入呼吸運動組，我們會教你呼吸技巧，配合步行，每天自行練習；如你被安排進入常規組，你只需維持你的日常活動。我們並會為呼吸運動組及常規組組員，安排免費參與社區中心每週一至兩次的活動。活動完結後，我們會送你一張太極氣功影碟，教授太極氣功十三式。

無論你在太極組、呼吸運動組或常規組，你都會接受三次身體檢查，分別在研究開始前、第六週及於三個月後進行，包括肺功能測試，六分鐘步行測試及血氧飽和度等，同時每次你需要填寫一份問卷。在太極氣功班完結後三個月，我們會為太極組及呼吸運動組再作一次相同的身體檢查及問卷調查，作為跟進及與之前所得的資料作比較。

不適 /退出研究

這項研究對參與者並不會帶來不適或危險，練習太極氣功間中會有的正常現象包括氣促或疲倦，通常稍事休息便可舒緩。雖然我們會鼓勵你盡量完成三個月之課程，你的參與純粹為自願性質，你可以選擇不參與、或隨時拒絕、中斷或退出這項研究而不會影響你現時接受的治療。你可以對研究提出問題。若有需要，亦可以直接聯絡陳惠嬌護士，電話號碼為 9621-5386。

保密原則

研究人員將會以專業態度保護你的身份和私隱，所有醫療資料會受到醫院和中文大學的保密和私隱條例所管制。有關個人的敏感資料，將存放於鎖緊的文件櫃內及只有編碼號作辨認。從這項研究所得的資料可能會刊載於國際醫學期刊或在會議發表，但參加者的姓名將會保密。

編號：_____

授權

我已詳細閱讀這份同意書，或研究員已向我讀出這份同意書的內容，我了解這項研究的目的及性質。我明白參加這項研究純粹為自願性質，而我可以隨時退出這項研究而不會影響我現時接受的治療。我現在同意參加是項研究。

參加者姓名：_____ 參加者簽署：_____

研究員姓名：_____ 研究員簽署：_____

日　　期：_____