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Comparative Study on the Quality of Life of Chronic Obstructive Pulmonary Disease Patients

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Abstract

***Objective**: The main goal of this study is to compare the Quality of Life (QoL) of Chronic Obstructive Pulmonary Disease (COPD) patients between three different regions: the United Arab Emirates (UAE), the United Kingdom (UK) and Morocco. Another aim of this research is to assess the predictive factors correlated to the QoL and study the extent of their involvement as well as any possible interaction between them. It is also designed to compare the QoL of control group (healthy individuals) among the same countries.*

***Methods:** A total of 1800 subjects were recruited including stable COPD patients (n=430), and a control group (n=1370) from the UK, Morocco and the UAE. St George's Respiratory Questionnaire (SGRQ) was the instrument used to evaluate the QoL, while Mahler Dyspnoea Index was used to assess the dyspnoea. Lung functions were measured by a standardised Vitalograph spirometer, while a hand grip dynamometer was used to measure the muscle strength. Data was analysed using ANOVA Post Hoc test to compare the QoL between the centres and linear regression analysis used to assess the effect of various variables upon the QoL scores components. Extra questions were asked to the patients to study their awareness of their condition and its management, which have been tested using chi-square statistical method.*

***Results**: Our results show that differences in the QoL between the countries exist. The UK had better overall QoL than Morocco and the UAE, with no significant difference between genders. How well total SGRQ scores were predicted by BMI, dyspnoea index, total muscle grip and pulmonary function were assessed and the results indicated that age, total muscle grip, FVC% predicted, and dyspnoea index are significantly associated with the QoL. Regarding the control groups, our results indicated that there was a highly significant difference in all variables between the three countries.*

***Conclusion:** Muscle grip, age, dyspnoea and FVC% predicted are good predictors of QoL in COPD patients. Patients' QoL deteriorates with older age and increased dyspnoea. COPD patients with poor QoL experience muscle weakness and poor lung function. There was clearly a difference between the QoL of COPD patients in the three regions and the reason behind this is mainly due to the socio-economic status and the health care system followed in each country rather than the demographic location.*

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INTRODUCTION

1.1 Definition

Currently, Chronic Obstructive Pulmonary Disease (COPD) is defined by the Global Initiative for Chronic Obstructive Lung Disease (GOLD, 2009) as a preventable and treatable disease with some extra pulmonary effects that may contribute to the severity in individual patients. It is a disease state characterised by chronic airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious gases including cigarette smoke, biomass fuels and occupational agents. COPD should be regarded as a pulmonary disease, but these co-morbidities must be taken into account in a comprehensive diagnostic assessment of severity and in determining appropriate treatment. (GOLD, 2009)

Previous definitions of COPD have emphasised the terms of bronchitis and emphysema, which were not included in the last report of the GOLD guidelines. (GOLD, 2009) Emphysema is defined anatomically as abnormal permanent enlargement of the airspaces distal to the terminal bronchioles, and subsequent destruction of alveolar walls. (American Thoracic Society, 1995) Chronic Bronchitis is a chronic productive cough for 3 months in each of 2 consecutive years in a patient in whom other causes of productive chronic cough have been excluded. (GOLD, 2009)

While greater emphasis is now placed on extra-pulmonary disease, the definition of COPD still rests upon airflow obstruction. Airflow obstruction, usually measured using spirometry, is a useful marker of disease since testing is reasonably reproducible and widely available. (Ekaterina, 2010) However, the broad term COPD is used to designate a condition that defies more precise classification, the concept

of COPD as a diagnostic category continues to evolve and remains controversial. (Pride and Vermeire, 1998)

1.2 Epidemiology

The slow and intermittent nature of COPD progression, along with the similarity of its symptoms to other respiratory diseases, all stand behind the majority of undetected affected patients. Moreover, failure of patients to recognise their condition and seek early help, particularly among the "third world" population, made epidemiologists' duty harder in terms of achieving the most accurate reflective records about the disease worldwide. (Fletcher, 2010)

A study presented on the 19th May 2010 at the American Thoracic Society (ATS) Conference in New Orleans by the leading charity, Education for Health (EFH), shows that the economic toll of COPD is set to soar as the disease heads towards being the third biggest cause of death globally by 2020. The international and expert-led survey is the first of its kind detailing the impact of COPD on a working-age population and highlights an urgent need to keep individuals with COPD active and contributing to society for the benefit of all. (ATS, 2010)

The survey highlights that society faces a double economic impact from the growing COPD crisis. Patients are losing an average of USD 1,800 per year in lost income due to their COPD, which equates to lifetime losses of nearly USD 20,000. Nearly 1 in 5 of 45 to 68 years old are forced to retire prematurely due to the condition, thereby incurring increased health costs and reducing personal contribution from taxation. (Fletcher, 2010)

In addition to the global financial impact of COPD, the survey also illustrates the personal and Quality of Life (QoL) consequences for individuals, including effects on

their household income, certainty for the future and being able to maintain the same level of lifestyle prior to diagnosis. This not only affects individuals with the disease but other family members, potentially restricting their lifestyle choices and earning abilities further compounding the problem. (Fletcher, 2010)

Approximately 210 million people worldwide are currently known to be living with COPD. (WHO, 2009) Symptoms are often mistakenly attributed to aging or other respiratory diseases such as asthma, resulting in COPD being undetected in about 50% of cases and misdiagnosed in about 23%.

COPD is a major health problem affecting subjects over 40 years of age, the World Health Organisation (WHO, 2009) has published that COPD was the fifth leading cause of death in 2002. Total deaths from COPD are projected to increase by more than 30% in the next 10 years unless urgent action is taken to reduce the underlying risk factors, especially tobacco use.

It is not easy to quantify the population suffering from COPD because COPD is not well recognised among the general public, and among healthcare professionals it is still under diagnosed and poorly managed. (Shahab et al, 2006) A systematic review of all population based studies of COPD from anywhere in the world and published from 1990-2004 estimated that the prevalence of COPD in adults above the age of 40 years was 9-10%. (Halbert, et al, 2006) The estimated prevalence of COPD includes approximately 4-13% of adults in Europe and approximately 7% of adults in the United States.

In Africa, the majority of the prevalence surveys on COPD have been conducted in limited and specific population groups: miners, agricultural or industrial workers, civil servants and hospital patients. These studies used the British Medical Research

Council questionnaire. The results only gave a reflection of the prevalence of COPD, as airway obstruction occurs in only a proportion of chronic bronchitis cases. In 1998 a study was conducted on hospitalised COPD patients and estimated that the prevalence of COPD in Morocco is 14 % (Bartal, 1998)

In the Middle East, there are no statistics about the prevalence of COPD. In 2007, Hadi HA and co-workers carried out a large cohort study in 6 Middle Eastern countries to report the prevalence of clinically recognised COPD during acute coronary syndrome. Their results show that the prevalence of COPD was 5.3% (Hadi, 2010)

According to recent COPD disease surveillance in the United States there was a five-fold increase in female COPD-related mortality between 1971 and 2000 and in 2000 for the first time, more women died from COPD than men. (Mannino et al 2002)

COPD was more common in men, but because of increased tobacco use among women in high-income countries and the higher risk of exposure to indoor air pollution (such as biomass fuel used for cooking and heating) in low-income countries, the disease now affects men and women almost equally. According to the British Lung Foundation, women are more susceptible to developing COPD than men as their lung function worsens with less duration of smoking or intensity of smoking than that of men. (British Lung Foundation, 2005)

COPD represents an enormous health problem for the communities: patients and their families, the workplace, health institutions, and society as a whole are heavily affected by the disease. (Minkoff, 2005)

Costs, both economic and human, associated with medical and auxiliary care, loss of livelihood, diminished Quality of Life (QoL) and reduced life expectancy cannot be estimated. As knowledge of the pathophysiology of COPD expands, as awareness of the enormous social and economic impact of COPD grows, and as the success of smoking cessation strategies improves, it is realistic to hope that this public health epidemic can be controlled. (Jane, 2001)

In the UK, the Chief Medical Officer has reported COPD accounts for more than £800 million in direct health care costs, although the National Institute for Clinical Excellence estimated slightly lower costs. (de Marco, 2004) More than half the costs are related to hospital care and costs are, as expected, greater for those with more severe disease: £149 for a person with mild COPD, £307 for someone with moderate COPD and £1,307 for someone with severe COPD. (Healthcare commission, 2006)

Mortality from COPD in England shows a strong urban rural gradient (Hansell A, 2003) with high mortality rates in the North of England. There are also striking social inequalities with men aged 20-64 employed in unskilled manual occupations being 14 times more likely to die from COPD than those in professional occupations. (Burney, 2006)

1.3 Aetiology

Cigarette smoking, both active and passive, is believed to be the major etiological factor in the development of COPD. Because only 10-20% of smokers develop severe COPD, other factors in addition to those cited, such as socioeconomic status, diet and nutrition, climate, and nonspecific airway hyper-responsiveness, may modify risk.

Smoking affects the lung at various places: the bronchi, the bronchioles, and the lung parenchyma. The effect of tobacco smoke in the larger airways (i.e. the bronchi) alters both the structure and function of the bronchial mucous glands. Exposure to smoke increases both the number and size of these mucus-secreting glands, resulting in the production and deposition of excess mucus within the lumen of the airway. In response to enlarged, hyperactive mucous glands, as well as to the influx of inflammatory cells, airway walls become thickened.

Occupational exposure to irritating fumes and dusts may aggravate COPD. Exposure to certain vegetable dusts, such as cotton fibre, moulds and fungi in grain dust, may increase airway resistance and sometimes produce permanent respiratory impairment. Repeated bronchopulmonary infections can also intensify the existing pathological changes, playing a role in destruction of lung parenchyma and the progression of COPD.

Heredity or biological factors can determine the reactions of pulmonary tissue to noxious agents. The homozygotes may develop severe panlobular emphysema (PLE) early in adult life. The heterozygotes appear to be predisposed to the development of centrilobular emphysema related to cigarette smoking. The other

better-known cause of chronic lung disease is mucoviscidosis or cystic fibrosis. (Varkey, 2004)

Bacterial infection (*Haemophilus influenza*) colonises the normally sterile lower airways of about 30% of patients with COPD. Smoking and airflow obstruction may lead to impaired mucus clearance in lower airways, which predisposes to infection. Repeated bouts of infection increase the inflammatory burden that hastens disease progression. There is no evidence, however, that long-term use of antibiotics slows the progression of COPD in susceptible smokers. (Varkey, 2004)

1.4 Pathophysiology

Pathological changes in COPD lead to corresponding physiological abnormalities that usually become evident first on exercise and later also at rest. Physiological changes characteristic of the disease include mucus hypersecretion, ciliary dysfunction, airflow limitation, pulmonary hyperinflation, gas exchange abnormalities, pulmonary hypertension, and they usually develop in this order over the course of the disease. In turn, various physiological abnormalities contribute to the characteristic symptoms of COPD chronic cough sputum production, and dyspnoea. (Barnes et al, 2002)

Chronic inflammation in the central airways is also associated with an increase in the number (metaplasia) of epithelial goblet and squamous cells, dysfunction, damage, and/or loss of cilia, enlarged submucosal mucus-secreting glands, an increase in the amount of smooth muscle and connective tissue in the airway wall, degeneration of the airway cartilage, and mucus hypersecretion. (Mullen et al, 1985)

The mechanisms of mucus gland hypertrophy and goblet cell metaplasia have not yet been identified, but animal studies show that irritants including cigarette smoke can produce these changes. (Rogers and Jeffery, 1986)

The various pathological changes in the central airways are responsible for the symptoms of chronic cough and sputum production, which identify people at risk for COPD and may continue to be present throughout the course of the disease.

The early decline in lung function in COPD is correlated with inflammatory changes in the peripheral airways, similar to those that occur in the central airways: exudate of fluid and cells in the airway wall and lumen, goblet and squamous cell metaplasia of the epithelium, edema of the airway mucosa due to inflammation, and excess mucus in the airways due to goblet cell metaplasia. (Cosio et al, 1978) Inflammatory changes such as airway edema and mucus hypersecretion also contribute to airway narrowing in COPD. (Hogg et al, 1968)

The peripheral airways become the major site of airways obstruction in COPD, and direct measurements of peripheral airways resistance show that the structural changes in the airway wall are the most important cause of the increase in peripheral airways resistance in COPD.

1.5 Quality of Life (QoL)

Several definitions of QoL exist, The World Health Organization (WHO) definition of health is “not merely the absence of disease, but complete physical, psychological, and social well-being”. (WHO, 1958) QoL refers to the physical, psychological and social domains of health that are unique to each individual. (Testa, 1996) Another definition is “QoL can be defined as the functional effect of an illness and its consequent therapy upon a patient, as perceived by a patient”. (Schipper et al, 1996)

Since the health care use by COPD patients is more related to an impaired QoL than the severity of the disease itself (Molarius et al, 2001), the goal of managing COPD is improving the QoL of COPD patients by relieving symptoms and enhancing functionality. (Perruzza et al 2003, Van Manen et al 2003)

Over the past decade, interest in QoL has increased and that is mainly because patients are more concerned about their symptoms and their physical function, cognitive performance, psychosocial condition, emotional status and adaptation to disease, rather than objective measures such as expiratory airflow. (McSweeny et al 1982, Prigatano et al 1984, Schrier et al 1990, Stavem et al 2000)

Even if the severity of disease is an important determinant of COPD patient's health, patient perception and adaptation largely defines the overall QoL. (Curtis et al, 1994) Peruzza performed a study and suggested that COPD causes severe deterioration of QoL, physical activity and functional status in elderly populations and that the degree of this impairment mainly depends on the severity of chronic airway obstruction. (Perruzza et al, 2003) other studies showed that there is a significant relationship between age and the QoL of COPD patients. (Stahl et al 2005, Ferrer et al 2002)

Pulmonary rehabilitation is a multidisciplinary program of care that is individually tailored to optimise physical and social performance, (Nice Guidelines, 2010) rehabilitation at home resulted in an improved QoL in COPD patients, this improvement was not associated with an improvement in lung function or exercise tolerance. (Wijkstra et al, 1994) The improvement of QoL is probably due to the comprehensive care of the rehabilitation program and not only to a part of it. (Jones et al, 1992)

To identify and manage the problems mostly important to COPD patients, a great attention has been paid to develop and validate QoL questionnaires for these patients. (Guyatt et al 1987, Maille et al 1997, Donohue et al 2002) These questionnaires were developed and now being used in clinical trials. (Wijkstra et al 1994, Spencer et al 2001, Jones et al 1992)

The relationship between physiological measurements and QoL has been studied separately and collectively in few studies. The physiological factors include lung function tests, Body Mass Index and grip strength. Research has been undertaken for the last decade to relate them to QoL.

Garrido suggested that stable COPD patients experience a low QoL. The factors determining the QoL include gender, FEV1 (Forced Expiratory Volume in one second), use of oxygen therapy, and the number of visits to emergency departments and hospital admissions. (Garrido et al, 2006) However, this particular study was only limited to stable COPD patients and there was no account of other physiological parameters of the disease.

Quality of Life (QoL) assessment involves a class of measurement fundamental to many aspects of health care planning and outcomes research. It is relevant for assessing symptoms, side effects of treatment, disease progression, satisfaction with care, quality of support services, unmet needs, and appraisal of health and health care options. (Rapkin and Schwartz, 2004)

Elderly patients affected with COPD-related respiratory failure are frequently impaired in their social life, psychic functions and activities of daily living. Therefore, it is of crucial importance to establish the relationship between COPD and QoL in those people. In developing QoL measures for clinical trials in patients with chronic

airflow limitation, the areas of physical and emotional dysfunction that patients experience and feel are important.

Interest in QoL over the past decade has increased substantially because of recognition of the following factors:

- Individual patients are most concerned about their symptoms (e.g. dyspnoea) and their function (e.g. ability to perform physical tasks), rather than objective measures such as expiratory airflow.
- QoL is a unique construct that is different from physiologic measures or survival.
- The goals of therapy have been expanded to include relief of symptoms and improvement in QoL, in addition to the standard physiologic outcomes.

COPD is a condition that involves multiple organs and systems. In addition to emphysema, airway inflammation and remodelling, COPD is associated with various local and systemic complications including cachexia, weight loss, muscle wasting, systemic inflammation and depression. (Pauwels et al 2001, Yvonne et al 2003, Vestbo et al 2006)

1.5.1 Effect of Muscle Strength on the QoL of COPD Patients

Skeletal muscle dysfunction and wasting is considered as one of the most important manifestations of COPD. (Wouters, 2002) As the disease severity advances, COPD patients lose muscle bulk, especially in their thighs and upper arms. Over time, patients start losing exercise endurance and complain of fatigue and dyspnoea on minimal exertion. (Sin et al, 2004)

Skeletal muscle dysfunction contributes to a reduced health status of patients with COPD and substantially increases the risk of mortality, independent of traditional markers of COPD mortality such as baseline lung function, age, and cigarette smoking. (Sin & Man, 2006)

The figure below was presented by Professor Jones in the ERS congress 2008, representing the disease pathways in COPD. The figure shows that as stated in the beginning of this section that muscle wasting in one of the manifestations of COPD which leads to exercise limitation and therefore to an impairment in QoL. (Figure1)

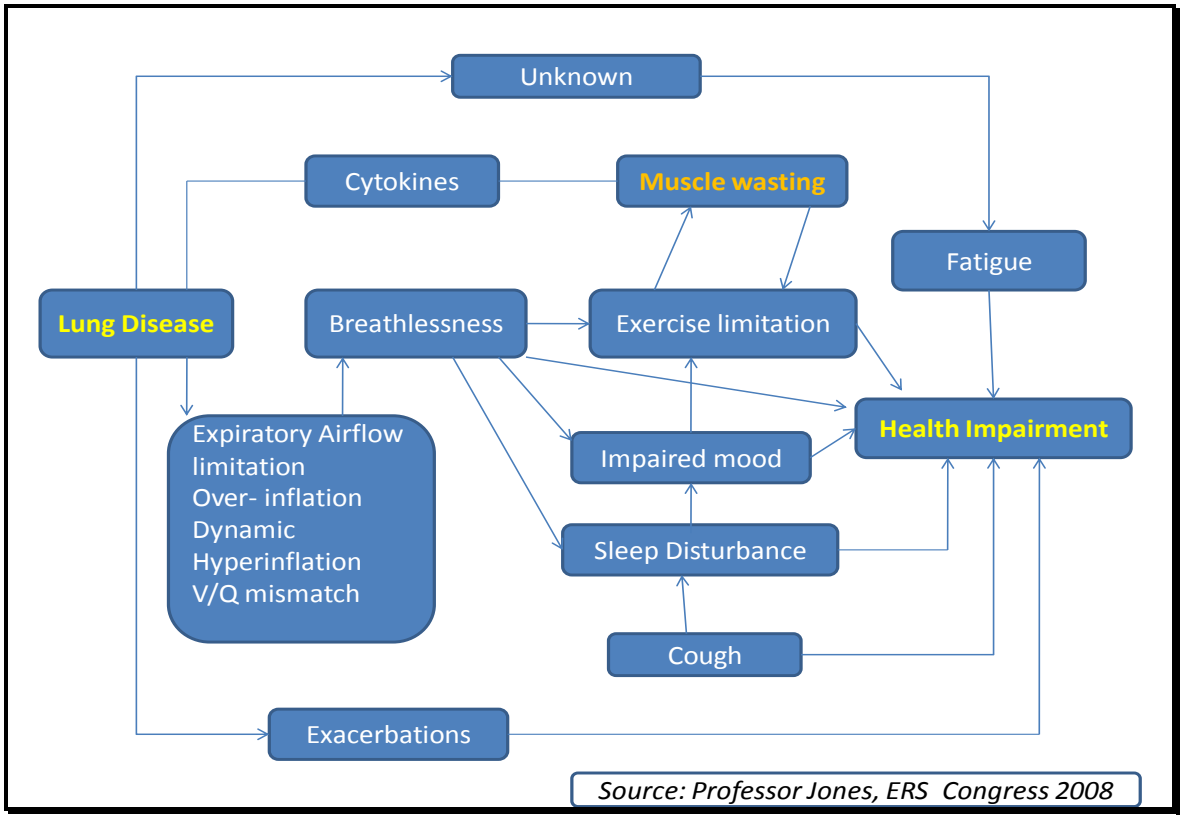

Figure 1: Disease pathways in COPD

Many studies confirmed that muscle dysfunction is common in patients with COPD and that it plays a role in limiting their exercise capacity and their QoL. (Agusti et al, 2003)

COPD patients usually experience low exercise tolerance, and peripheral muscle dysfunction is also seen especially in patients with malnutrition. This dysfunction includes weakness, atrophy, morphologic changes and altered metabolic capacity. (Heijdra et al, 2003)

Whether the mechanisms of skeletal muscle dysfunction are local, systemic, or both are still under debate. A predominantly systemic process would result in a widely distributed loss of muscle function, whereas chronic inactivity as result of breathlessness and subsequent deconditioning would result in dysfunction predominantly in the locomotor muscles such as the quadriceps. (Bernard et al, 1998) The peripheral muscle weakness, the relationship between quadriceps strength and the degree of airflow obstruction suggest that chronic inactivity and muscle deconditioning are important factors in the loss in muscle mass and strength. (Coronell et al, 2004)

Muscle wasting in COPD is poorly understood. Certainly inadequate nutritional intake can affect weight loss and loss of muscle mass. Recent studies suggest that intake of certain nutrients such as fresh fruits and vegetables can decrease the expression of key inflammatory genes and therefore inflammation. (Kornman, 2006)

A study done by Coronell and colleagues (Coronell et al, 2004) has shown that COPD patients have impaired peripheral muscle function when compared to healthy control group, suggesting that there might be other factors contributing to this impairment. These factors include malnutrition, exposure to corticosteroids, tissue hypoxia, heart disease history, tobacco use, systemic inflammation and hormone alteration. (Mador and Bozkanat, 2001)

Hand grip strength and the rate of decline changes as the weight decreases and the disease advances. Janaudis-Ferreira et al showed that there are gender-related differences regarding muscle strength in COPD patients, female patients seemed to experience decrease in thigh muscle function when compared to male patients. (Janaudis-Ferreira et al, 2006) Rantanen et al suggested that in women, hand grip strength may predict mortality. Grip strength tests may help identify patients at increased risk of deterioration of health. (Rantanen et al, 2003) Ansari suggests that hand grip was a powerful predictor of QoL in COPD patients. (Ansari et al, 2007)

Some studies suggested that exercise training has shown to improve muscle function in patients with COPD, suggesting that deconditioning is an important contributor to the skeletal muscle dysfunction. A study conducted by Simpson et al has shown that weight training in COPD patients improves the exercise capacity as well as the QoL in these patients. (Simpson et al, 1992)

Vermeeren and colleagues performed a study and it has been shown that the prevalence of nutritional depletion is high in COPD patients and mainly in females. There was an association between peripheral muscle weakness and nutritional depletion while no association was found between the nutritional depletion and the low level of FEV1% predicted (Forced Expiratory Volume in one second). Gender and age were also found as independent predictors of muscle weakness. (Vermeeren et al, 2006)

1.5.2 Relationship between BMI and QoL of COPD Patients

The mechanisms of weight loss are still unclear in COPD but the main basis is believed to be due to an inadequate food intake in subjects too short of breath to eat. (Karakas et al 2005, Friedrich et al 2006, Prescott et al 2002) However, most weight

loss in COPD patients is due to the increased metabolic demand of respiratory muscles that are overworked because of emphysema damage. (Schols et al 1991, Schols and Wouters 2000) Disturbances in intermediary metabolism caused by altered anabolic and catabolic mediators such as hormones, cytokines, and growth factors, and resulting in disproportionate muscle wasting have been described. (Wedzicha, 2004)

A study of the up regulation of the nuclear transcription factor NF-kB in muscle biopsy specimens of patients with COPD carried out by Agusti et al found a 30% increase in NF-kB activity in patients of low body weight compared with those of normal body weight and up regulation of the inducible form of nitric oxide synthase (iNOS) in the skeletal muscle of low body weight COPD patients. The authors also suggest that the higher levels of nitric oxide (NO) in the presence of unregulated iNOS can contribute to skeletal muscle atrophy either by enhancing skeletal muscle apoptosis or stimulating protein nitrotyrosination. (Agusti et al, 2003)

COPD patients with malnutrition have shown to have an impaired pulmonary status, lower exercise capacity, lower QoL, and higher mortality rate. Several studies conducted comparing well nourished and malnourished patients have shown that malnourished patients have more respiratory muscle weakness and reduced maximal exercise capacity compared with well nourished COPD patients. (Vandenbergh et al 1967, Renzett et al 1996, Burg et al 2004, Gray et al 1996)

The effect of nutritional status on the QoL is still poorly understood. Katsura and co-workers performed a study to assess deterioration of both generic and disease-specific QoL in groups of normal weight and underweight patients with stable COPD and to investigate whether body weight is a determinant of QoL in COPD patients.

The study found that patients with low BMI had poor QoL (assessed by St Goerge's Respiratory Questionnaire and Short Form-36) and also suggested that to improve the QoL and dyspnoea in these patients introduction of nutritional intervention might be of benefit. (Katsutra et al, 2005) This can be achieved by encouraging and helping patients to avoid weight loss and regain weight as dietary habits play an important role in the aetiology of COPD. (Smit et al, 1999)

Another study carried out by Salpeci et al on 65 male COPD patients has shown that BMI is closely related to dyspnoea score, respiratory muscle strength and QoL in COPD patients, and suggested that pulmonary rehabilitation programs including nutritional support should be introduced in the management of COPD. (Salpeci et al, 2007)

Weight and fat-free mass loss, and the impaired function of skeletal muscle have been demonstrated to play an important role in the clinical implications of malnutrition in COPD patients. (Shoup et al, 1997)

The prevalence of nutritional depletion in a COPD population is high, and especially in female patients. The presence of nutritional depletion was not associated with lower levels of FEV1%predicted. It was suggested that the assessment of body composition additional to body weight should be looked at in all COPD patients, independent of the stage of disease severity. (Vermeeren et al, 2006)

Planas and co-workers performed a study on a small number of patients and suggested that in some stable depleted COPD patients, a defined oral nutritional supplement to reach total daily energy intake without overfeeding could be beneficial to improve their QoL. (Planas et al, 2005)

1.5.3 Effect of Dyspnoea on the QoL of COPD Patients

A number of clinical and physiological outcomes, such as dyspnoea, functional status and health status, are recognised as being important for characterising response to treatment. Dyspnoea is the primary reason for patients seeking medical care, and is an important determinant of QoL. One of the main goals of treatment is reducing the breathlessness in COPD subjects. (Rennard et al 2002, Celli et al 2004)

A study carried out by Lareau et al showed that patients' ratings of dyspnoea were not directly linked to changes in lung impairment. (Lareau et al, 1999) Furthermore, there may be improvements in dyspnoea, exercise capacity and QoL with only minimal changes in FEV1. Although measures such as FEV1 reflect direct changes in airflow limitation, it is important to measure dyspnoea to reveal the practical effects of treatment on a patient's everyday life. (Celli and MacNee, 2004)

Measurements of dyspnoea provide an insight into the practical effects of treatment on everyday life, reflecting whether or not patients perceive an improvement in this primary symptom of COPD. Dyspnoea limits exercise capacity in COPD patients and is associated with central perception of an overall increase in central respiratory motor output directed preferentially to the rib cage muscles. Patients with COPD frequently decrease their activity in order to avoid the unpleasant sensation of breathlessness. Functional status measurement reveals the number of activities that a patient can perform. (Celli and MacNee 2004, Mahler et al 1995, Stendardi et al 2007)

A study carried out by Martinez et al to indentify the determinants of baseline dyspnoea and to ascertain how that factor influences the health-related QoL of patients with COPD, found that anxiety was the main determinant of QoL in COPD

patients, and it is triggered mainly by baseline dyspnoea and exertional dyspnoea. (Martinez et al, 2008) Higher dyspnoea symptoms have been related to worse exercise performance, health status and poor survival in COPD. (Spruit et al 2007, Nachimura et al 2002)

Hajiro et al carried out a cross-sectional study to compare the level of dyspnoea with the staging of COPD severity as defined by the American Thoracic Society (ATS) using the SGRQ and SF-36 to assess the QoL and the Medical Research Council (MRC) to evaluate the severity of dyspnoea. The results suggested that the QoL of COPD patients ranging from mild to severe was clearly separated using dyspnoea level rather than the staging of the disease severity as defined by the ATS. (Hajiro et al, 1999)

Dyspnoea being an important determinant of QoL, it is weakly correlated to severity of obstruction and there is little information available on how it exercises its effect on QoL.

Nordic walking which an exercise is involving walking with specially designed poles was effective in alleviation of dyspnoea, increased QoL and functional exercise capacity after three months according to recommendations. (Nici et al, 2006)

1.5.4 Relationship between Lung Function and QoL of COPD Patients

Spirometry is a method to measure the airflow obstruction in COPD. A diagnosis of airflow obstruction can be made if the FEV1/FVC ratio is less than 70% predicted and FEV1 less than 80% predicted. (Jones and Bosh, 1997) In addition to clinical exams, spirometry improves diagnosis of COPD and it helps to identify subjects who

might benefit from medical treatment in order to prevent and improve exacerbations. (Wilt et al, 2005)

Values for the Forced Expiratory Volume in 1 second (FEV1) and forced vital capacity (FVC) must be compared with the predicted normal values which depend on the individual's age, height and sex.

Spirometry has proven a poor predictor of disability and QoL in COPD but helps in predicting prognosis and contributes to the assessment of the severity of COPD. Spirometry alone cannot separate asthma from COPD. Although FEV1 is an accurate marker of mortality in population studies it has only shown a weak relationship with dyspnoea and QoL.

Stahl et al carried out a study to assess the relationship between QoL and disease severity using lung function measures. The study found that COPD patients had an impaired QoL as the disease advances and that the deterioration is related to a decrease in FEV1% predicted normal values. (Stahl et al, 2005) Some studies have shown that there is a weak relationship between pulmonary function (FEV1) and the QoL in COPD patients. (Ferrer et al 1996, Jones et al 1992, Jones et al 1989)

Another study conducted by McGlone et al found that there is a significant relationship between physical activity, disease severity which was assessed by spirometry and QoL of COPD patients. (McGlone et al, 2006) Ketelaars and co-workers conducted a study to assess the contribution of respiratory impairment (measured by lung function tests), physical disability, coping, age, and socioeconomic variables on the QoL. They found that FEV1, walking test and coping strategies are good predictors of the QoL. (Ketelaars et al, 1997)

Recent studies have shown that FEV in 6 seconds (FEV6) is a good surrogate marker for the FVC. (Vandevoorde 2005, Akpinar 2006, Vandedevoorde, 2006) The major benefit of using FEV6 is that it is easier for the patients because the maximal end-expiration can be avoided. Results have proven that FEV_1/FEV_6 is a sensitive and specific test and can be used as a valid alternative for FEV_1/FVC in the diagnosis of airway obstruction. (Jing, 2009)

1.5.5 Quality of Life (QoL) Measures

One important reason for measuring QoL in patients with chronic respiratory disease is to differentiate between patients who have a better health status and those who have a worse health status (a discriminative instrument).

The most widely used application (for both clinical and research purposes) for measuring QoL is to detect how much QoL has changed in response to therapy (an evaluative instrument). Related to the responsiveness criterion of a QoL questionnaire is the threshold for a clinically meaningful change. There are two approaches to measure the QoL that we will be reviewing below.

1.5.5.1General Measures

A number of generic QoL instruments have been used to characterise COPD.

Sickness Impact Profile (SIP) has been well validated and demonstrated to be reliable and responsive among patients with COPD. (Engstrom et al, 2001) This instrument was designed to both interviewer or self-administered. It takes 20-30 minutes to be completed which is one of its disadvantages.

Medical Outcome Study (MOS) Short Form-36 (SF-36) has proven to be reliable and responsive in COPD. (Mahler & Mackowiak, 1995) SF-36 consists of eight

domains: physical-functioning, role-physical, bodily pain, general health, vitality, social-functioning, role emotional and general health. The SF-36 also has two summary scores: a physical component scale and a mental component scale that were developed with factor analysis. This questionnaire offers significant advantages in that it is self-administered, completed in 5 min and has been translated and validated in several languages.

Nottingham Health Profile (NHP) uses statements that measure departures from "normal" functioning by affirming particular statements or items that describe QoL. The first part contains 38 items that fall into six domains: physical mobility, energy, sleep, pain, social isolation and emotional reactions. The second section contains seven items that address areas of daily living affected by a patient's health status. (Hunt et al, 1980) NHP has been proven valid and reliable among patients with COPD, it is self-administered and can be completed in 10-15 min. (van Schayck et al, 1995)

Quality Well Being (QWB) is a questionnaire developed as part of the health status index. (Fanshel & Bush, 1970) QWB contains three scales: mobility, physical activity and social activity. A single cross-sectional study has been performed demonstrating validity among patients with COPD. (Kaplan et al, 1984) This questionnaire can be either by interviewer or self-administered and takes 20 min to complete.

1.5.5.2 COPD-Specific Measures

Disease-specific measures can be designed to include items that are particular to the condition being studied as well as exclude items that are not related to the condition.

A few COPD-specific QoL measures are available; we will be summarising these in the following sections.

Chronic Respiratory Disease Questionnaire (CRDQ)

Developed in 1987 by Guyatt, it contains 20 questions and covers four dimensions of functioning dyspnoea, fatigue, emotional function and mastery or a “feeling of control over the disease”. (Guyatt et al, 1987)

The CRDQ is administered to the patient by a trained interviewer and requires approximately 20 minutes to be completed. Guyatt found that the instrument was reliable and sensitive to the effects of bronchodilator or steroid treatment, as well as rehabilitation program. (Guyatt et al, 1987)

In addition, changes in CRDQ were moderately but significantly related to changes in pulmonary function variables, exercise capability and clinician or self-improvement ratings. Since this instrument includes physical symptoms related to COPD process, it may be useful for periodic clinical evaluations of patients’ adjustment. (Cottrell, 1992)

St. George’s Respiratory Questionnaire (SGRQ)

St George’s Respiratory Questionnaire (SGRQ) has become one of the most widely used instruments for assessing QoL in respiratory patients. The SGRQ has been used extensively in descriptive and therapeutic evaluation studies (bronchodilator agents, oxygen therapy, psychotherapy and respiratory rehabilitation). (Ferrer et al, 2002)

St George’s Respiratory Questionnaire, developed by Professor Paul Jones at St George’s Hospital in London in 1990, is a standardised self questionnaire for

measuring impaired health, daily life, and perceived well-being (QoL) in airways disease. It was developed to be used by patients with fixed and reversible airway obstruction and has been designed to allow comparative measurements of health between patient populations and quantify changes in health following therapy. (Jones et al, 1991)

St Georges' Respiratory Questionnaire is used to assess the health of specific population at a point in time, monitor their health over time, both cross-sectional and longitudinally, and evaluate the efficacy of the medical interventions. SGRQ is valid, repeatable and sensitive questionnaire.

SGRQ is a 76-item questionnaire which measures three dimensions:

1. Symptoms associated with pulmonary disease (frequency and severity),
2. Activities likely to be limited by dyspnoea,
3. Impacts on social and psychological functioning resulting from the airway obstruction.

Symptom section contains items on five-point Likert scale; Activity and Impact sections are dichotomous items (yes/no). Scores range from 0 to 100, with higher scores indicating poor health. (Jones et al, 1991)

The questionnaire's parent language is UK English and it has been validated and translated into many languages including American English, French, Arabic, Moroccan dialect, Indian, Spanish, Chinese, Danish, Polish, Portuguese, Swedish, and other languages with the exception of African. (Jones and Wijkstra, 2005)

More recently, a shortened version of the SGRQ has been developed and validated for COPD (SGRQ-C). (Meguro et al 2007, Meguro and Jones 2005)

Seattle Obstructive Lung Disease Questionnaire (SOLQ)

Developed by Tu SP in 1997, SOLQ is self-administered questionnaire that takes 10-15 minutes to be completed and it consists of 29 items measuring four health dimensions (Tu et al, 1997): physical function, emotional function, coping skills and treatment satisfaction.

Studies have shown that the SOLQ is a reliable, valid and responsive measure of physical and emotional function, coping skills, and treatment satisfaction. Brief, self-administered, and computer scannable, it is useful in monitoring long-term outcomes among large groups of COPD patients. (Tu et al, 1997)

Quality of Life Questionnaire for Respiratory Illness

Developed by Maillé and colleagues, this questionnaire was intended for use with asthma as well as with COPD. (Maillé et al, 1994)

Fifty-five items were chosen for the questionnaire from a pool of 221 accordingly to whether COPD or asthma patients indicated that an item applied to their recent experience. The items are grouped into seven subscales: Breathing problems, physical problems, emotions, situations triggering or enhancing breathing problems, daily and domestic activities, social activities, relationship and sexuality and general activities.

1.6 Management of COPD

After COPD is being diagnosed, a successful management of the disease should be aimed at relieving the symptoms, preventing disease progression, improving exercise tolerance, improving health status and patients' Quality of Life (QoL), preventing and treating the complications and exacerbations, and reducing the mortality. (Siafakas and Celli, 2006)

COPD has a long natural history and different stages of severity. In addition to a systematic management, a multidisciplinary approach should be adapted according to each individual patient. In order to achieve a good management some factors should be taken in considerations: for all stages of COPD smoking should be stopped, the assessment of severity should be diagnosed early and properly, education and self-management, rehabilitation, early detection of exacerbation and end of life issues. (Siafakas and Celli, 2006)

Before starting any treatment, a diagnosis of the condition should be confirmed. History of cigarette smoking, complaining of cough, sputum and shortness of breath are suggestive of the disease.

Management of stable COPD includes pharmacological therapy, long term oxygen therapy (LTOT), rehabilitation and surgery. The following figure (Figure 2) represents the therapy to be induced at each stage of COPD; the scale of severity of COPD includes symptoms, signs and spirometry according to Global Initiative for Chronic Obstructive Lung Disease. (GOLD, 2009)

<table>
<tr><th>Stage</th><th>I: Mild</th><th>II: Moderate</th><th>III: Severe</th><th>IV: Very severe</th></tr>
<tr><td>Symptoms</td><td>FEV1/FVC<0.70
FEV1≥80% predicted</td><td>FEV1/FVC<0.70
50%≤FEV1<80% predicted</td><td>FEV1/FVC<0.70
30%≤FEV1<50% predicted</td><td>FEV1/FVC<0.70
FEV1<30% or
FEV1<50% Plus chronic respiratory failure</td></tr>
<tr><td rowspan="4">Treatment</td><td colspan="4">-Active reduction of risk factor(s), influenza vaccination.
-Add short-acting bronchodilator (when needed).</td></tr>
<tr><td></td><td colspan="3">-Add regular treatment with one or more long-acting bronchodilators
-Add rehabilitation.</td></tr>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">-Add inhaled glucocorticoids if repeated exacerbation.</td></tr>
<tr><td></td><td>- Add long-term oxygen if chronic respiratory failure
- Consider surgical treatment</td></tr>
<tr><td colspan="5">FEV1: Forced Expiratory Volume in 1 second, FVC: Forced Vital Capacity.
Source: Adapted from Global Initiative for Chronic Obstructive Pulmonary Disease (GOLD).
Global strategy for diagnosis, management, and prevention of COPD. 2009. Available from http://goldcopd.org.</td></tr>
</table>

Figure 2: Schematic illustration of therapy at each stage of chronic obstructive pulmonary disease

1.6.1 Pharmacologic Therapy

The treatments used for COPD reduce the symptoms, increase exercise capacity, reduce exacerbations and improve the QoL. Glucocorticoids and inhaled corticosteroids have shown to reduce COPD exacerbations and the rate of deterioration in health status in patients with severe and very severe COPD, but over time it loses the effect on FEV1.

Combination therapy can also be used to increase the degree of bronchodilation for equivalent or lesser side effects. The combination of short-acting β-agonists plus anticholinergic in one inhaler (Fenoterol/Ipratropium, Salbutamol/Ipratropium) produces greater and more sustained improvements in FEV1 than either drug alone and does not produce evidence of tachyphylaxis over 90 days of treatment. (Snider,

1989) It has been shown that this combination improves lung function and the health status. (Guyatt et al, 1987)

Combination of inhaled glucocorticosteroid/bronchodilator therapy, an inhaled glucocortico-steroid combined with a long-acting β- agonist, is more effective than the individual components in reducing exacerbations and improving lung function and health status. (Szafranski et al, 2003)

Patients with alpha-1 antitrypsin deficiency and established emphysema can benefit from alpha-1 antritrypsin augmentation therapy. (Siafakas and Celli, 2006)

1.6.2 Long-Term Oxygen Therapy (LTOT)

Used in severe COPD patients, it is believed that LTOT improves exercise, sleep and survival in patients with chronic respiratory failure. The main aim of the oxygen therapy is to increase the baseline PaO2 (partial pressure of oxygen in arterial blood) to at least 8kPa and/or arterial oxygen saturation SaO2>90% (symbol for percentage of available hemoglobin that is saturated with oxygen) during sleep and rest. (Nocturnal Oxygen Therapy Trial Group, 1980)

Long-term oxygen therapy prolongs life in patients with COPD. (Medical Research Council Working Party 1981, Nocturnal Oxygen Therapy Trial Group 1980) Survival appeared to depend on the daily duration of treatment, with better outcome among subjects who received oxygen for more hours per day. LTOT has also been associated with improvements in mood, neuro-cognitive function, sleep and Quality of Life. (Kim et al, 2008)

Before starting LTOT, COPD patients should be receiving appropriate treatment for their condition (e.g. bronchodilators, corticosteroids and treatment of infections). Gas

exchange can improve substantially following smoke cessation; therefore assessment for LTOT should be made at least 1 month after the patient has stopped smoking. (McDonald et al, 2009) LTOT is contraindicated in current smoker, as it increases fire risk and the probability that the poorer prognosis conferred by smoking will offset treatment benefits. (Muehibeberger et al, 1998)

1.6.3 Pulmonary Rehabilitation

Pulmonary rehabilitation includes exercise programs, nutritional counselling and patient education. The rehabilitation reduces the symptoms, improves the QoL, and improves patients' functional and maximum exercise capacity and emotional participation in daily activities. It also reduces the depression, anxiety and the length of hospital stay. (Siafakas and Celli 2006 & Nice guidelines, 2006)

1.6.4 COPD Surgery

Bullectomy is a surgical procedure to remove a large bulla (large air-filled spaces in the lungs that are bigger than 1 centimeter or so in diameter) that does not contribute to gas exchange; it can be performed thoracoscopically. Once the bulla is removed, the healthy air sacs around it have room to expand, and the muscles used to breathe can function better. This procedure improves lung function and reduces dyspnoea. (Laros et al, 1986 & Lederer et al, 2007)

Lung Volume Reduction Surgery (LVRS) is the resection of parts of the lung to reduce hyperinflation; it improves the mechanical efficiency of the respiratory muscles and the expiratory flow rates by increasing the recoil pressure of the lung. (Cooper et al, 1995) This helps the lungs work better and in carefully selected patients, LVRS can improve breathing and QoL. (Yim et al, 2004)

Lung transplantation is performed in very advanced COPD subjects where the damaged lung is removed and replaced with a healthy lung from a deceased donor. Lung transplant improves lung function, exercise capacity, symptoms and QoL. (Trulock 1997, Thabu et al 2008, Janseen et al 2010)

1.7 Main Aims and Objectives

The introduction chapter provided an overview and a summary of the studies carried out to assess the QoL of COPD patients and those that tested the relationship between the QoL, muscle strength, Body Mass Index, lung function and dyspnoea.

The main aims and objectives of this study are to:

- Compare the QoL of COPD patients between three different countries which represent different regions: United Kingdom (UK), Morocco and the United Arab Emirates (UAE).
- Compare the QoL of the control group between the three countries.
- Assess the relationship between the QoL and Body Mass Index of stable COPD patients.
- Assess the relationship between the QoL and muscle strength of stable COPD patients.
- Assess the relationship between the QoL and lung function of stable COPD patients.
- Assess the relationship between the QoL and dyspnoea of stable COPD patients.

This is the first study comparing the QoL of COPD patients between three different countries and regions, bearing in mind that these countries have different cultural, socio-economical and environmental backgrounds. To my knowledge this will be also the first study that assesses the QoL of COPD patients in the UAE and in

Morocco, also looking at the possible relationship between the QoL and several variables (BMI, muscle strength, and dyspnoea).

1.8 Hypothesis

The main hypothesis is that the patients from the United Kingdom will have better QoL than patients from Morocco and the United Arab Emirates. This is believed to be due to the patient's care system and health services provided in the UK and that are not found in the other countries, considered as emerging countries.

The other hypothesis is that COPD patients with low QoL will have low BMI, poor muscle strength and severe shortness of breath.

Our hypothesis will be tested by using different tools as follows:

1. St George's Respiratory Questionnaire (SGRQ) to assess the QoL of COPD patients.
2. Hand-held spirometer to measure the lung function.
3. Hand-held dynamometer to measure the muscle strength.
4. Base line Dyspnoea Index (BDI) to assess the dyspnoea.

In the following chapter, detailed measurements and research tools will be discussed along with an overview of the study subjects recruited, centres involved, inclusion and exclusion criteria.

CHAPTER II – RESEARCH METHODOLOGY

CHAPTER II

RESEARCH METHODOLOGY

In this chapter a detailed methodology used in the recruitment of COPD patients and the control group will be given. The measurements used during this study will also be discussed as well as the analysis methods.

2.1 Selection of Patients with COPD

For this study, outpatients with COPD were recruited by a cluster sampling method. Participants were recruited during the period of November 2004 to January 2007 from chest clinics in three countries:

1. United Kingdom: Royal Victoria Infirmary (RVI) (Newcastle).
2. Morocco: Avicenne Hospital (Rabat), Moulay Youssef Hospital (Rabat), and 20-Août Hospital (Casablanca). We used the three hospitals in Morocco because they are all connected and under one healthcare team doing rotation during the week.
3. United Arab Emirates: Al Maktoum Hospital and Dubai Hospital (Dubai).

The study has been approved by the University of Sunderland and the NHS Newcastle Ethical Committee in the United Kingdom; by the Department of Health Dubai in the United Arab Emirates; and by the Ministry of Health in Morocco.

The targeted patients (males and females aged 40 years old and above) were identified during their attendance to the outpatient chest clinics and were invited to take part in the study.

Comprehensive information about the nature of the study was supplied to each patient and details about the test that will be performed by the investigator (myself) including the questionnaire, spirometry and muscle strength measurements were also explained to the subjects. Patients were assured that their responses would be

treated confidentially and that their participation in the study would not affect their medical treatment. (Appendix 1)

The diagnosis of COPD was made by the consulting doctors and was based on the definition provided by the Global Initiative for Chronic Obstructive Lung Disease (GOLD). The COPD patients who were included in the study were either newly diagnosed with COPD or coming to the clinic for a follow-up.

Subjects who could not participate, either because they refused to take part in the study, or those who had exacerbation within two weeks, or were with known co-morbidities (hemi-paralysis, severe visual impairment). These details were taken from patients' medical files and from the healthcare professional following the case. Patients unable to perform spirometry due to shortness of breath were excluded from the study.

2.1.1 Measurements

2.1.1.1 Patients' Information

The following personal information (Appendix 2) was collected from the patient/patient file:

- Gender
- Age
- Height and weight to calculate the BMI
- Smoking history
- Medical history

2.1.1.2 Lung Function Characteristics

The Forced Expiratory Volume in 1 second (FEV1), Forced Vital Capacity (FVC) and the ratio FEV1/FVC% were measured using the same hand-held spirometer (Vitalograph). The spirometer was provided by the University of Sunderland to use during the study in all the centres (Morocco and the United Arab Emirates). In the United Kingdom I was not able to perform the spirometry and therefore used readings from the patient file as it is a routine to perform spirometry for the patients at every visit to the chest clinic and our hand-held spirometer could not be used because the patients were not keen to perform the spirometry twice during their visit to the physician, this information was told by the physician at the start of the study after some patients were asked and refused to do so.

Before a subject is tested it is important to perform a calibration check on the spirometer. If a calibration is not performed then it is impossible to know whether the results obtained are accurate or not. The calibration mode can be entered by holding down the "VIEW" arrow button whilst holding down the "ON" button. The messages "zeroing sensor" and "please wait" are displayed. When the instrument is ready to be calibrated the display shows “pump air”. The calibration syringe (we have used 1-L syringe vitalograph - 3 x 1 to give us 3 L calibration) should be attached and one litre of air is pumped through the flow head. It usually takes around one second for each litre pumped through, the air should not be blasted through the flow head as this will not calibrate. The message "sampling flow" appears. If the calibration does not require modification, the display shows an asterix in the top left hand corner. If it does require modification, the display shows "pump air" followed by the measured volume in millimetres. The procedure is repeated until calibration is successful; it usually requires only one more pump.

The airflow obstruction was represented by FEV1/FVC% and FEV1% predicted. The European Respiratory Society (ERS) guidelines set up equations for the European patients in order to calculate the predicted values of FEV1 the equations are as follows: (Quanjer et al, 1993)

- ***Males*** *FEV1 predicted= 4.30 x height (m) - 0.029 x age (yrs) - 2.49*
  FVC predicted= 5.76 x height (m) - 0.026 x age (yrs) – 4.34
- ***Females*** *FEV1 predicted= 3.95 x height (m) - 0.025 x age (yrs) - 2.60*
  FVC predicted= 4.43 x height (m) - 0.026 x age (yrs) - 2.89

Then we calculated the FEV1% predicted and FVC% predicted for the COPD patients using these equations:

$$FEV1\%\ predicted = \frac{FEV1(actual)}{FEV1(predicted)} * 100$$

$$FVC\%\ predicted = \frac{FVC(actual)}{FVC(predicted)} * 100$$

The classification of COPD used in this research is the GOLD guidelines classification which is mentioned in the introduction chapter. (Figure 2)

2.1.1.3 Muscle Strength

A hand grip dynamometer was provided by the University of Sunderland to measure the muscle strength of each patient. Reasons behind performing the test and the method how to hold the dynanomometer were explained to the subjects. The hand grip strength values of each hand (right and left) was measured and recorded.

2.1.1.4 Dyspnoea

Patients were asked to answer a few questions related to their breathlessness in relation to the impaired activities using the Mahler Dyspnoea Index (MDI). MDI was developed by Mahler and colleagues in 1984 to assess the shortness of breath experienced by COPD patients and it consists of: (a) Baseline Dyspnoea Index (BDI) to measure the severity of dyspnoea at a single point in time as well as the impact of dyspnoea on an individual's life, and (b) Transition Dyspnoea Index (TDI) to note changes from the baseline assessment. (Mahler et al, 1984) Each index rates three different categories: magnitude of task needed to evoke dyspnoea, magnitude of effort needed to evoke dyspnoea, and functional impairment. Dyspnoea was rated in five grades from 0 (severe) to 4 (unimpaired) for each category. The score is determined based on the answers of the patient.

BDI indices have been validated in a multinational clinical trial, the BDI was significantly correlated with the Dyspnoea Diary and the symptom and activity scores of the SGRQ. (Witeck, 2003) (Baseline Dyspnoea Index: Appendix 6)

2.1.1.5 Quality of Life (QoL)

Patient's QoL was assessed using the St Georges' Respiratory Questionnaire (SGRQ) with the permission of Professor Paul Jones from St Georges' Hospital in London. English version (Appendix 3) of the questionnaire is used in all the centres and administered by the same investigator (myself) throughout the data collection and it was translated directly to the patients into the appropriate dialect in Morocco and in the United Arab Emirates. The translation was made by me with the help of the physicians and we agreed about the medical and frequently used terms, that

patients would understand and to employ in each dialect to avoid any major confusion. The Arabic version of SGRQ (Appendix 4) was used for reference.

As discussed in the introduction chapter, SGRQ is a disease specific measurement mainly used in COPD. The questionnaire has 76 items which are divided into three components:

1. **Symptom:** concerned with the effect of respiratory symptoms, their frequency and severity. The symptom score is calculated from the summed weights for the positive responses (Questions 1-8).
2. **Activity:** concerned with activities that cause or are limited by breathlessness. Activity score is calculated from the summed weights for the positive responses (Questions 11 and 15).
3. **Impact**: covers a range of aspects concerned with social functioning and psychological disturbances resulting from airways disease. The impact score is calculated from the summed weights for the positive responses (Questions 9-10, 12-14 and 16-17).

The total score is also calculated which summarises the impact of the disease on overall health status. It is calculated by summing all positive responses in the questionnaire, and scores are expressed as a percentage of overall impairment. (Appendix 6)

The questionnaire's scores are expressed in % for all the components; this percentage is calculated as follows:

- Symptom%: Symptoms score of each patient / 662.5 x 100
- Activity%: Activity score of each patient / 1209.1 x 100

- Impact%: Impact score of each patient/ 2117.8 x 100
- Total%: Total SGRQ score of each patient / 3989.4 x 100

Each questionnaire response has a unique empirically derived 'weight'. The lowest possible weight is zero and the highest is 100. Where 100 represents poor health status and 0 indicates better health status.

In multiple choice questions missing items were considered as “No=0”, and those with yes/no answer, the weight was subtracted from the total possible weight in each component.

2.1.1.6 Extra Questions

Some extra questions (see below) were asked to the patients in order to assess their awareness of their condition and their treatment. The results will be compared between patients from the three countries:

Question1: *Do you know that you have COPD?*

Question2: *Do you know your symptoms (cough, sputum and wheezing)?*

Question3: *Do you know smoking is the primary cause of COPD?*

Question4: *Do you know the most common causes of an exacerbation are infection of the tracheobronchial tree and air pollution?*

Question5: *Do you expect simple, one-off treatment to cure the symptoms?*

Question6: *Did you have influenza vaccination?*

Note: Influenza vaccinations are currently recommended in the care of people with COPD on a yearly basis. (Poole et al, 2010)

Question7: *Did you attend pulmonary rehabilitation?*

Question8: *Do you take irregular inhaled corticosteroids?*

Note: Some patients choose to take irregular inhaled steroids; both regular and irregular steroids reduce the risk of exacerbation. (Vollmer, 2007)

2.2 Selection of Control Group

The healthy group was recruited from the:

- Workers and passengers of the Moroccan National Rail Network in Casablanca (Morocco)
- In the United Arab Emirates: hospital employees, consultants, and some patients consulting other wards and not suffering from co-morbidities, severe illnesses such as severe visual impairments.
- Clients of Age Concern in the North East in the UK.

Age range was matched in all the three centers studied; in other words very young or very old healthy subjects were not recruited.

Participants aged 40 years old and above who agreed to take part in the study were included after being given a full explanation about the research and its purpose.

The tests performed for the control group were similar to those used for patients. Subjects were asked to complete the English version (Appendix 3) of the questionnaire and it was administered by the same investigator (myself) throughout the data collection and it was translated directly to the patients into the appropriate dialect in Morocco and in the United Arab Emirates. Subjects did also perform the spirometry test using the hand-held spirometer and then their muscle strength was measured using the hand grip dynamometer. Other information was also collected including: age, gender, height, weight, and smoking history.

Subjects who refused to take part in the study, those who could not perform spirometry and with known respiratory illness were excluded. Data was collected

under supervision of a GP at the Moroccan National Rail Network therefore subjects with doubts of having COPD were excluded from the study.

2.3 Statistical Analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) Version 14.0. Results are described as 'significant' if two-sided p-values were less than or equal to 0.05, but this is purely a conventional value. Estimates of means are shown with 95% two-sided confidence intervals.

2.3.1 Patients' Data Analysis

Chi-Square test is a statistical procedure for comparing proportions in two groups. In this study the Chi-Square test was used to compare the extra questions that were asked to the patients in two or more groups. It was also used to examine if there was a difference between countries for the two measures (gender and smoking status).

ANOVA Post Hoc test was used to compare each centre to every other one to see if they are significantly different in terms of their total SGRQ scores.

The effects of various study variables upon the QoL scores components were assessed using ***linear regression*** (As the QoL scores were measured on a continuous scale). Initially the separate effect of each variable upon the outcome was examined separately in a series of univariate analyses. For the continuous explanatory variables, the relationship with the QoL outcome was examined to see if a non-linear (i.e. curved) relationship was more appropriate than a linear (straight line) one.

The joint effect of the variables upon QoL in a multivariate analysis was assessed. This analysis has the advantage that the effect of each variable upon the QoL is

adjusted for the other factors in the analysis. A backwards selection procedure was used to retain only the statistically significant variables. This involves removing the non-significant variables, one at a time, until all remaining variables were significant.

The differences between the three countries were examined in terms of a number of parameters. All continuous variables were approximately normally distributed, and so analysis of variance (ANOVA) was used to compare between the three countries. The Chi-square test was used to compare the categorical variables (Gender and smoking status) between countries.

The differences in QoL between countries were examined next. Firstly the differences between countries were examined without considering any other factors in the analysis. Subsequently, the same difference was examined, this time adjusting for factors found to be significant in the first part of the analysis. Smoking status was included in this analysis, as this factor was almost significant in the multivariate analysis. All the analysis was performed using linear regression.

Additionally, the interaction between each of the explanatory variables and country was examined. A significant interaction would imply that the difference between country varied by that factor.

The final set of analysis examined the effect of the three dyspnoea variables upon QoL. This analysis was performed in three stages. Firstly the effect of each variable upon QoL was examined separately. Then the variables were examined together in a multivariate analysis. Finally the multivariate analysis was extended to also include factors previously found to significantly influence QoL and centre.

Before the multivariate analysis, the collinearity between the three dyspnoea variables was examined. Collinearity between variables occurs when two or more variables are very similar to each other. In such situations this can influence the results of regression analysis and produce unusual results. Collinearity was assessed using variance inflation factors (VIFs), with values of over 10 used to indicate collinearity. If this was present, then the solution is to only include one of the collinear variables in the regression analysis.

2.3.2 Control Group Data Analysis

The first set of analysis examined the differences between the countries in terms of a number of parameters. Data on some parameters was available for all three countries, whilst other information was only available for the UAE and Morocco. Where information was available for 3 countries, the comparisons were made between the 3 countries, and where it was available for only two, the comparisons were restricted to these two countries. All continuous variables were approximately normally distributed. Therefore, analysis of variance (***ANOVA***) was used to compare between the continuous measures between three countries, whilst the ***unpaired t-test*** was used where data was only present for two countries. The ***Chi-square*** test was used to compare the categorical variables between countries.

The effects of various study variables upon the QoL scores were examined. Due to missing data for some variables, this analysis was restricted to subjects from the UAE and Morocco only. As the QoL scores were measured on a continuous scale, the analysis was performed using ***linear regression***. Initially the separate effect of each variable upon the outcome was examined separately in a series of univariate analyses. For the continuous explanatory variables, the relationship with the QoL

outcome was examined to see if a non-linear (i.e. curved) relationship was more appropriate than a linear (straight line) one.

The second stage in the analysis process was to examine the joint effect of the variables upon QoL in a multivariate analysis. This analysis has the advantage that the effect of each variable upon the outcome is adjusted for the other factors in the analysis. A backwards selection procedure was used to retain only the statistically significant variables. This involves removing the non-significant variables, one at a time, until all remaining variables were significant.

The differences in QoL between countries were examined next. Firstly the differences between countries were examined without considering any other factors in the analysis. Subsequently, the same difference was examined, this time adjusting for factors that could potentially confound the country differences. The factors adjusted for were restricted to those where there was data for all three countries, namely age, BMI, gender and smoking status.

CHAPTER III

RESULTS

Total of 1800 subjects were included in this study, the table below shows the detailed number of subjects recruited from each centre. (Table 1) One of the first objectives was to compare the QoL between COPD patients and the control group, but after analysing the QoL of the control group we observed that in fact this group is not quite healthy therefore we decided to analyse both groups separately.

Associations between QoL and the physiological measurements will also be assessed, differences between the two genders from the United Kingdom will also be analysed as we were not able to recruit female COPD patients from the UAE and Morocco; we will come back to this point in the discussion chapter.

Centre	**United Arab Emirates**	**Morocco**	**United Kingdom**	
Gender	***Male***	***Male***	***Male***	***Female***
COPD Subjects	120	115	137	58
Control Group	301	301	284	484

Table 1: Number of COPD patients and control group included

3.1 Analysis of COPD Patients Data

ANOVA was used to compare the continuous variables between the three countries, and the results are summarised in the next table. (Table 2) The figures reported are the mean and standard deviation value for each country, and the p-values indicating the significance of the overall difference between the three countries.

Variable	**UAE Mean ±SD**	**Morocco Mean ±SD**	**UK Mean ±SD**	**p-value**
Age	60 ±15	62 ±10	71 ±9	**<0.001**
BMI	25 ± 3.6	21 ±3.0	26 ±3.6	**<0.001**
FEV1% Predicted	55 ±28	44 ±24	53 ±27	**0.004**
FVC% Predicted	48 ±23	54 ±21	76 ±21	**<0.001**
Grip score	58 ±19	57 ±19	51 ±18	**<0.001**
FEV1: Forced Expiratory Volume in 1 second, FVC: Forced Vital Capacity, FEV1/FVC%: Forced Expiratory Ratio				

Table 2: Baseline characteristics for COPD patients

The results indicated that there was a highly significant difference in all variables between the three countries:

- Patients from the UK tended to be older than patients from the other two countries, with a mean age of 71, compared to nearer 60 for the other countries.
- The BMI of Moroccan patients was the lowest, with similar values for the UAE and UK. The Patients from Morocco also had a lower FEV1% predicted than the other two countries.
- UK patients had the highest FVC% predicted, with a mean of 76 compared to 54 for Morocco, and a mean of 48 for the UAE. Conversely, UK patients had a lower grip score than the other two countries.

The next set of analysis used the Chi-square test to examine if there was a difference between countries for the two categorical measures (smoking status and gender. A summary of the analysis results is given in the next table. (Table 3) The figures reported are the number and percentage of responses in each category for each country.

Variable	Category	UAE N (%)	Morocco N (%)	UK N (%)	P-value
Smoking Status	Non/Ex-Smoker	77 (64%)	76 (66%)	172 (88%)	**<0.001**
	Smoker	43 (36%)	39 (34%)	23 (12%)	
Gender	Male	120 (100%)	115 (100%)	137 (70%)	**<0.001**
	Female	0 (0%)	0 (0%)	58 (30%)	

Table 3: Number and percentage of responses in gender and smoking status for each country

The results suggested that both smoking status and gender varied between countries. Smoking was much higher in the UAE and Morocco where over 30% of patients smoked, than in the UK where the figure was only 12%. The UAE and Moroccan groups consisted of all male patients, whilst 30% of UK patients were females.

3.1.1 Analysis of the Total Quality of Life of COPD Patients

3.1.1.1 Factors Associated with Total SGRQ Scores

Linear regression was used to examine the effect of various parameters upon the total SGRQ scores. Initially the separate effect of each variable upon this outcome was examined separately and the results are summarised in the next table.

The figures reported are the regression coefficients and also their corresponding 95% confidence intervals. For the continuous variables, the regression coefficients represent the change in the total SGRQ scores for a given increase in that variable (size of increase indicated in the table). For the categorical variables, the regression coefficients indicate the difference in QoL between each category and a baseline category. Also reported are the R-square values. These indicate the proportion of the total variation in QoL that is explained by each predictor. (Table 4)

Variable	Term /category	Coefficient (95% CI)	R^2	p-value
Age (**)	Linear term	-0.78 (-2.00, 0.45)	0.16	**<0.001**
	Squared term	0.11 (0.02, 0.21)		
BMI (*)	-	-0.31 (-0.56, -0.06)	0.01	**0.01**
FEV1% Predicted (**)	**-**	-0.31 (-0.38, -0.24)	0.15	**<0.001**
FVC% Predicted (**)	Linear term	-0.90 (-1.29, -0.51)	0.17	**<0.001**
	Squared term	0.05 (0.01, 0.08)		
Grip score (**)	Linear term	0.37 (-0.12, 0.86)	0.28	**<0.001**
	Squared term	-0.08 (-0.13, -0.04)		
Smoking Status	Non/Ex-Smoker	0	0.09	**<0.001**
	Smoker	-1.49 (-1.94, -1.04)		
Gender	Male	0	0.00	0.84
	Female	-0.06 (-0.65, 0.53)		
(*) Coefficients reported for a 5-unit increase in explanatory variable (**) Coefficients reported for a 10-unit increase in explanatory variable				

Table 4: Factors associated with the QoL in COPD patients

The results of the univariate analysis indicated that age, BMI, FEV1% predicted, FVC% predicted, Total Muscle Grip score and smoking status were all significantly associated with the total SGRQ scores. However, there was no significant difference between genders in terms of their QoL.

The analysis indicated that there was a significant second order regression component shown in a non-linear effect of age upon QoL. This makes it difficult to interpret the regression coefficients, and so the results are best shown graphically. The graph below shows the fitted regression line between age and total QoL. (Figure 3)

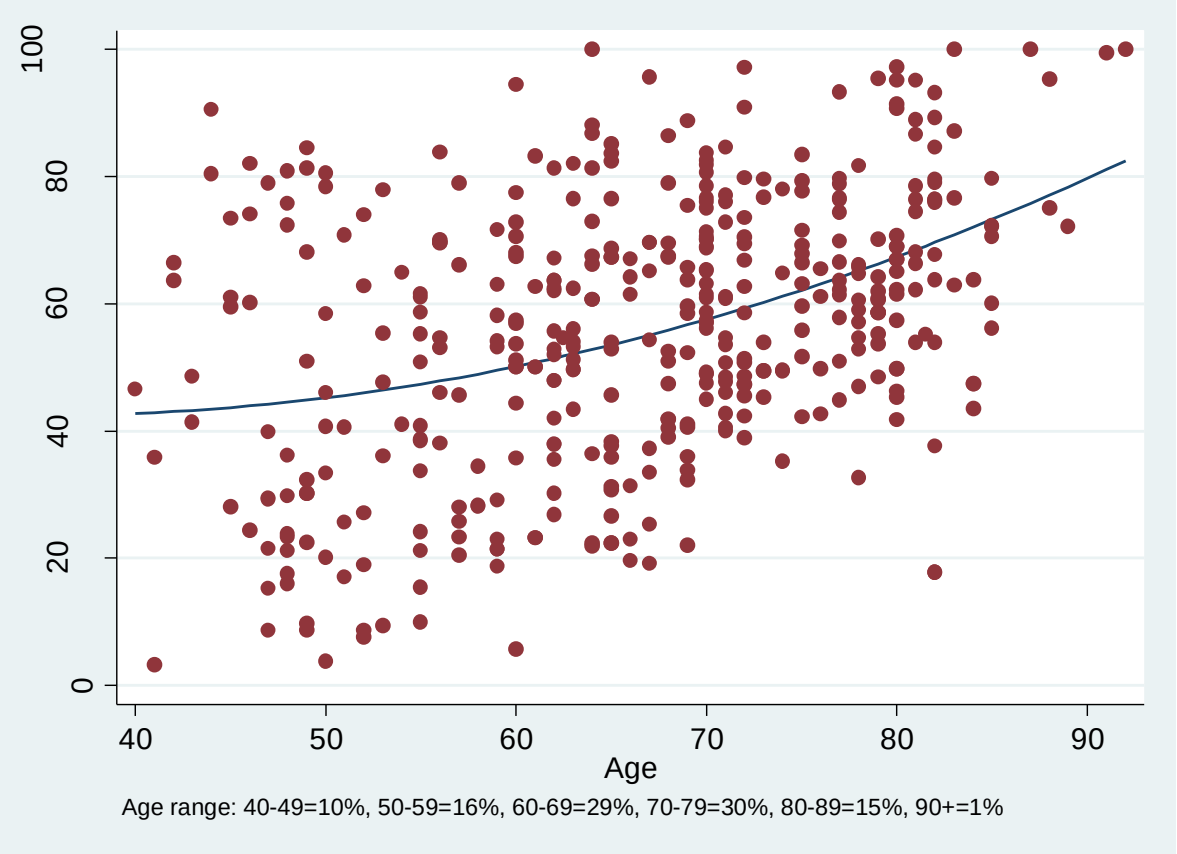

Figure 3: Regression line between age and QoL

The graph suggests that for older subjects the QoL scores increases with age, in other terms older patients tend to have poor QoL.

The results for BMI indicated that patients with a greater BMI had a better QoL. A 5-unit increase in BMI was associated with the SGRQ total score decreasing by 0.3 units. (Figure 4) A higher FEV1% predicted value indicated lower QoL scores. A 10-unit increase in FEV1% predicted was associated with a decrease in SGRQ score of 0.3 units. (Figure 5) Graphical representations of both of these two results are shown in the next graphs.

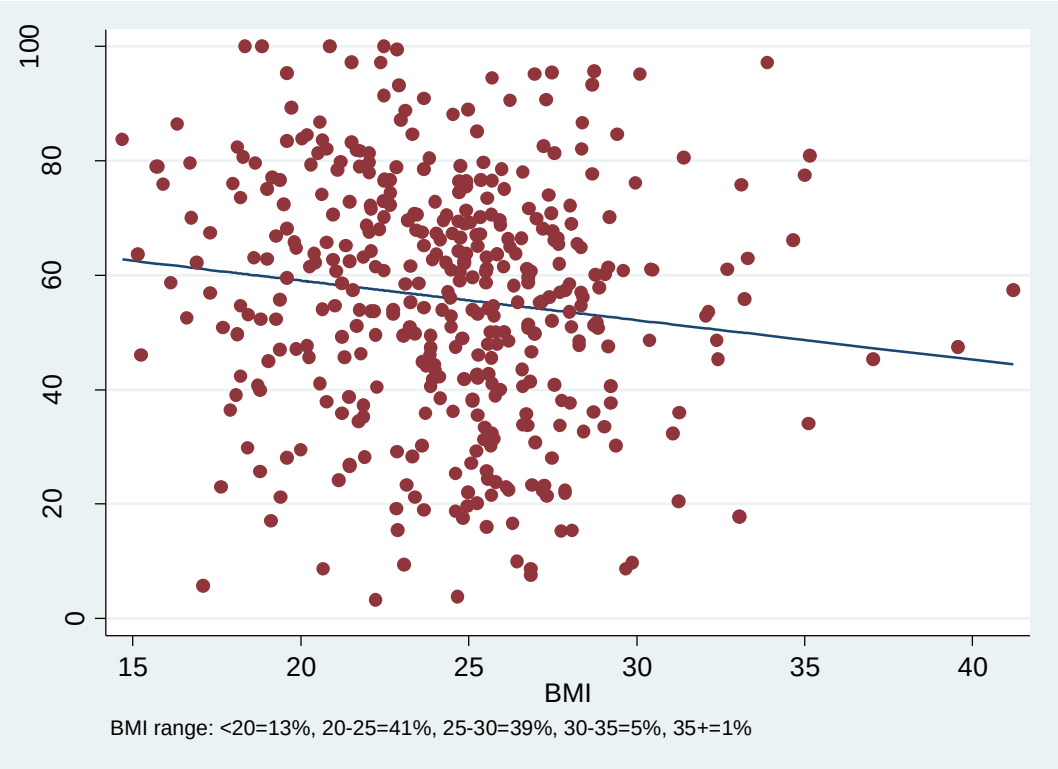

Figure 4: Regression line between BMI and QoL

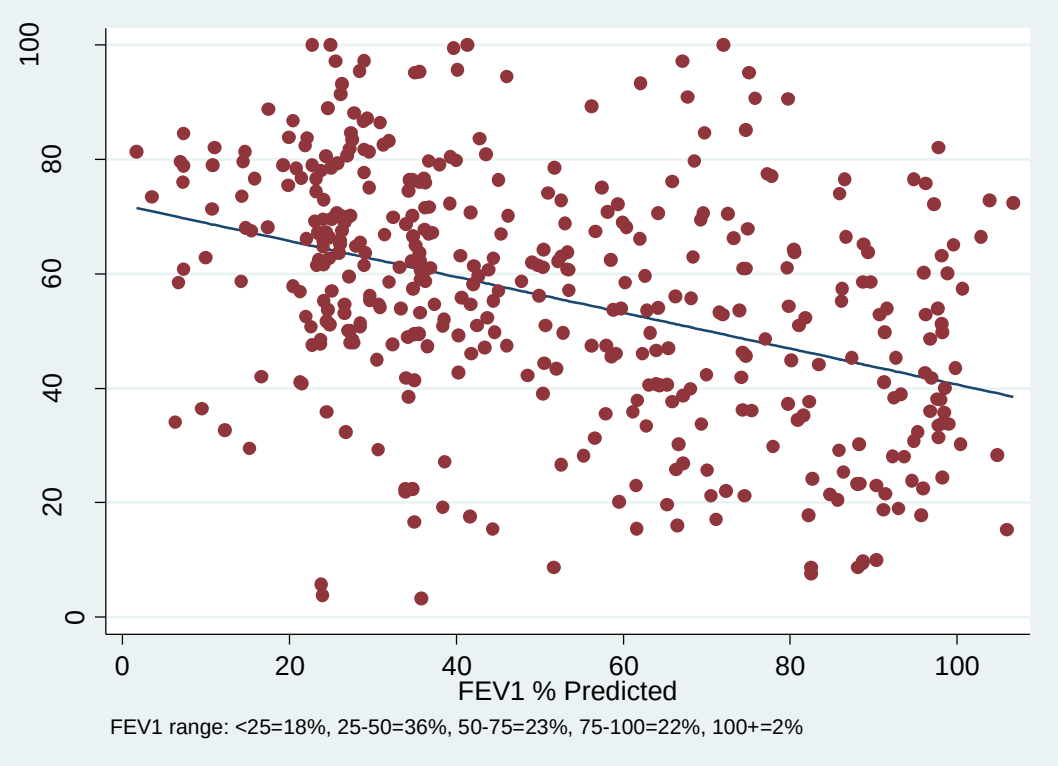

Figure 5: Regression line between FEV1% predicted and QoL

The results for FVC% predicted indicated that there was a non-linear (i.e. not a straight line) relationship with QoL. A graphical illustration of the relationship is shown in the next graph. (Figure 6)

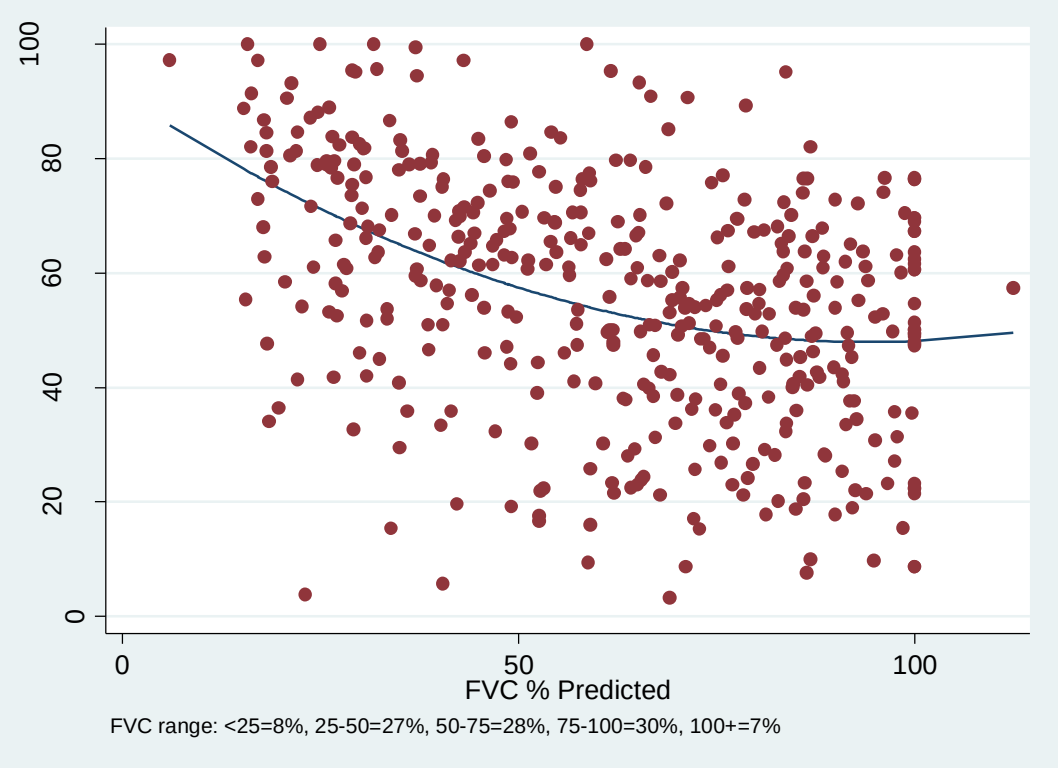

Figure 6: Relationship between FVC% predicted and QoL

The graph suggests that there was a decrease in SGRQ scores with increased FVC% predicted up to around 80% or 90%, after which there was little relationship with QoL.

There was also a non-linear relationship between TMG score and QoL. Again, with such a relationship it is easier to interpret the results graphically than from the coefficients. The fitted relationship between the two variables is shown in the next graph. (Figure 7) The graph suggests that there is little relationship between grip score and QoL for scores below 40. However, for scores above 40 there is a decrease in the SGRQ scores with increase grip score therefore better QoL.

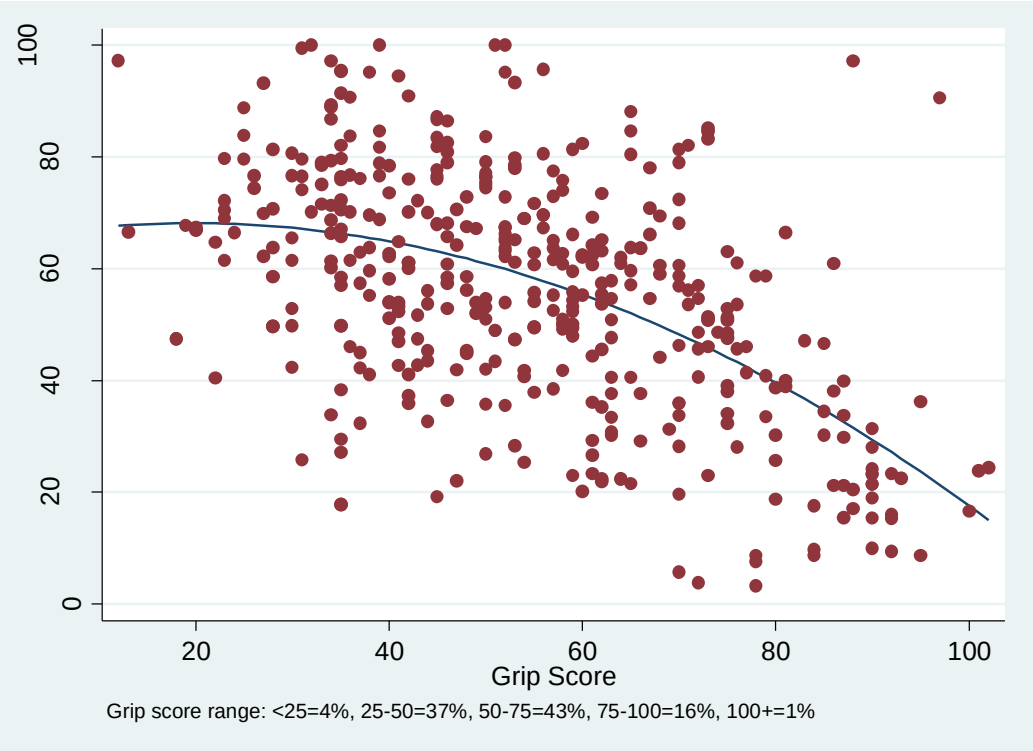

Figure 7: Relationship between Total Muscle Grip and QoL

The results for smoking status indicated that non or ex-smokers (of which the vast majority were ex-smokers) had lower SGRQ scores than current smokers, meaning that non or ex-smokers had better QoL than current smokers.

Afterwards multivariate analysis was performed to look at the joint effect of the factors upon the total SGRQ scores. A backwards selection procedure was used to retain only the statistically significant variables, and the final model is shown in the next table. (Table 5)

Variable	Term / category	Coefficient (95% CI)	p-value	R^2
Age (**)	Linear term	-1.41 (-2.49, -0.34)	<0.001	0.43
	Squared term	0.14 (0.06, 0.23)		
FVC% Predicted (**)	Linear term	-0.74 (-1.07, -0.41)	<0.001	
	Squared term	0.04 (0.01, 0.06)		
Grip score (**)	Linear term	0.66 (0.20, 1.11)	<0.001	
	Squared term	-0.09 (-0.13, -0.05)		
(**) Coefficients reported for a 10-unit increase in explanatory variable				

Table 5: Factors affecting the QoL (Multivariate analysis)

The results of the multivariate analysis indicated that age, FVC% predicted score and TMG score were all significantly associated with total QoL. After adjusting for these three measures, there was no longer a real evidence of an effect of BMI, FEV1% predicted and smoking status upon QoL (although the result for smoking status was very weakly significant p=0.049).

The coefficients for age, FVC% and TMG score were all in the same direction as the univariate analysis, suggesting similar direction of effects to those seen in this analysis. This suggests positive relationship between age and SGRQ scores, and a negative relationship between both FVC% predicted and TMG score with QoL score.

This final model had an R-square value of 0.43. This suggests that 43% of all variation in QoL can be attributed to the combination of age, FVC% predicted and TMG score. This suggests that just over half the remaining variation is due to other sources.

3.1.1.2Difference in QoL between Countries

When looking at the QoL of the patients included from each centre, we observed that the UK patients had lower symptom score than subjects from Morocco, with the poorest QoL seen in the UAE patients in terms of symptoms. In terms of activity scores, patients from the UAE had better QoL giving the low scores compared to the other centres, with no significant difference between Morocco and the UK. Patients from the UK had the best QoL in terms of impact scores over the UAE and Morocco. Overall, we observed that patients from the UAE had the poorest QoL, while the best QoL was recorded for patients from the UK. (Table 6)

Centre	United Arab Emirates	Morocco	United Kingdom
Symptom	57±23	53±22	47±18
Activity	67±25	81±24	82±21
Impact	40±22	41±26	35±19
Total Scores	63±25	55±22	51±17

Table 6: Quality of Life of COPD patients in each centre

To find out whether there were significant differences between the averages of the Total SGRQ scores for the three groups of patients, the one-way analysis of variance was used and the results were demonstrated in the following table.(Table 7)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	1168104.84	1	1168104.84	2537.02	**<0.001**
Centre	8706.99	2	4353.5	9.45	**<0.001**
Dependent Variable: Total QoL percent, R square=0.049 (Adjusted R square=0.44)					

Table 7 : Univariate analysis of variance, tests of effects between-subjects

The F-ratio value that was calculated from the analysis of variance of total SGRQ scores factor values for the three groups of patients was 9.455 and less than 1% significance level; this indicates the existence of significant differences among the averages of the Total SGRQ scores for COPD patients in the three regions. In other words, the averages of the Total SGRQ scores for COPD patients at the three regions are not at the same intensity.

The ANOVA Post Hoc test was used to test whether several means are equal across one variable. The table of post hoc analysis using Tukey test (using centre only) lists the three centres in the first column, and then compares each centre to every other centre to see if they are significantly different. It lists the mean differences between the total scores.

The differences in QoL between countries were examined next. Firstly the differences between countries were examined without considering any other factors in the analysis. Subsequently, the same difference was examined, this time adjusting for factors found to be significant in the first part of the analysis. Smoking status was included in this analysis, as this factor was almost significant in the multivariate analysis. All the analysis was performed using linear regression.

Here we see that the UAE (Centre 1) has a mean total SGRQ score 8 points higher than Morocco (Centre 2) with p=0.013 and more than 10 points higher than the UK (Centre 3) with p<0.001, meaning that the UAE has the worst QoL of the three centres. Morocco has higher SGRQ scores than the UK but not at significant level (p=0.4). (Table 8)

Centre	Centre	Mean Difference	Std. Error	p-value	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	8.03	2.81	.013	1.41	14.64
	3	11.54	2.69	.000	5.19	17.88
2	1	-8.03	2.81	.013	-14.64	-1.41
	3	3.50	2.71	.400	-2.87	9.89
3	1	-11.54	2.69	.000	-17.88	-5.19
	2	-3.50	2.71	.400	-9.89	2.87
Dependent variable: Total QoL percent						

Table 8: Post Hoc Tests (Tukey HSD)

The results above show that there is:

- Statistical significant differences between the total SGRQ scores for COPD patients in the regions of the UAE and Morocco, it can be said that with 95% confidence level that the average of total SGRQ scores for COPD patients in the UAE is higher than patients from Morocco. In other words patients from the UAE have poorer QoL than Moroccan patients.

- Statistical significant differences at (1%) significance level between the total SGRQ scores for COPD patients from the UAE and the UK, Patients from the UK had better QoL than patients from the UAE.
- No statistical significant differences between the total SGRQ scores for COPD patients from Morocco and the UK.

Another way to analyse if there are differences between the three countries was done twice; firstly unadjusted and then adjusted for factors associated with total QoL. A summary of the results is given in the next table. The figures are the regression coefficients, which represent the difference in QoL between each country and the baseline category (in this case the UAE). The first p-value reported is the significance of the overall difference between countries. The subsequent p-values indicated the specific differences between pairs of countries. These latter set of p-values were given a Bonferroni adjustment to allow for multiple comparisons.(Table 9)

Country	**Unadjusted**		**Adjusted**	
	Coefficient (95% CI)	**p-value**	**Coefficient (95%**	**p-value**
UAE	0	**<0.001**	0	**<0.001**
Morocco	-0.9 (-1.4, -0.3)		-0.8 (-1.2, -0.4)	
UK	-1.1 (-1.6, -0.6)		-1.4 (-1.9, -1.0)	
UAE vs. Morocco		**0.006**		**<0.001**
UAE vs. UK		**<0.001**		**<0.001**
Morocco vs. UK		1.00		**0.009**

Table 9: Differences between pairs of countries before and after adjusting for the other factors

The results indicated that there was an overall significant difference between three countries when no other factors were considered (the unadjusted results). The highest scores were for the UAE, which were significantly higher than those in Morocco and the UK. On average, there was a difference of around 1 unit on the scale between countries. However, there was no significant difference between

Morocco and the UK. In other words the UAE patients have the poorest QoL than those from the UK and Morocco.

When the significant risk factors (BMI, age, TMG, FEV1% predicted, smoking) were taken into account, there was still a significant overall difference between the three countries. Again scores in the UAE were the highest, significantly more than both of the other two countries. However, after adjustment, scores were now significantly lower in the UK than they were in Morocco. The difference in total SGRQ scores between the UAE and the UK was 1.4 units.

Subsequently the interaction between country and each of the other variables was examined. The results suggested no significant interaction between country and TMG score (p=0.35). This suggests that differences between countries do not vary depending on either age or TMG score.

However, there was found to be a significant interaction between country and FVC% predicted (p=0.03). This suggests that the difference between countries varies depending of the FVC% predicted values. As a result of this, the effect of FVC% predicted upon QoL was quantified for each of the three countries. The results are summarised below. (Table 10)

Country	Term / category	Coefficient (95% CI)	P-value
UAE	Linear term	-0.04 (-0.19, 0.12)	**0.002**
	Squared term	0.05 (0.01, 0.08)	
Morocco	Linear term	-0.29 (-0.44, -0.14)	**<0.001**
	Squared term	0.05 (0.01, 0.08)	
UK	Linear term	-0.20 (-0.32, -0.08)	**0.004**
	Squared term	0.05 (0.01, 0.08)	

Table 10: Effect of FVC% predicted upon QoL on each country

The results show that although there is a significant interaction with country, there was still a significant effect of FVC% predicted upon QoL for each of the three countries.

Due to the non-linear relationship between variables, it is easier to show the results graphically. A graphical illustration of the nature of the interaction is shown in the next graph. This shows the relationship between FVC% predicted and total QoL for each of the three countries. (Figure 8)

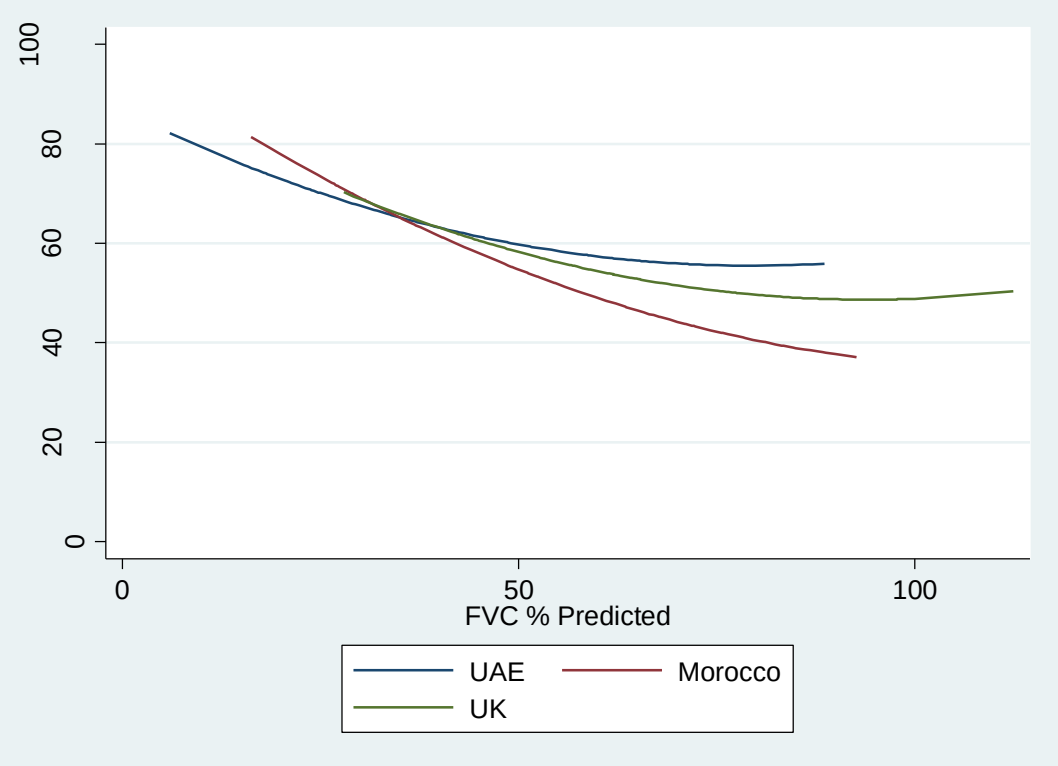

Figure 8: Relationship between FVC% predicted and total QoL for each of the three countries

The nature of the interaction suggests that for patients with low FVC% predicted values, the total SGRQ scores are lowest in the UAE and highest in Morocco. Conversely for patients with high FVC% predicted scores, values are lowest in Morocco, but highest in the UAE.

The following graphs represent the effect of FVC% predicted on the total SGRQ scores for each country and representing individual regression points. Figures 9-11 show the relationship between FVC% predicted and total SGRQ scores in the UAE, Morocco and the UK respectively.

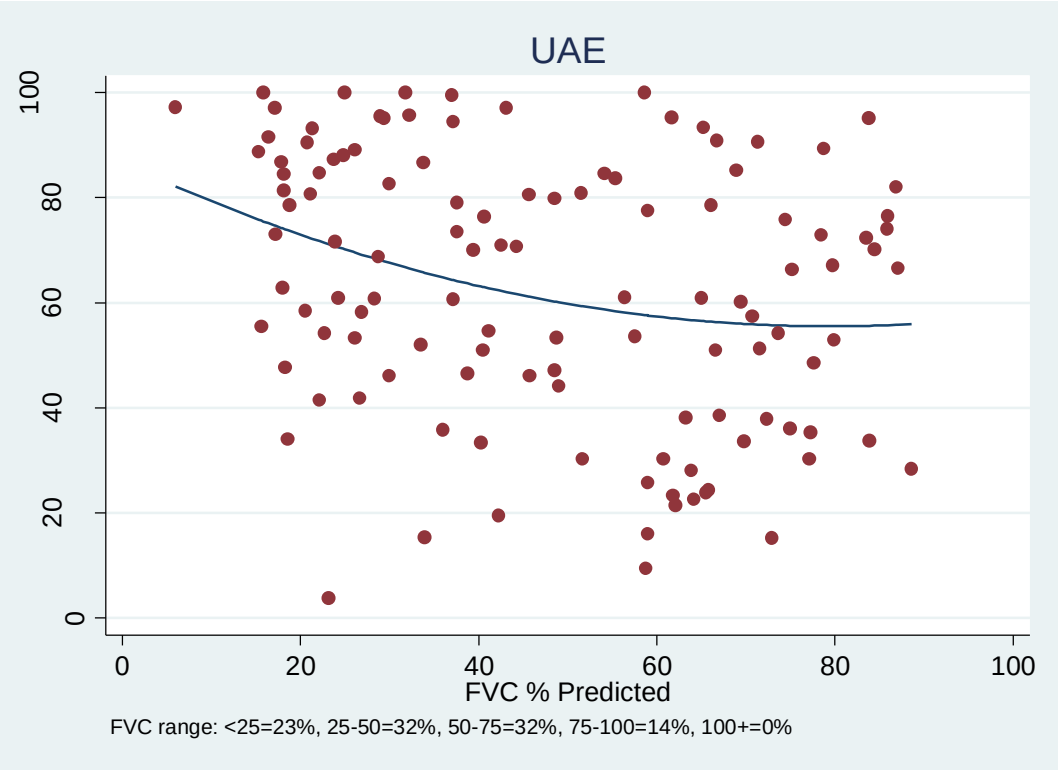

Figure 9: Effect of FVC% predicted on the total SGRQ scores in the UAE

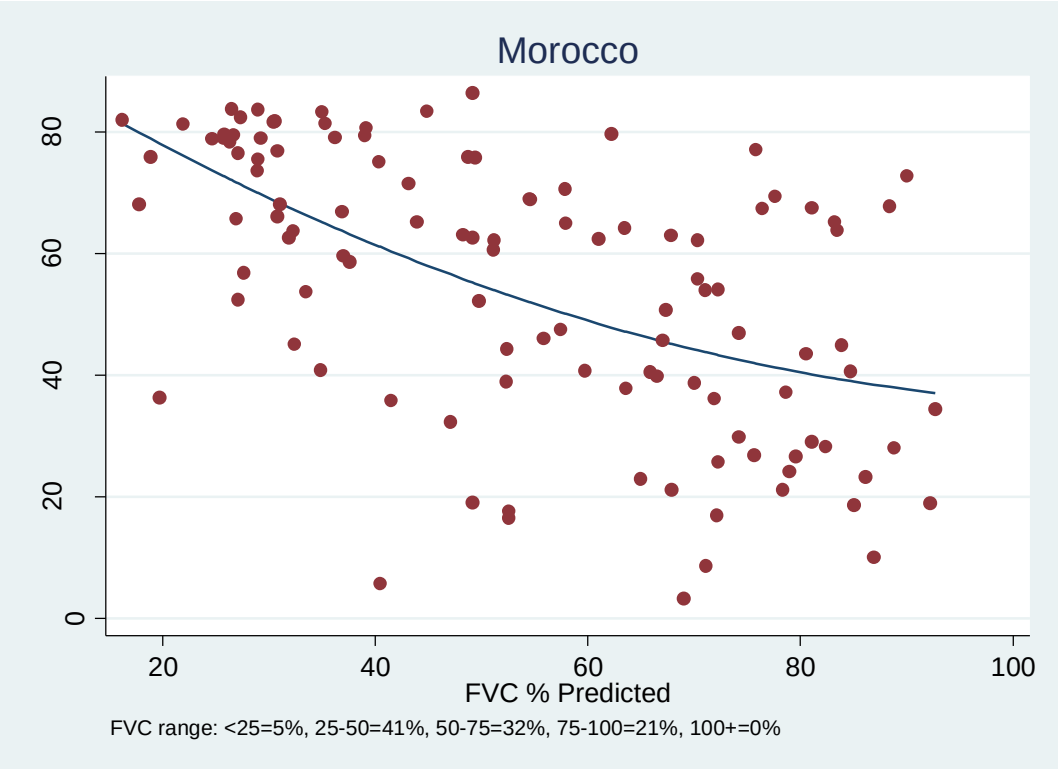

Figure 10: Effect of FVC% predicted on the total SGRQ scores in Morocco

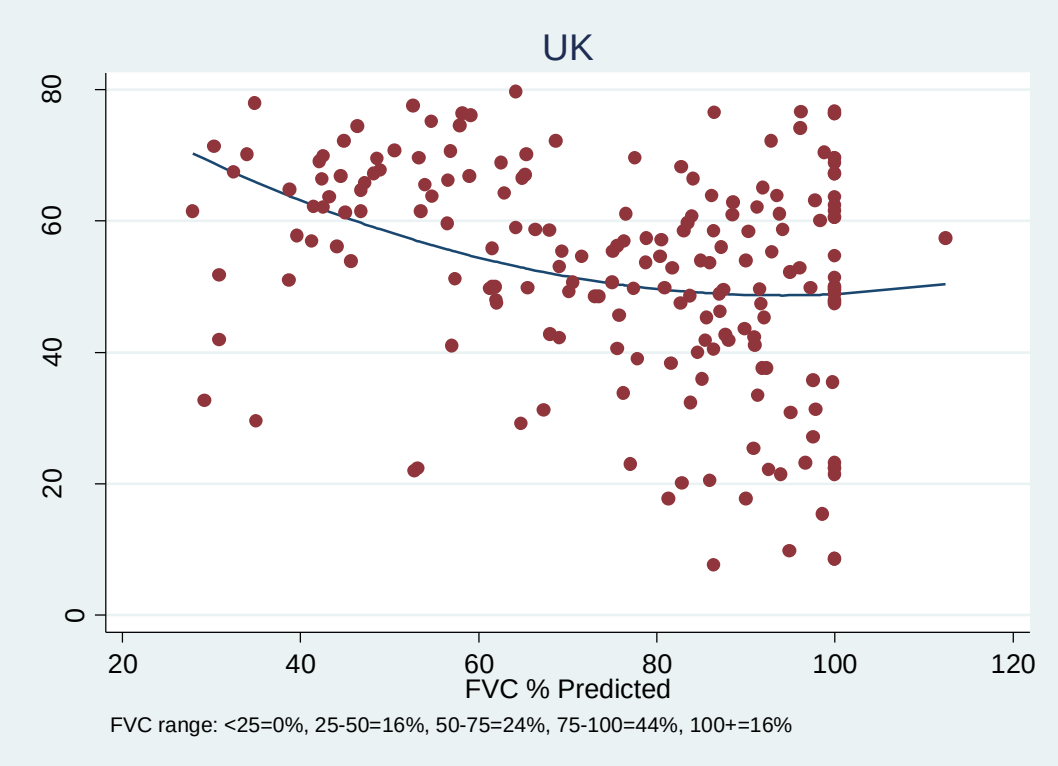

Figure 11: Effect of FVC% predicted on the total SGRQ scores in the UK

3.1.1.3 Effect of Dyspnoea on the Total QoL Scores

Dyspnoea, which is defined as an uncomfortable sensation of breathing is the main cause of disability in COPD patients. Several studies confirm that dyspnoea affects the QoL of COPD patients.

The next set of analysis examined the effect of the three dyspnoea variables from the BDI upon QoL. This was done using linear regression in three stages, and the results are summarised in the next table. (Table 11) Noting that in the multivariate analysis including the three dyspnoea variables: magnitude of task, functional impairment and magnitude of effort, a strong evidence of collinearity was found between the magnitude of effort and the magnitude of task. This suggests that these two variables are almost identical to each other; in fact they have a correlation of 0.99, with VIF of 12.7 (greater than 10), and the tolerance of 0.079 (below 0.1). These results suggest that the two variables are near perfect linear combinations of one another; therefore it is not possible to include both variables in the same analysis, and so it was chosen to include only the magnitude of effort. (Figure 12)

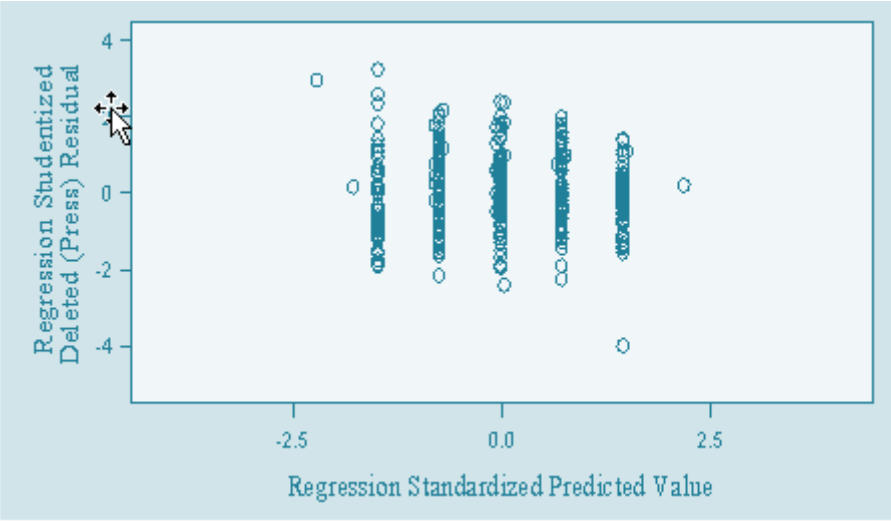

Figure 12: Collinearity between magnitude of task and magnitude of effort

The figures reported are the regression coefficients and their corresponding 95% confidence intervals. The scales for all variables are that higher values represent a lower grade. So the regression coefficients represent the change in total QoL for a one-grade decrease in each variable. (Table 11)

Analysis	Variable	Coefficient (95%	P-value
Univariate	Functional impairment	1.23 (1.11, 1.35)	**<0.001**
	Magnitude of task	1.17 (1.05, 1.28)	**<0.001**
	Magnitude of effort	1.17 (1.05, 1.29)	**<0.001**
Multivariate	Functional impairment	0.77 (0.45, 1.08)	**<0.001**
	Magnitude of task	0.49 (0.19, 0.79)	**0.002**
Multivariate + adjusted	Functional impairment	0.50 (0.24, 0.76)	**<0.001**
	Magnitude of task	0.58 (0.34, 0.83)	**<0.001**

Table 11: Relationship between dyspnoea and total QoL

The univariate results suggested that all three factors were associated with total SGRQ scores. A one-grade decrease in any of the variables was associated with an increased total SGRQ score of just over one-unit.

The relationship between function impairment and the total SGRQ score is illustrated in the next graph, which shows that COPD patients with advanced dyspnoea (functional impairment) have poor QoL. (Figure 13)

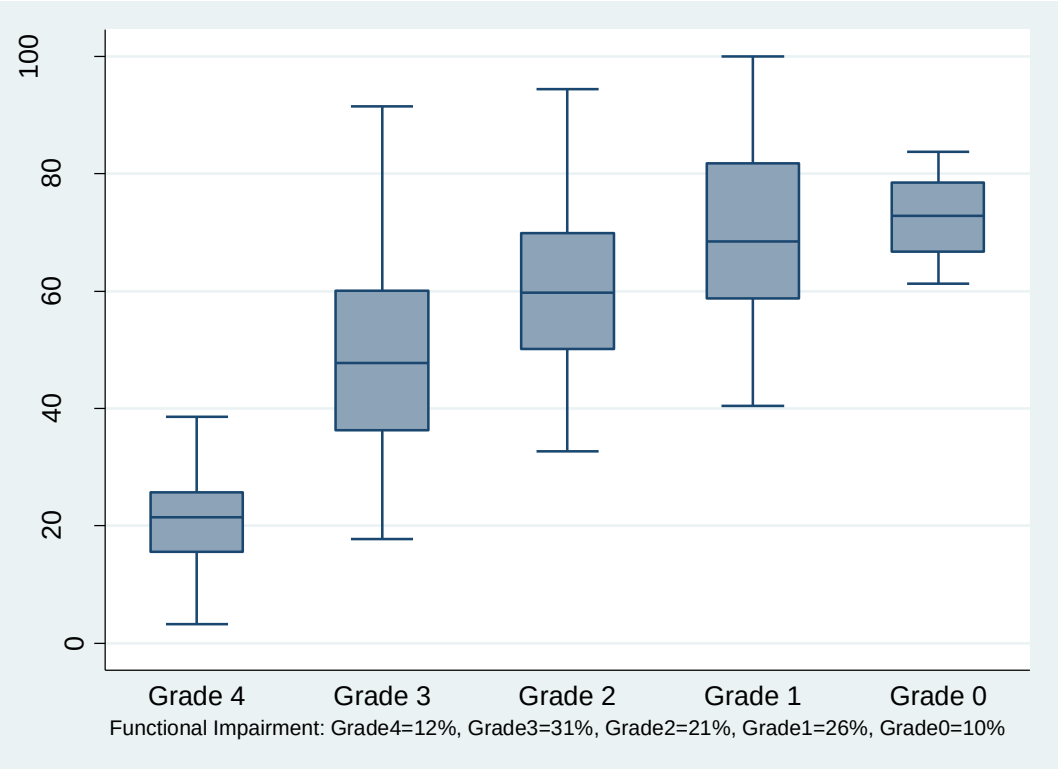

Figure 13: Association between total SGRQ scores and functional impairment

When both functional impairment and magnitude of task were included in the same regression model in a multivariate analysis, both were still statistically significant although the effects of each factor were smaller. Similarly both factors were still significant after adjusting for age, FVC% predicted and TMG score.

3.1.1.4 QoL and Gender Differences in COPD Patients

Because no female COPD patients were recruited in the UAE or Morocco, the gender differences will be analysed comparing the UK COPD patients only: 137 male patients and 58 female patients. The table below represents the patients' main characteristics. (Table 12)

Centre	United Kingdom	
Subjects	Male (n=137)	Female (n=58)
Age (yrs)	71±9.2	73±9.7
BMI	26±3.5	25±4.5
FEV1% predicted	53±26.7	60±26.1
FVC% predicted	76±20.9	74±20.4
Total Muscle Grip	51±17.6	36±10.8

Table 12: UK patients' characteristics

In order to assess the effect of gender on the QoL of COPD patients a T-test was used. This test is used to verify whether there is significant difference between the means of two groups (male v female).

The table below represents the means of the QoL components for the two genders. (Table 13)

	Gender	N	Mean	Std. Error Mean
Symptom score	Male	137	47±18.4	1.5
	Female	58	51±18.8	2.4
Impact score	Male	137	35±18.5	1.6
	Female	58	38±16.8	2.2
Activity score	Male	137	82±20.6	1.7
	Female	58	86±15.7	2
Total score	Male	137	51±16.9	1.4
	Female	58	55±14.7	1.9

Table 13: QoL of COPD patients from the UK

The results indicate that there is no significant difference between the mean total SGRQ scores for males and females. There is no significant difference between the mean symptom, impact and activity scores for males and females (0.09, 0.32 and 0.11 respectively). (Table 14)

Scores	Levene's test for equality of		t-test for equality of means					
	F	Sig.	df	p-value	Mean difference	Std. error difference	95% confidence interval of the	
							Lower	Upper
Total	0.45	0.50	193	0.14	-3.70	2.55	-8.74	1.32
Symptom	0.11	0.74	193	0.09	-4.81	2.90	-10.54	.918
Impact	1.04	0.30	193	0.32	-2.76	2.82	-8.33	2.80
Activity	2.74	0.09	193	0.11	-4.75	3.02	-10.72	1.21

Table 14: Effect of gender on the QoL of COPD patients from the UK

3.1.2 Analysis of the Symptom SGRQ Scores of COPD Patients

This section details how the three different countries varied in terms of the symptoms component of the QoL score. In this section only male patients were included because gender did not have any effect as noted in the previous section. The methods used for the analysis was equivalent to those described in the first section of the results.

3.1.2.1 Factors Associated with the Symptom Scores

Linear regression was used to examine the effect of various parameters upon the symptom scores. Initially effect of each variable upon this outcome was examined one at a time, and the results are summarised in the next table. (Table 15) The figures reported are the regression coefficients, and also their corresponding 95% confidence intervals. For the continuous variables, the regression coefficients represent the change in the symptom scores for a given increase in that variable (size of increase indicated in the table). For the categorical variables, the regression coefficients indicate the difference in QoL in terms of symptom scores between each

category and a baseline category. Also reported are the R-square values. These indicate the proportion of the total variation in symptom SGRQ score that is explained by each predictor. (Table 15)

Variable	Term / category	Coefficient (95% CI)	R^2	P-value
Age (**)	Linear term	0.75 (0.58, 0.91)	0.16	**<0.001**
	Squared term	0.17 (0.07, 0.26)		
BMI (*)	-	-0.32 (-0.57, -0.07)	0.01	**0.01**
FEV1% Predicted (**)	**-**	-0.28 (-0.35, -0.20)	0.12	**<0.001**
FVC% Predicted (**)	Linear term	-0.30 (-0.38, -0.22)	0.16	**<0.001**
	Squared term	0.05 (0.02, 0.08)		
Total Muscle Grip(**)	Linear term	-0.48 (-0.57, -0.38)	0.21	**<0.001**
	Squared term	-0.06 (-0.10, -0.01)		
Smoking Status	Non/Ex-Smoker	0	0.06	**<0.001**
	Smoker	-1.22 (-1.67, -0.76)		

(*) Coefficients reported for a 5-unit increase in explanatory variable

(**) Coefficients reported for a 10-unit increase in explanatory variable

Table 15: Effect of each variable upon the Quality of Life

Our results showed a very similar picture to those observed for the total QoL. The univariate analysis indicated that age, BMI, FEV1% predicted, FVC% predicted, grip score and smoking status were all significantly associated with the symptom component of QoL score.

The analysis indicated that there was a non-linear effect of age upon the QoL symptom component. This makes it difficult to interpret the regression coefficients, and so the results are best shown graphically. The graph below shows the fitted regression line between age and symptom SGRQ score. (Figure 14)

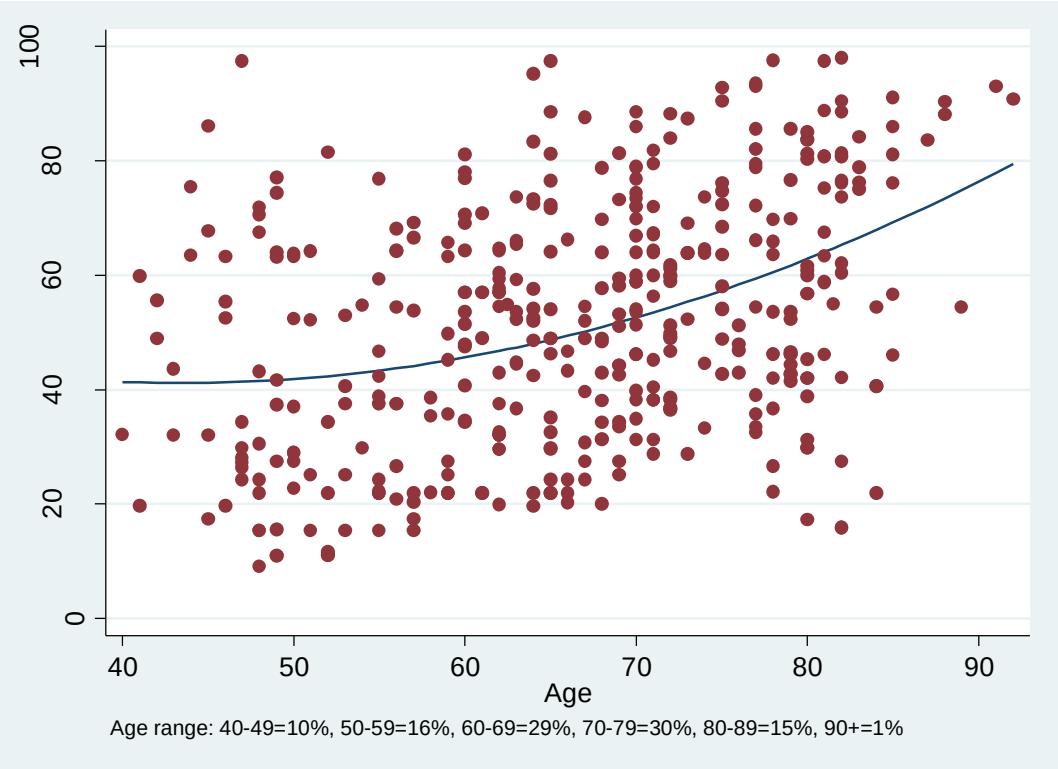

Figure 14: Association between age and symptom scores

The graph suggests that the symptom SGRQ scores increase with age; in other words the older the patient is the poorest the QoL symptom is.

The results for BMI indicated that patients with a high BMI had a poor QoL (high symptom scores). A 5-unit increase in BMI was associated with the SGRQ symptom score decreasing by 0.3 units. A higher FEV1% predicted value was also associated with a lower SGRQ symptom score. A 10-unit increase in FEV1% predicted was associated with a decrease in the symptom score of 0.3 units.

The results for FVC% predicted indicated that there was a non-linear (i.e. not a straight line) relationship with the QoL symptom measure. A graphical illustration of the relationship is shown in the next graph. (Figure 15)

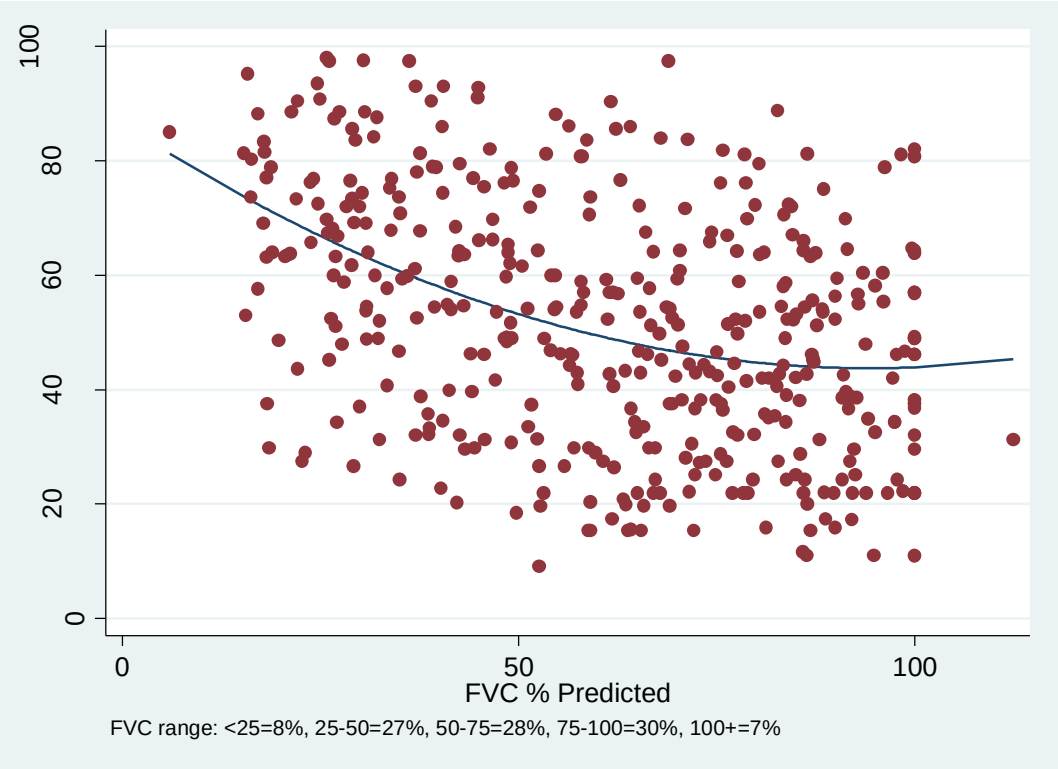

Figure 15: Effect of FVC% predicted on symptom scores

The graph suggest that there was a decrease in SGRQ symptom scores with increased FVC% predicted up to around 80% or 90%, after which there was little relationship with QoL.

There was also a non-linear relationship between TMG score and QoL. Again, with such a relationship it is easier to interpret the results graphically than from the coefficients. The fitted relationship between the two variables is shown in the next graph. The graph suggests that there is little relationship between TMG and QoL for scores below 40. However, for scores above 40 there is a decrease in the SGRQ symptom score with an increase in grip score. (Figure 16)

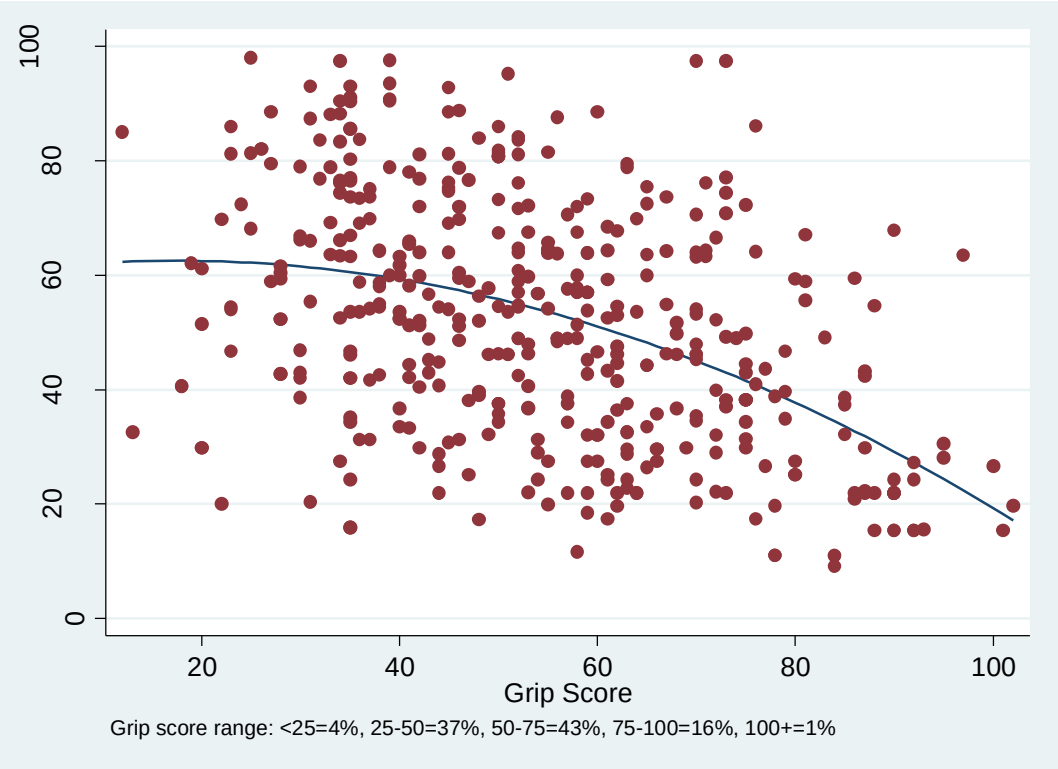

Figure 16: Association between Total Muscle Grip and symptom scores

The results for smoking status indicated that non or ex-smokers had higher QoL scores in terms of symptom scores than current smokers. Current smokers had scores that were, on average, 1.2 units lower than non/ex-smokers.

A multivariate analysis was performed to look at the joint effect of the factors upon the QoL symptom score. A backwards selection procedure was used to retain only the statistically significant variables and the final model is shown in the next table. (Table 16)

Variable	Term /	Coefficient (95% CI)	P-value
Age (**)	Linear term	0.55 (0.38, 0.73)	<0.001
	Squared term	0.18 (0.10, 0.27)	
FVC% Predicted (**)	Linear term	-0.27 (-0.34, -0.21)	<0.001
	Squared term	0.04 (0.01, 0.07)	
Total Muscle Grip (**)	Linear term	-0.23 (-0.34, -0.12)	<0.001
	Squared term	-0.07 (-0.11, -0.03)	
(**) Coefficients reported for a 10-unit increase in explanatory variable			

Table 16: Joint effect of the significant variables on the symptoms scores

The results of the multivariate analysis indicated that age, FVC% predicted score and TMG were all significantly associated with the symptoms component of QoL. After adjusting for these three measures, there was no longer found to be real evidence of an effect of BMI, FEV1% predicted and smoking status upon symptom scores.

The coefficients for age, FVC% and TMG were all in the same direction and a similar magnitude as the univariate analysis, suggesting similar direction of effects to those seen in this analysis. This suggests positive relationship between age and symptom score, and a negative relationship between both FVC% predicted and TMG and the QoL symptom score.

This final model had an R-square value of 0.38. This suggests that 38% of all variation in QoL symptoms score can be attributed to the combination of age, FVC% predicted and TMG. This suggests that the remaining 62% of variation is due to other sources.

3.1.2.2 Difference in Symptoms Scores between Countries

The next set of analyses compared the QoL symptoms score between the three countries. Initially this was done twice, firstly unadjusted, and then adjusted for factors associated with symptoms scores. A summary of the results is given in the next table. The figures are the regression coefficients, which represent the difference in QoL between each country and the baseline category (in this case UAE). The first p-value reported is the significance of the overall difference between countries. The subsequent p-values indicated the specific differences between pairs of countries. These latter set of p-values were given a Bonferroni adjustment to allow for multiple comparisons. (Table 17)

Country	Unadjusted		Adjusted	
	Coefficient	P-value	Coefficient (95%	P-value
UAE	0	**<0.001**	0	**<0.001**
Morocco	-0.6 (-1.1, -0.1)		-0.4 (-1.2, -0.4)	
UK	-1.0 (-1.4, -0.5)		-1.2 (-1.9, -1.0)	
UAE vs. Morocco		0.08		0.20
UAE vs. UK		**<0.001**		**<0.001**
Morocco vs. UK		0.44		**0.003**

Table 17: Comparison of the symptoms scores between the three countries

The results indicated that there was an overall significant difference between the three countries when no other factors were considered (the unadjusted results). The highest scores were for the UAE, which were significantly higher than those in the UK. On average, there was a difference of around 1 unit in the symptoms score between the UK and the UAE. However, there was no significant difference between Morocco and the UK.

When the significant risk factors were taken into account, there was still a significant overall difference between the three countries. Again scores in the UAE were the highest, although there was no significant difference with the scores from Morocco. Patients from the UK had the lowest scores, and after adjusting for the other variables, symptom scores from the UK were now significantly lower than they were in both Morocco and the UAE. The difference in the QoL symptom scores between the UAE and the UK was 1.2 units.

Subsequently the interaction between country and each of the other variables was examined. The results suggested no significant interaction between country and age (p=0.12), between FVC% predicted and country (p=0.48), or between country and TMG (p=0.55). This suggests that differences between countries do not vary depending on age, FVC% or TMG.

3.1.2.3 Effect of Dyspnoea on the Symptom Scores

The next set of analysis examined the effect of the three dyspnoea variables from the BDI upon the QoL symptoms component. This was done using linear regression in three stages, and the results are summarised in the next table.

As indicated previously, there was strong collinearity between the magnitude of effort and the magnitude of task, suggesting that only one of the two variables can be included in the multivariate analysis.

The figures reported are the regression coefficients and their corresponding 95% confidence intervals. The scales for all variables are such that higher values represent a lower grade. So the regression coefficients represent the change in QoL for a one-grade decrease in each variable. (Table 18)

Analysis	Variable	Coefficient (95% CI)	p-value
Univariate	Functional impairment	1.00 (0.86, 1.15)	**<0.001**
	Magnitude of task	0.93 (0.79, 1.06)	**<0.001**
	Magnitude of effort	0.93 (0.78, 1.07)	**<0.001**
Multivariate	Functional impairment	0.79 (0.43, 1.16)	**<0.001**
	Magnitude of task	0.22 (-0.13, 0.57)	0.21
Multivariate + adjusted	Functional impairment	0.45 (0.12, 0.78)	**0.008**
	Magnitude of task	0.27 (-0.04, 0.58)	0.09

Table 18: Association between Dyspnoea and symptom scores in COPD patients

The univariate results suggested that all three factors were associated with symptom QoL. A one-grade decrease in any of the variables was associated with an increased QoL symptom score of around one-unit.

When both functional impairment and magnitude of task were included in the same regression model in a multivariate analysis, only functional impairment was

statistically significant. After adjusting for this variable, there was no longer a significant effect of magnitude of the task upon the QoL symptom scores.

3.1.3 Analysis of Activity SGRQ Scores of COPD Patients

In this section we will study how the three countries varied in terms of the activity component of the QoL. This part will only analyse and compare male COPD patients as gender effect appeared to be non significant as noted in the previous section. This will be analysed using similar tests used in the previous sections.

3.1.3.1 Factors Associated with Activity Scores

Linear regression analysis was used to examine the effect of various parameters upon the activity SGRQ scores. Initially the separate effect of each variable upon this outcome was examined separately and the results are summarised in the next table. The figures reported are the regression coefficients, and also their corresponding 95% confidence intervals. For the continuous variables, the regression coefficients represent the change in the activity score for a given increase in that variable (size of increase indicated in the table). For the categorical variables, the regression coefficients indicate the difference in QoL between each category and a baseline category. (Table 19) Also reported are the R-square values. These indicate the proportion of the total variation in QoL activity component that is explained by each predictor. (Table 19)

Variable	Term / category	Coefficient (95% CI)	R^2	p-value
Age (**)	-	0.97 (0.82, 1.13)	0.27	**<0.001**
BMI (*)	-	-0.39 (-0.66, -0.12)	0.02	**0.004**
FEV1% predicted (**)	-	-0.29 (-0.37, -0.21)	0.12	**<0.001**
FVC% predicted (**)	-	-0.11 (-0.20, -0.02)	0.01	**0.02**
Grip score (**)	Linear term	-0.59 (-0.69, -0.49)	0.31	**<0.001**
	Squared term	-0.10 (-0.15, -0.06)		
Smoking status	Non/Ex-Smoker	0	0.18	**<0.001**
	Smoker	-2.21 (-2.67, -1.74)	0.02	

(*) Coefficients reported for a 5-unit increase in explanatory variable

(**) Coefficients reported for a 10-unit increase in explanatory variable

Table 19: Univariate analyses of the effect of the variables on the activity scores

The univariate analysis indicated that all the variables examined were significantly associated with the activity component of QoL score.

The results for age suggested that there was a significant positive relationship with activity score. A10 year increase in age was associated with the activity score increasing by almost one-unit.

The results for BMI indicated that patients with a greater BMI had a lower QoL activity score, meaning better QoL in terms of activity. A 5-unit increase in BMI was associated with the QoL activity scores decreasing by 0.4 units.

Higher FEV1% and FVC% predicted values were also associated with better QoL. A 10-unit increase in FEV1% predicted was associated with a decrease in activity scores of 0.3 units, whilst a 10-unit increase in FVC% predicted was associated with a decrease in activity score of 0.1units.

There was a non-linear relationship between TMG and QoL activity score. With such a relationship it is easier to interpret the results graphically than from the coefficients. The fitted relationship between the two variables is shown in the next graph. The

graph suggests that there is little relationship between TMG and activity score for TMG scores below 40. However, for grip scores above 40 there is a decrease in the QoL activity score with an increase in grip score, so the higher the TMG the better the QoL. (Figure 17)

Figure 17: Relationship between Total Muscle Grip and activity scores

The results for smoking status indicated that current smokers had better QoL than non or ex-smokers. Current smokers had scores that were, on average, 2.2 units lower than non/ex-smokers.

Then, a multivariate analysis was performed to look at the joint effect of the factors upon the QoL activity scores. A backwards selection procedure was used to retain only the statistically significant variables and the final model is shown in the next table. (Table 20)

Variable	Term / category	Coefficient (95% CI)	p-value
Age (**)	-	0.55 (0.38, 0.73)	<0.001
BMI (*)	-	-0.25 (-0.47, -0.04)	0.02
FEV1% Predicted (**)	-	-0.16 (-0.23, -0.09)	<0.001
Grip score (**)	Linear term	-0.27 (-0.38, -0.15)	<0.001
	Squared term	-0.05 (-0.09, 0.00)	
Smoking Status	Non/Ex-Smoker	0	<0.001
	Smoker	-0.86 (-1.30, -0.41)	
(*) Coefficients reported for a 5-unit increase in explanatory variable (**) Coefficients reported for a 10-unit increase in explanatory variable			

Table 20: Joint effect of the factors on the activity scores (multivariate analysis)

The results of the multivariate analysis indicated that age, BMI, FEV1% predicted score, Total Muscle Grip and smoking status were all significantly associated with the activity component of QoL. After adjusting for these three measures, there was no longer evidence of an effect of FVC% predicted upon the activity SGRQ score.

The results again suggested that older patients had poor QoL activity component, whilst those with a higher BMI and FEV1% predicted values had lower scores therefore better QoL in terms of activity. The shape of the relationship for TMG scores was similar to that observed in the univariate analysis. Again smokers had lower activity scores than non/ex-smokers.

This final model had an R-square value of 0.44. This suggests that 44% of all variation in QoL activity scores can be attributed to the combination of age, BMI, FEV1% predicted, TMG and smoking status. This suggests that the remaining 56% of variation is due to other sources.

3.1.3.2 Differences in Activity Scores between Countries

The next set of analysis compared the QoL activity score between the three countries. Initially this was done twice, firstly unadjusted, and then adjusted for factors associated with QoL. A summary of the results is given in the next table. The figures are the regression coefficients, which represent the difference in QoL between each country and the baseline category (in this case UAE). The first p-value reported is the significance of the overall difference between countries. The subsequent p-values indicated the specific differences between pairs of countries. These latter set of p-values were given a Bonferroni adjustment to allow for multiple comparisons. (Table 21)

Country	**Unadjusted**		**Adjusted**	
	Coefficient	**p-value**	**Coefficient**	**p-value**
UAE	0	**<0.001**	0	**0.002**
Morocco	1.6 (1.0, 2.1)		0.9 (0.4, 1.4)	
UK	1.7 (1.1, 2.2)		0.4 (0.0, 0.9)	
UAE vs. Morocco		**<0.001**		**<0.001**
UAE vs. UK		**<0.001**		0.20
Morocco vs. UK		1.00		0.11

Table 21: Differences between the three centres

The results indicated that there was an overall significant difference between the three countries in their activity score when no other factors were considered (the unadjusted results). The lowest scores were for the UAE, which were significantly lower than those in both Morocco and the UK. On average, there was a difference of around 1.6 units in the activity score between the UAE and the other two countries. However, there was no significant difference between Morocco and the UK.

When the significant risk factors were taken into account, there was still a significant overall difference between the three countries. Again scores in the UAE were the

lowest, although there was now no significant difference with the scores from the UK. Patients from Morocco had the highest scores, and after adjusting for the other variables, these were significantly higher than in the UAE. The difference in the QoL activity scores between the UAE and Morocco was 0.9 units.

Subsequently the interaction between country and each of the other variables was examined. The results suggested no significant interaction between country and BMI (p=0.42), between FEV1% predicted and country (p=0.40), between country and TMG score (p=0.41), or between country and smoking status (p=0.47). This suggests that differences in activity scores between countries do not vary depending on any of BMI, FEV1% predicted, TMG score or smoking status.

However, there was found to be a significant interaction between country and age (p=0.01). This suggests that the difference between countries varies depending on patient age. As a result of this, the effect of age upon activity score was quantified for each of the three countries. The results are summarised below. (Table 22)

Country	**Coefficient (95% CI)**	**p-value**
UAE	0.34 (0.07, 0.60)	**0.01**
Morocco	0.25 (-0.08, 0.59)	0.14
UK	0.81 (0.53, 1.08)	**<0.001**

Table 22: Interaction between country and age

The results indicated that there was significant effect of age upon activity scores in both the UAE and UK, although the strongest effect was seen in the UK. There was no significant effect of age upon activity score in Morocco.

3.1.3.3 Effect of Dyspnoea on Activity SGRQ Scores

The next set of analysis examined the effect of the three dyspnoea variables upon the QoL activity component. This was done using linear regression in three stages, and the results are summarised in the next table.

As indicated previously, there was strong collinearity between the magnitude of effort and magnitude of task, suggesting that only one of the two variables can be included in the multivariate analyses.

The figures reported are the regression coefficients and their corresponding 95% confidence intervals. The scales for all variables are that higher values represent a lower grade. So the regression coefficients represent the change in the activity SGRQ score for a one-grade decrease in each variable. (Table 23)

Analysis	Variable	Coefficient (95% CI)	p-value
Univariate	Functional impairment	1.39 (1.26, 1.52)	**<0.001**
	Magnitude of task	1.34 (1.22, 1.46)	**<0.001**
	Magnitude of effort	1.34 (1.21, 1.46)	**<0.001**
Multivariate	Functional impairment	0.72 (0.40, 1.03)	**<0.001**
	Magnitude of task	0.70 (0.40, 1.01)	**<0.001**
Multivariate + adjusted	Functional impairment	0.52 (0.22, 0.84)	**0.001**
	Magnitude of task	0.53 (0.24, 0.82)	**<0.001**

Table 23: Dyspnoea effect on activity scores in COPD patients

The univariate analysis results suggested that all three factors were associated with the activity SGRQ scores. A one-grade decrease in any of the variables was associated with an increased QoL activity score of around 1.3 units.

When both functional impairment and magnitude of task were included in the same regression model in a multivariate analysis, both were found to be statistically

significant. This was also the case after adjusting for the other significant risk factors (e.g. age, grip score etc.).

3.1.4 Analysis of the Impact QoL Scores of COPD Patients

In this section we will analyse how the three countries studied varied in terms of the impact component of QoL using similar methods as used to analyse the other components of the QoL. Only males were included in the analysis of the impact scores, because there was no significant gender difference in terms of the impact SGRQ scores.

3.1.4.1 Factors Associated with QoL

Linear regression was used to examine the effect of various parameters upon the QoL impact SGRQ scores. Initially the separate effect of each variable upon this outcome was examined separately, and the results are summarised in the next table. The figures reported are the regression coefficients, and also their corresponding 95% confidence intervals. For the continuous variables, the regression coefficients represent the change in the impact score for a given increase in that variable (size of increase indicated in the table). For the categorical variables, the regression coefficients indicate the difference in QoL between each category and a baseline category. (Table 24) Also reported are the R-square values. These indicate the proportion of the total variation in QoLe activity component that is explained by each predictor. (Table 24)

Variable	Term / category	Coefficient (95% CI)	R^2	p-value
Age (**)	Linear term	0.74 (0.57, 0.91)	0.15	**<0.001**
	Squared term	0.14 (0.04, 0.24)		
BMI (*)	Linear term	-0.59 (-0.87, -0.32)	0.04	**<0.001**
	Squared term	0.19 (0.01, 0.37)		
FEV1% Predicted (**)	**-**	-0.36 (-0.42, -0.29)	0.19	**<0.001**
FVC% Predicted (**)	Linear term	-0.29 (-0.20, -0.02)	0.15	**<0.001**
	Squared term	0.05 (0.02, 0.09)		
Grip score (**)	Linear term	-0.54 (-0.64, -0.45)	0.26	**<0.001**
	Squared term	-0.06 (-0.11, -0.02)		
Smoking Status	Non/Ex-Smoker	0	0.08	**<0.001**
	Smoker	-1.40 (-1.87, -0.93)		
(*) Coefficients reported for a 5-unit increase in explanatory variable (**) Coefficients reported for a 10-unit increase in explanatory variable				

Table 24: Separate effect of variable on the impact scores

The univariate analysis indicated that all variables examined were significantly associated with the impact component of QoL score, with the exception of gender where there were no differences between males and females.

The results for age suggested that there was a non-linear relationship with impact score. Therefore, this relationship is best shown graphically, and the relationship between the two variables is shown in the next graph. (Figure 18) The graph suggests that there is an increase in the impact SGRQ scores with increased age.

Figure 18: Effect of age on the impact scores of COPD patients

The results for BMI also suggested a non-linear relationship between the variables, and this relationship is shown in the next graph. QoL scores decreased with increasing BMI up to a BMI of around 30 after which the QoL remained fairly stable, in other words the higher the BMI the better the QoL. (Figure 19)

The analysis for FEV1% predicted indicated that higher values were associated with lower QoL impact scores (Patients with high FEV1% predicted have better QoL). A 10-unit increase in FEV1% predicted was associated with a decrease in impact score of 0.4 units.

There was a significant effect of FVC% predicted upon the impact component of the QoL, and a graphical representation of the relationship between the measures is given in the figure 20.

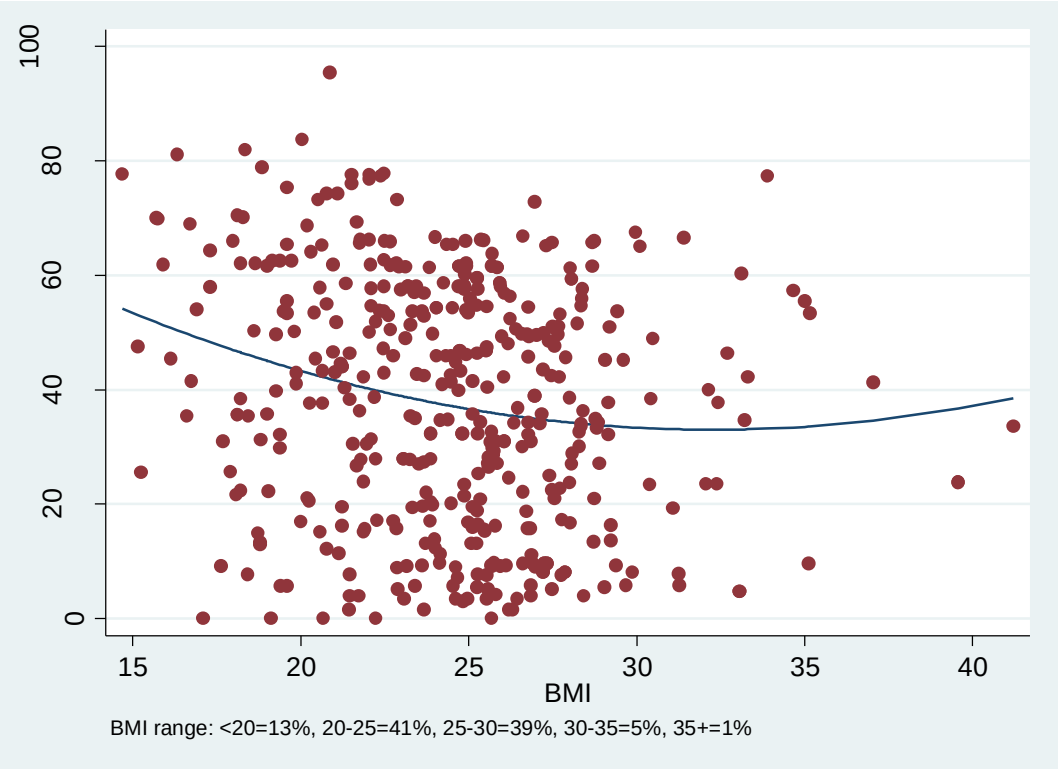

Figure 19: Effect of BMI on impact scores of COPD patients

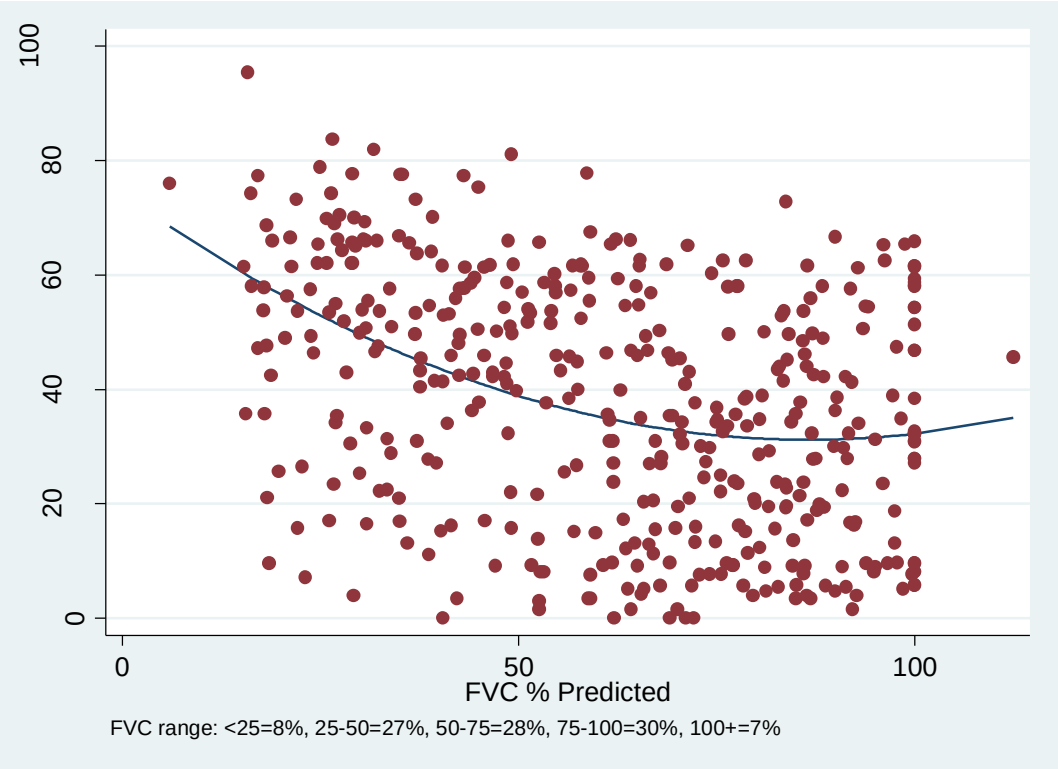

Figure 20: Association between FVC% predicted and impact scores of COPD patients

The graph suggests a general decrease in impact scores with increased FVC% predicted, although this relationship tails off for larger FVC% predicted values.

There was also a non-linear relationship between TMG score and QoL impact score. The fitted relationship between the two variables is shown in the next graph. The graph suggests that there is little relationship between grip score and impact score for grip scores below 40. However, for TMG scores above 40 there is a decrease in the QoL impact score (better QoL) with an increase in TMG score. (Figure 21)

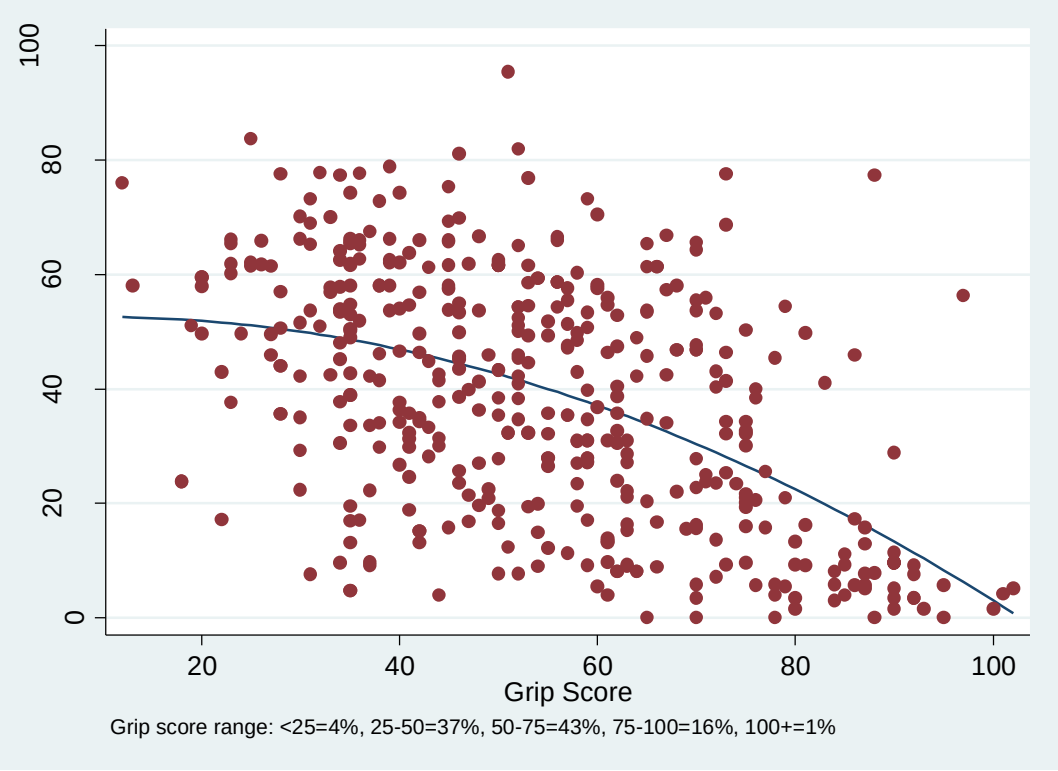

Figure 21: Effect of TMG on the impact scores of COPD patients

The results for smoking status indicated that non- or ex-smokers had poorer QoL compared to current smokers. Current smokers had scores that were, on average, 1.4 units lower than non/ex-smokers.

A multivariate analysis was performed to look at the joint effect of the factors upon the QoL impact score. A backwards selection procedure was used to retain only the statistically significant variables, and the final model is shown in the next table. (Table 25)

Variable	Term / category	Coefficient (95% CI)	P-value
Age (**)	Linear term	0.48 (0.31, 0.66)	<0.001
	Squared term	0.19 (0.10, 0.28)	
BMI (*)	-	-0.26 (-0.47, -0.04)	0.02
FEV1% Predicted (**)	-	-0.14 (-0.22, -0.06)	0.001
FVC% Predicted (**)	Linear term	-0.15 (-0.24, -0.07)	<0.001
	Squared term	0.03 (0.01, 0.06)	
Total Muscle Grip (**)	Linear term	-0.29 (-0.38, -0.15)	<0.001
	Squared term	-0.06 (-0.10, -0.01)	
(*) Coefficients reported for a 5-unit increase in explanatory variable (**) Coefficients reported for a 10-unit increase in explanatory variable			

Table 25: Joint effect of the physiologic measurement on the impact scores

The results of the multivariate analysis indicated that age, BMI, FEV1% predicted score, FVC% predicted and grip score were all significantly associated with the impact component of QoL. After adjusting for these three measures, there was no longer found to be evidence of an effect of smoking status upon the impact score. After adjusting for the effects of the other variables, there was now a more linear effect of BMI, with increasing BMI associated with a decreased impact score.

The results for the other variables were of a similar nature to those obtained in the univariate analysis. That is an increase in impact score with increasing age, but a decrease in impact scores with increasing FEV1% predicted, FVC% predicted and TMG score.

This final model had an R-square value of 0.42. This suggests that 42% of all variation in QoL impact scores can be attributed to the combination of age, BMI, FEV1% predicted, FVC% predicted and TMG score. This suggests that the remaining 58% of variation is due to other sources.

3.1.4.2 Difference in Impact SGRQ Scores between Countries

The next set of analysis compared the QoL impact score between the three countries. Initially this was done twice, firstly unadjusted, and then adjusted for factors associated with the QoL. A summary of the results is given in the next table.

The figures are the regression coefficients, which represent the difference in QoL between each country and the baseline category (in this case UAE). The first p-value reported is the significance of the overall difference between countries. The subsequent p-values indicated the specific differences between pairs of countries. These latter set of p-values were given a Bonferroni adjustment to allow for multiple comparisons. (Table 26)

Country	Unadjusted		Adjusted	
	Coefficient (95% CI)	p-value	Coefficient (95% CI)	p-value
UAE	0	0.13	0	**0.001**
Morocco	0.2 (1.0, 0.7)		-0.1 (0.6, 0.4)	
UK	-0.3 (-0.8, 0.2)		-0.9 (-1.5, -0.4)	
UAE vs. Morocco		1.00		1.00
UAE vs. UK		0.56		**0.003**
Morocco vs. UK		0.16		**0.006**

Table 26: Differences between the studied countries in their impact scores

The results indicated that there was no significant difference between the three countries in their impact score when no other factors were considered (the unadjusted results).

However, when the significant risk factors were adjusted for, there was found to be a significant overall difference between the three countries. The results suggested that results from the UK were the lowest, and significantly lower than those from both the UAE and Morocco. The difference in the QoL activity scores between UAE and the UK was 0.9 units. There was no difference in impact SGRQ scores between the UAE and Morocco.

Subsequently the interaction between country and each of the other variables was examined. The results suggested no strong evidence of a significant interaction between country and age ($p=0.05$), between BMI and country ($p=0.09$). This suggests that differences in impact scores between countries do not strongly vary depending on age or BMI.

However, there was found to be a significant interaction between country and FEV1 ($p<0.001$), between country and FVC ($p<0.001$) and also between country and TMG score ($p=0.007$). This suggests that the difference between countries varies depending on each of these 3 variables. As a result of this, the effect of these 3 variables upon the impact score was quantified for each of the three countries. The results are summarised below. (Table 27)

Variable	Country	Term	Coefficient (95% CI)	p-value
FEV1% predicted	UAE	-	0.02 (-0.13, 0.17)	0.78
	Morocco	-	-0.34 (-0.51, -0.18)	**<0.001**
	UK	-	-0.24 (-0.34, -0.14)	**<0.001**
FVC% predicted	UAE	Linear term	0.19 (0.01, 0.37)	**0.03**
		Squared term	0.05 (0.01, 0.09)	
	Morocco	Linear term	-0.24 (-0.41, -0.07)	**<0.001**
		Squared term	0.05 (0.01, 0.09)	
	UK	Linear term	-0.07 (-0.21, 0.07)	**0.04**
		Squared term	0.05 (0.01, 0.09)	
Grip Score	UAE	Linear term	-0.18 (-0.37, 0.01)	**0.007**
		Squared term	-0.04 (-0.08, 0.00)	
	Morocco	Linear term	-0.53 (-0.71, -0.35)	**<0.001**
		Squared term	-0.04 (-0.08, 0.00)	
	UK	Linear term	-0.27 (-.049, -0.04)	**<0.001**
		Squared term	-0.04 (-0.08, 0.00)	

Table 27: Difference in the effect of the three variables between the three countries

The results for FEV1% predicted indicated that there was significant effect of this measure upon impact scores in both Morocco and the UK. For both of these countries higher FEV1% predicted values were associated with a decrease in impact score. There was no significant effect of age upon activity score in the UAE. A graphical illustration of the nature of the interaction is shown in the next graph. This shows the relationship between FEV1% predicted and QoL impact scores for each of the three countries. (Figure 22)

The next graphs represent the effect of FEV1% predicted on the SGRQ impact scores of COPD patients in each country; the graphs also illustrate the individual regression points where figures 23-25 represent the relationship between FEV1% predicted and the impact scores in the UAE, Morocco and the UK respectively.

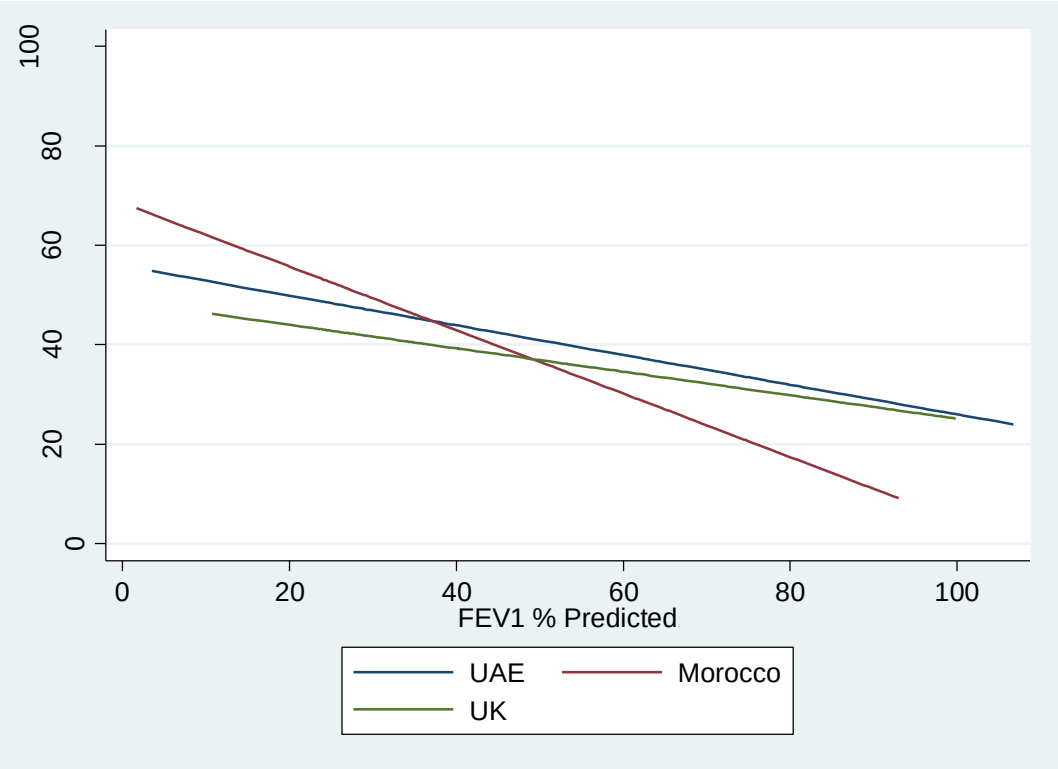

Figure 22: Relationship between FEV1% predicted and impact scores for the three countries

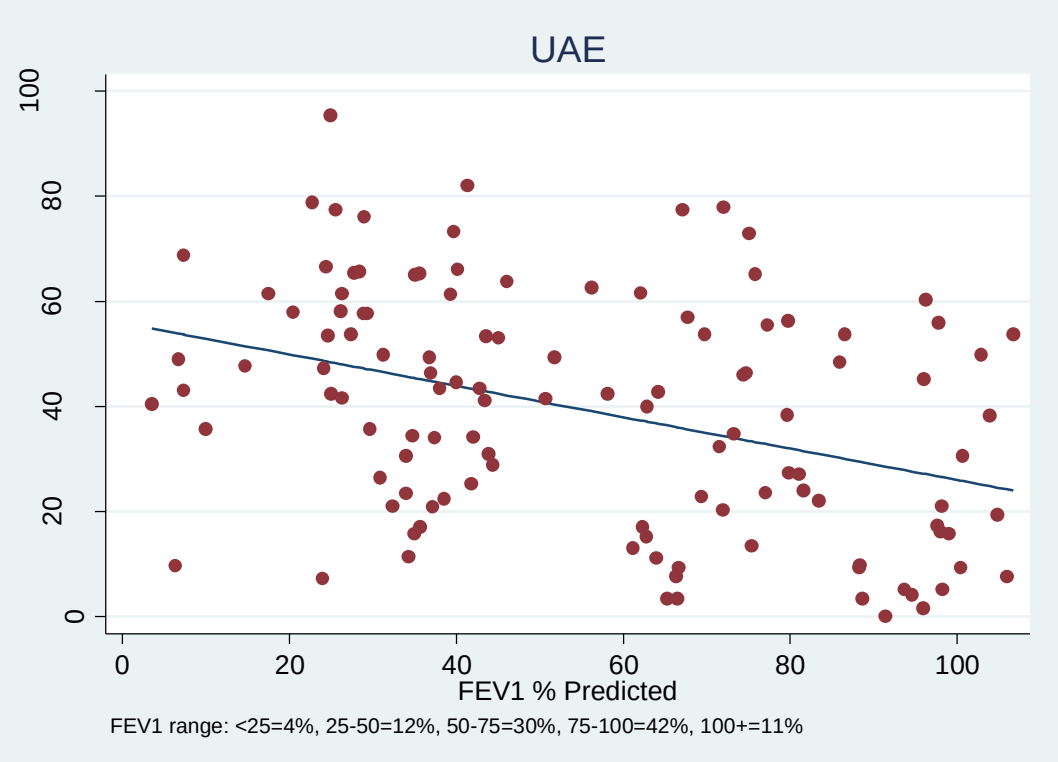

Figure 23: Effect of FEV1% predicted on the impact scores in the UAE

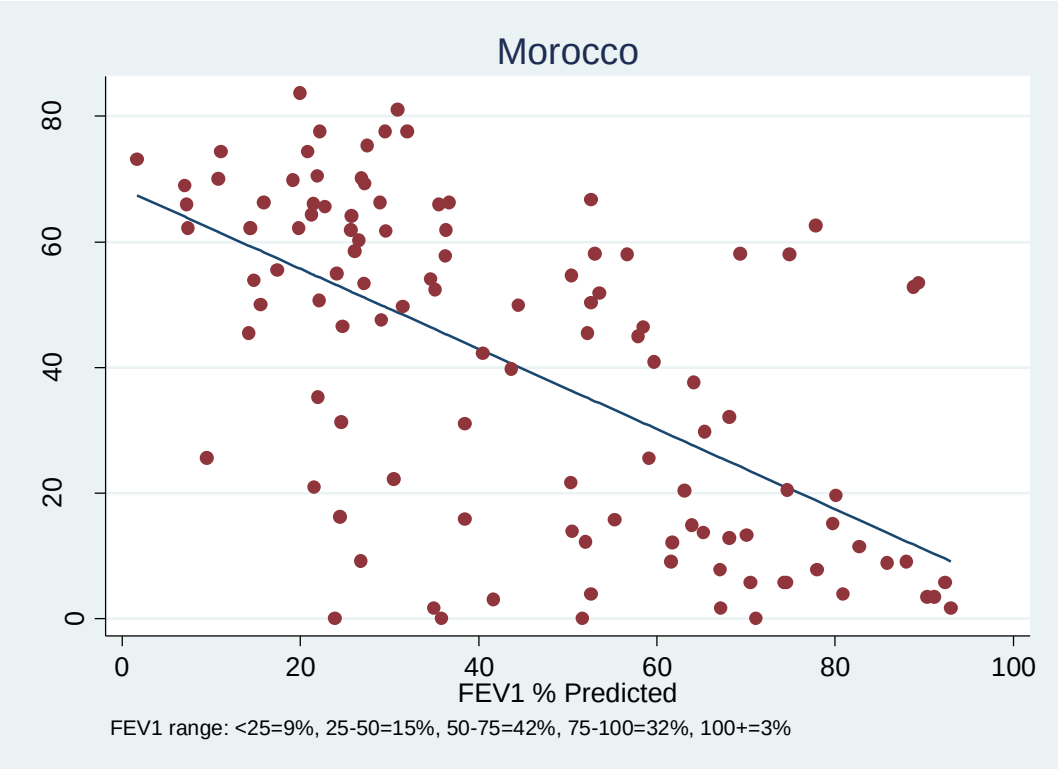

Figure 24: Effect of FEV1% predicted on the impact scores in Morocco

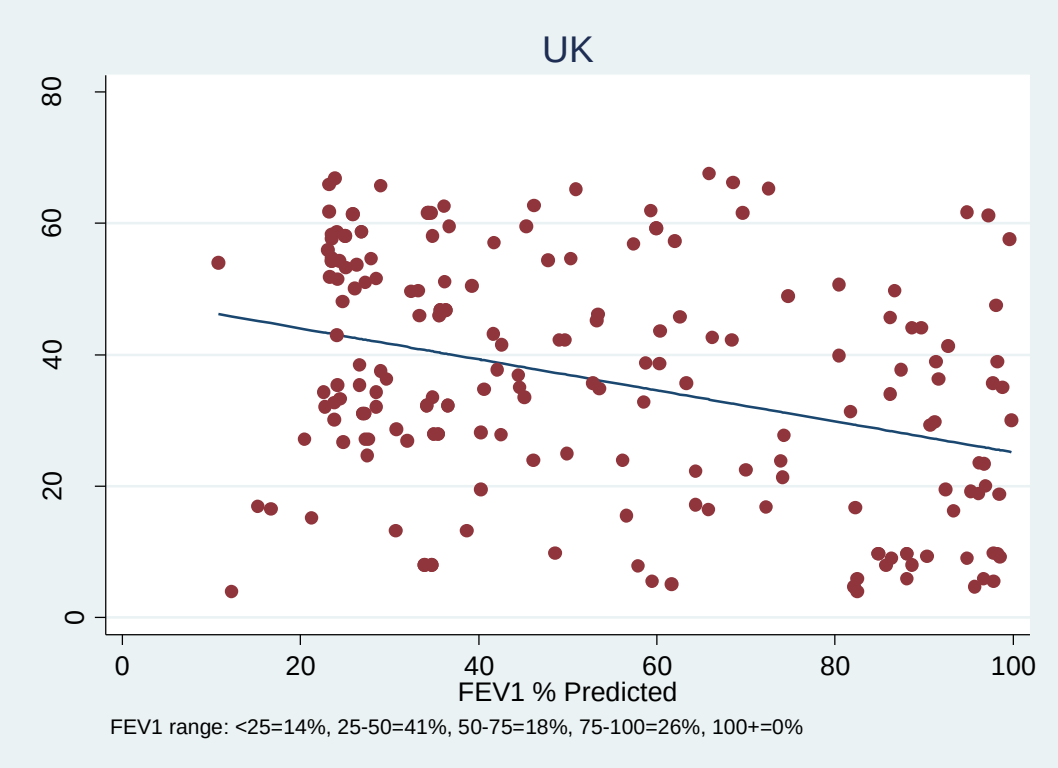

Figure 25: Effect of FEV1% predicted on impact scores in the UK

The results for FVC% predicted suggested there was a very strong effect of this measure for Moroccan patients, but significant results for the other two countries also. Due to the non-linear relationships the results are best viewed graphically, and these are shown in the next graph. (Figure26)

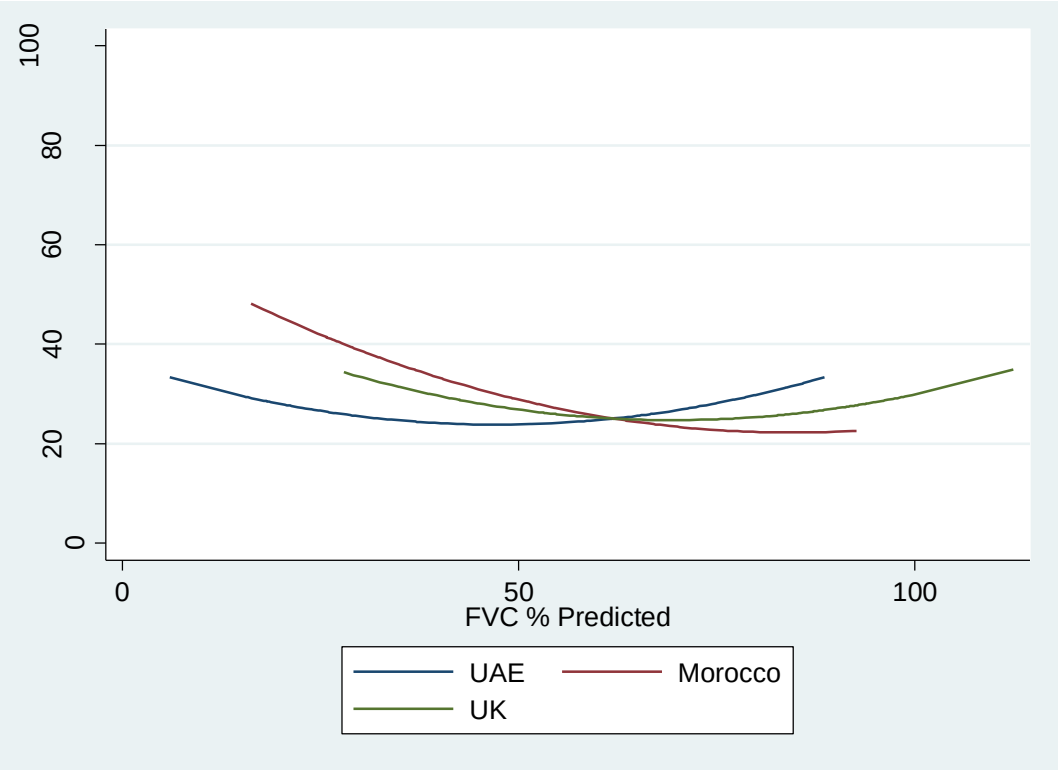

Figure 26: Relationship between FVC% predicted and QoL impact scores

The graph shows that in Morocco higher FVC% predicted values are associated with lower impact scores therefore better QoL. The picture is less consistent for the UAE and UK, where it appears that those with the highest and lowest FVC% predicted values have the highest impact SGRQ scores.

The next graphs represent the effect of FEV1% predicted on the SGRQ impact scores of COPD patients in each country; the graphs also illustrate the individual regression points where figures 27, 28 and 29 represent the relationship between FVC% predicted and impact scores in the UAE, Morocco and the UK respectively. (Figure 27-29)

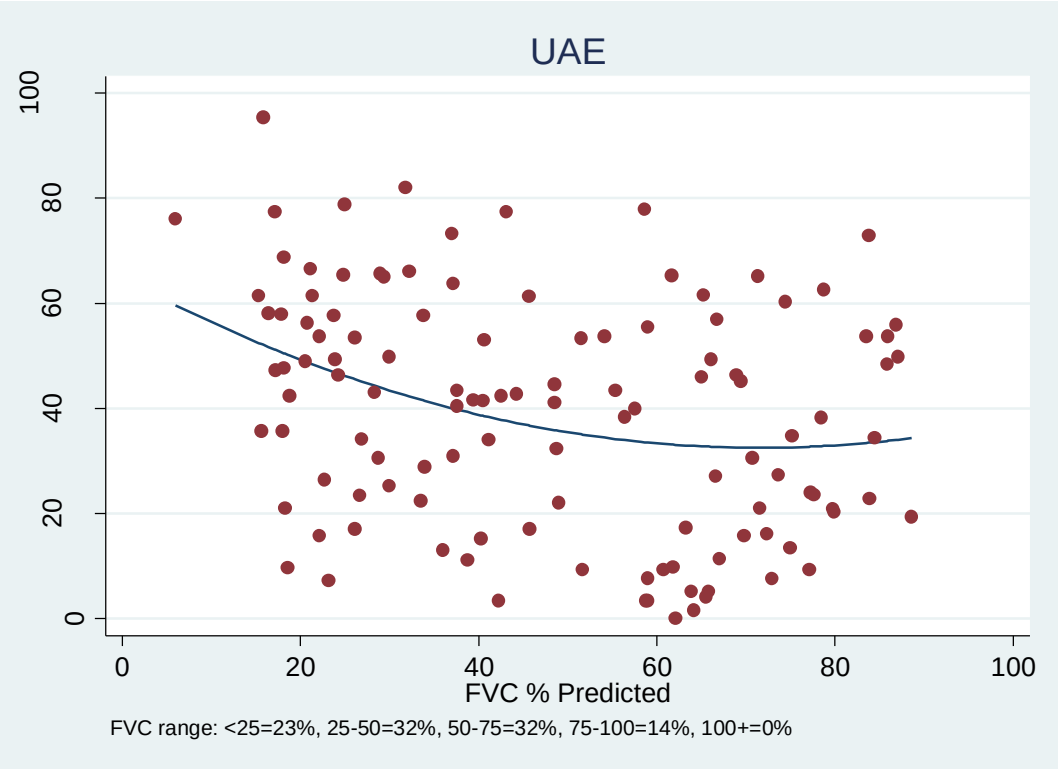

Figure 27: Relationship between FVC% predicted and impact scores in the UAE

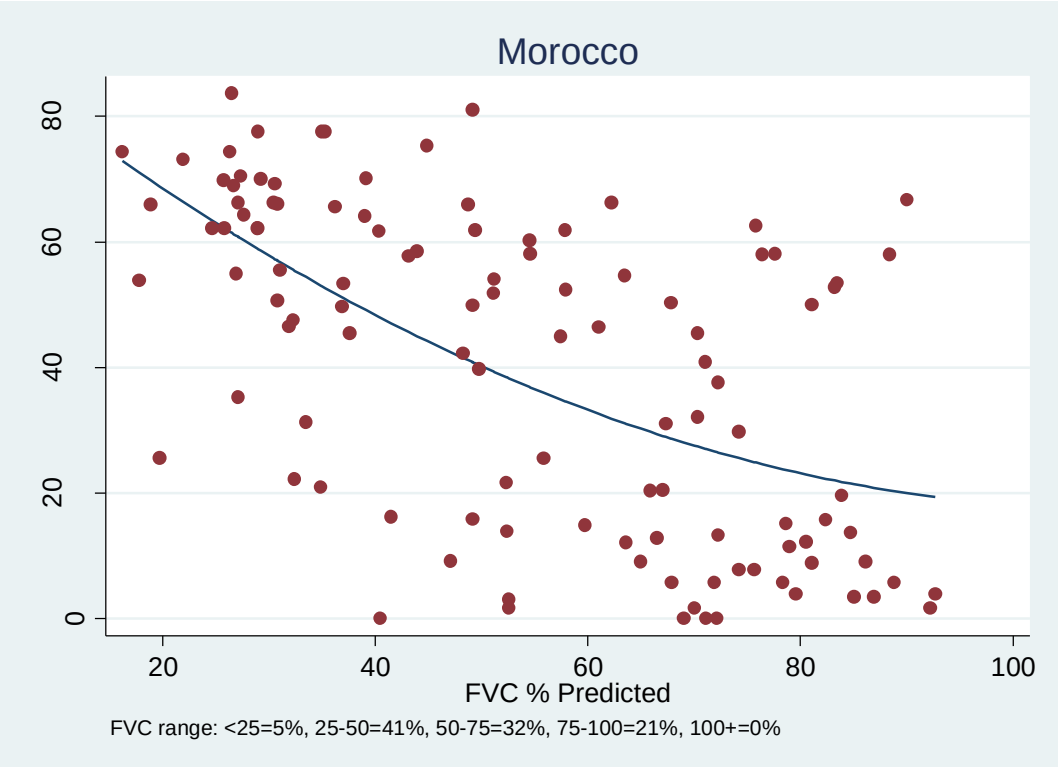

Figure 28: Relationship between FVC% predicted and impact scores in Morocco

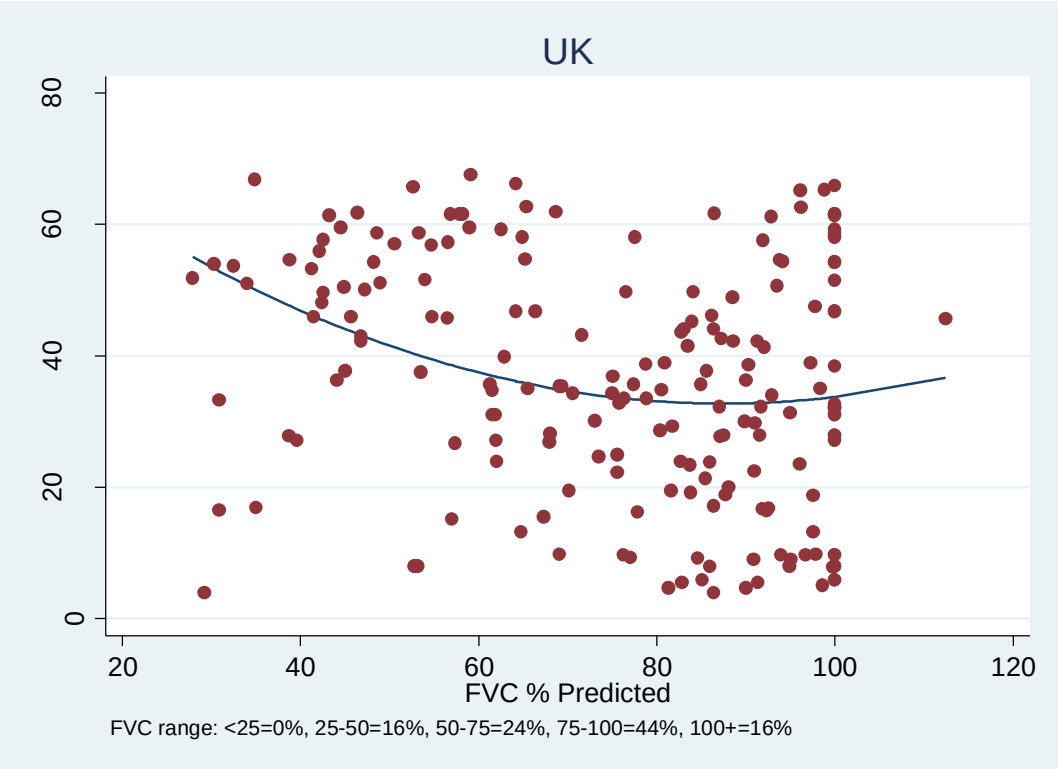

Figure 29: Relationship between FVC% predicted and impact scores in the UK

There was also a non-linear relationship between TMG score and impact scores, so again the results are best viewed graphically, and the relationships for each of the three countries is given in the next graph. Although the interaction was similar, there was a broadly similar picture for each of the three countries. There was generally a better QoL with increased TMG score, although the effects were less strong for lower TMG scores. The effect of TMG scores was highly significant for each of the three countries. (Figure 30)

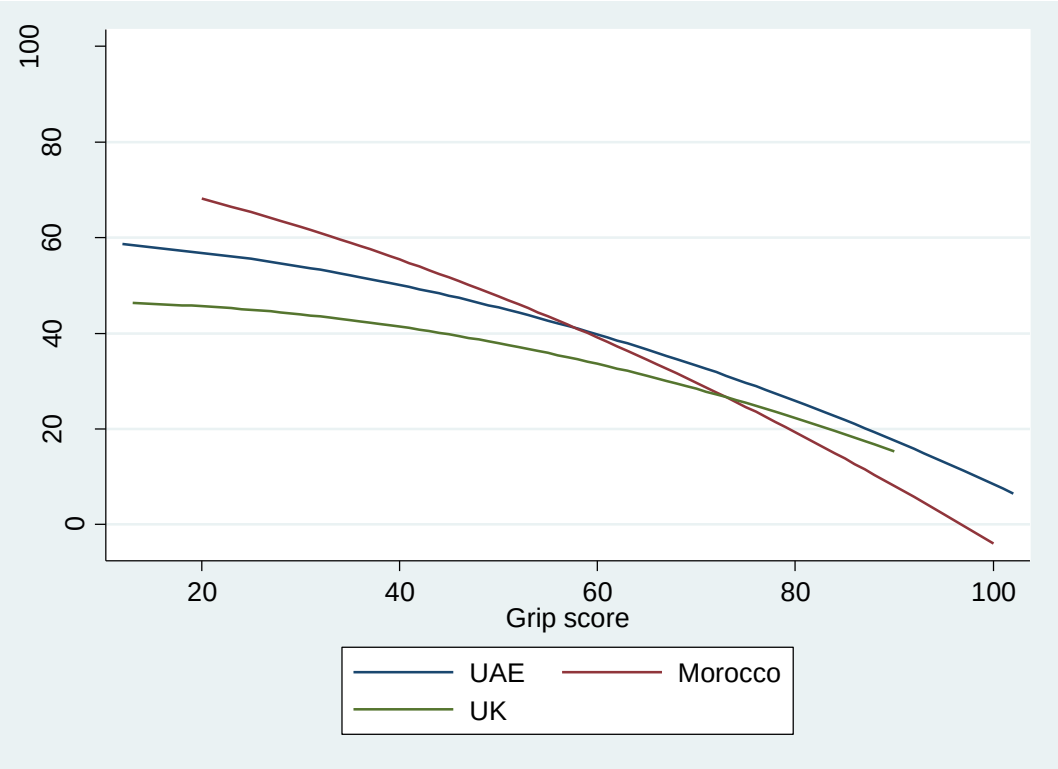

Figure 30: Relationship between TMG and QoL impact scores

3.1.4.3 Effect of Dyspnoea on Impact SGRQ Scores

The next set of analysis examined the effect of the three dyspnoea variables from the BDI upon the impact SGRQ scores. This was done using linear regression in three stages, and the results are summarised in the next table. (Table 28)

As indicated in the first report, there was strong collinearity between the magnitude of effort and magnitude of task, suggesting that only one of the two variables can be included in the multivariate analyses.

The figures reported are the regression coefficients and their corresponding 95% confidence intervals. The scales for all variables are that higher values represent a lower grade. So the regression coefficients represent the change in the impact score for a one-grade decrease in each variable.

Analysis	Variable	Coefficient (95% CI)	p-value
Univariate	Functional impairment	1.28 (1.14, 1.40)	**<0.001**
	Magnitude of task	1.22 (1.10, 1.34)	**<0.001**
	Magnitude of effort	1.22 (1.10, 1.34)	**<0.001**
Multivariate	Functional impairment	0.73 (0.40, 1.05)	**<0.001**
	Magnitude of task	0.57 (0.26, 0.88)	**<0.001**
Multivariate + adjusted	Functional impairment	0.44 (0.14, 0.75)	**0.005**
	Magnitude of task	0.59 (0.30, 0.88)	**<0.001**

Table 28: Effect of dyspnoea on the Quality of Life impact scores

The univariate results suggested that all three factors were associated with QoL. A one-grade decrease in any of the variables was associated with an increased QoL impact score of around 1.2 units.

When both functional impairment and magnitude of task were included in the same regression model in a multivariate analysis, both were found to be statistically significant. This was also the case after adjusting for the other significant risk factors (e.g. age, TMG score etc.).

3.2 Analysis of the Control Group

In this section of our study, we measured the QoL of control subjects from the UK, the UAE and Morocco. The first set of data analysis examined the differences between the countries in terms of a number of variables. Data on some variables was available for all three countries, whilst other information was only available for the UAE and Morocco. Where information was available for three countries, the comparisons were made between the three countries, and where it was available for only two, the comparisons were restricted to these two countries. All continuous variables were approximately normally distributed. Therefore, analysis of variance

(ANOVA) was used to compare between the continuous measures between three countries, whilst the unpaired t-test was used where data was only present for two countries. The Chi-square test was used to compare the categorical variables between countries.

The next set of analysis examined the effects of various study variables upon QoL scores. Due to missing data for some variables, these analyses were restricted to subjects from the UAE and Morocco only. As the QoL scores were measured on a continuous scale, the analysis was performed using linear regression. Initially the separate effect of each variable upon the outcome was examined separately in a series of univariate analysis. For the continuous explanatory variables, the relationship with the QoL outcome was examined to see if a non-linear (i.e. curved) relationship was more appropriate than a linear (straight line) one.

The next stage in the analysis process was to examine the joint effect of the variables upon QoL in a multivariate analysis. This analysis has the advantage that the effect of each variable upon the outcome is adjusted for the other factors in the analysis. A backwards selection procedure was used to retain only the statistically significant variables. This involves removing the non-significant variables, one at a time, until all remaining variables were significant.

The differences in QoL between countries were examined next. Firstly the differences between countries were examined without considering any other factors in the analysis. Subsequently, the same difference was examined, this time adjusting for factors that could potentially confound the country differences. The factors adjusted for were restricted to those where there was data for all three countries, namely age, BMI, gender and smoking status.

3.2.1 Analysis of the Total SGRQ Scores of the Control Group

3.2.1.1 Control Group Characteristics

The first set of analysis compared various factors between countries.

Firstly the continuous variables were compared. ANOVA was used to compare between countries where data was available for all three countries, whilst the unpaired t-test was used where data from the UK was unavailable. The results are summarised in the next table. (Table 29) The figures reported are the mean and standard deviation value for each country, and the p-values indicating the significance of the overall difference between countries.

Variable	UAE Mean (SD)	Morocco Mean (SD)	UK Mean (SD)	p-value
Age	52 (6)	46 (5)	76 (8)	**<0.001**
BMI	27.1 (3.8)	25.4 (4.1)	24.5 (4.7)	**<0.001**
FEV1% Predicted	82 (17)	71 (19)	-	**<0.001**
FVC% Predicted	69 (14)	65 (15)	-	**0.001**
Grip score	97 (8)	86 (14)	-	**<0.001**

Table 29: Control group characteristics

The results indicated that there was a highly significant difference in all variables between the three countries.

Centre	United Arab Emirates	Morocco	United Kingdom
Symptom	6.67±13.58	3.01±8.47	45.63±24.87
Activity	8.71±14.03	16.3±17.63	34.96±15.08
Impact	2.07±3.71	0	6.83±3.89
Total Scores	4.85±8.03	5.44±5.86	21.8±9.57

Table 30: Quality of Life of the control Group

The above table represents the descriptive analysis for the QoL of the control group. The table clearly shows a difference in the QoL between the three countries, especially the UK having the highest symptoms, impact, activity and total scores.

The next set of analysis used the Chi-square test to examine if there was a difference between countries for the two categorical measures. A summary of the analysis results is given in the next table. The figures reported are the number and percentage of responses in each category for each country. (Table 31)

Variable	Category	UAE N (%)	Morocco N (%)	UK N (%)	p-value
Smoking Status	Non/Ex-Smoker	285 (95%)	217 (72%)	630 (88%)	**<0.001**
	Smoker	16 (5%)	84 (28%)	18 (18%)	
Gender	Male	301 (100%)	301 (100%)	284 (37%)	**<0.001**
	Female	0 (0%)	0 (0%)	484 (63%)	

Table 31: Gender and smoking differences between the countries

The results suggested that both smoking status and gender varied between countries. Smoking was by far the lowest in the UAE where only 5% of the groups were current smokers. Conversely smoking was much higher in Morocco, where over 30% of the subjects currently smoked. The UAE and Moroccan groups consisted of all male patients, whilst 63% of UK subjects were female.

3.2.1.2 Factors Associated with the Total SGRQ Scores

The next set of analysis concerned the total SGRQ scores. The first objective was to examine the effect of various parameters upon the total SGRQ scores. Due to missing data for some variables, the analysis was performed on subjects from the UAE and Morocco only.

All analysis was performed using linear regression. Initially the separate effect of each variable upon this outcome was examined separately, and the results are summarised in the next table. (Table 32)

The figures reported are the regression coefficients, and also their corresponding 95% confidence intervals. For the continuous variables, the regression coefficients represent the change in the total QoL for a given increase in that variable (size of increase indicated in the table). For the categorical variables, the regression coefficients indicate the difference in QoL between each category and a baseline category. Also reported are the R-square values. These indicate the proportion of the total variation in QoL that is explained by each predictor.

Variable	Category	Coefficient (95% CI)	R^2	p-value
Age (**)	-	0.09 (-0.03, 0.22)	0.003	0.15
BMI (*)	-	0.05 (-0.05, 0.15)	0.002	0.33
FEV1% Predicted (**)	**-**	-0.09 (-0.13, -0.05)	0.03	**<0.001**
FVC% Predicted (**)	-	-0.07 (-0.12, -0.01)	0.009	**0.02**
Total Muscle Grip (**)	-	-0.03 (-0.08, 0.03)	0.002	0.31
Smoking Status	Non/Ex-Smoker	0		
	Smoker	0.58 (0.37, 0.78)	0.05	**<0.001**

(*) Coefficients reported for a 5-unit increase in explanatory variable
(**) Coefficients reported for a 10-unit increase in explanatory variable

Table 32: Univariate analysis of Effect of physiological measurements on the QoL

The results of the univariate analysis indicated that FEV1% predicted, FVC% predicted and smoking status were all significantly associated with the total QoL score. However, there was no significant effect of age, BMI or TMG score upon total QoL.

A higher FEV1% predicted and FVC% predicted value indicated lower QoL scores. A 10-unit increase in FEV1% predicted was associated with a decrease in QoL score of 0.09 unit, whilst a 10-unit increase in FVC% predicted resulted in 0.03 unit decrease.

Unlike the COPD patients, the results for smoking status indicated that current smokers had higher QoL scores than non/ex-smokers meaning that current smokers have lower QoL than ex-smokers. Current smokers had scores that were, on average, 0.6 units higher than non/ex-smokers.

Secondly, a multivariate analysis was performed to look at the joint effect of the factors upon the total QoL score. A backwards selection procedure was used to retain only the statistically significant variables, and the final model is shown in the next table. (Table 33)

Variable	Category	Coefficient (95% CI)	P-value
Age (**)	-	0.23 (0.10, 0.35)	0.001
BMI (*)	-	0.15 (0.05, 0.24)	0.003
FEV1% Predicted (**)	-	-0.20 (-0.29, -0.12)	<0.001
FVC% Predicted (**)	-	0.14 (0.02, 0.25)	0.02
Smoking Status	Non/Ex-Smoker	0	<0.001
	Smoker	0.57 (0.36, 0.79)	

(*) Coefficients reported for a 5-unit increase in explanatory variable
(**) Coefficients reported for a 10-unit increase in explanatory variable

Table 33: Joint effect of the factors upon the QoL (Multivariate analysis)

The results of the multivariate analysis indicated that age, BMI, FEV1% predicted, FVC% predicted score and smoking status were all significantly associated with total QoL.

Neither age nor BMI was significant in the univariate analysis, but after adjusting for the other variables, older subjects and those with higher BMI values had higher total SGRQ scores.

As in the univariate analyses, smokers had higher scores, whilst subjects with higher FEV1% predicted scores had lower scores therefore better QoL.

This final model had an R-square value of 0.11. This suggests that 11% of all variation in QoL can be attributed to the variables in this model. This suggests that around 90% of the remaining variation is due to other sources. In the patient data, the R-square value was 0.43 suggesting that the QoL of patients is much more determined by the measured factors than the QoL of the control group.

3.2.1.3 Differences in Total SGRQ Scores of Control Group

The next set of analysis compared the total SGRQ score between the three countries. The analysis was performed twice, firstly unadjusted, and then adjusted for potentially confounding factors. Adjustments in the second analysis were made for age, BMI, gender and smoking status.

A summary of the results is given in the next table. (Table 34) The figures are the regression coefficients, which represent the difference in QoL between each country and the baseline category (in this case UAE). The first p-value reported is the significance of the overall difference between countries. The subsequent p-values indicated the specific differences between pairs of countries. These latter set of p-values were given a Bonferroni adjustment to allow for multiple comparisons.

Country	Unadjusted		Adjusted	
	Coefficient (95% CI)	p-value	Coefficient (95% CI)	p-value
UAE	0	**<0.001**	0	**<0.001**
Morocco	0.33 (0.17, 0.49)		0.33 (0.16, 0.50)	
UK	1.90 (1.77, 2.03)		1.64 (1.40, 1.90)	
UAE vs. Morocco		**<0.006**		**<0.001**
UAE vs. UK		**<0.001**		**<0.001**
Morocco vs. UK		**<0.001**		**<0.001**

Table 34: Comparison of the QoL between the three countries for control group

The results indicated that there was an overall significant differences between three countries when no other factors were considered (the unadjusted results), and also after adjusting for potentially confounding factors.

Both analyses indicated that the highest scores were for the UK, which were significantly higher than those in Morocco and the UAE. On average, QoL scores were 1.9 units higher in the UK than in the UAE, and 1.6 units higher after adjusting for confounding factors.

The scores were lowest in the UAE, significantly lower than in Morocco. Morocco had scores that were, on average, 0.3 units higher than in the UAE.

3.2.2 Analysis of Symptom SGRQ Scores for the Control Group

3.2.2.1 Factors Associated with Symptom SGRQ Scores

The next set of analysis concerned the symptoms component of the QoL scores. The effect of various parameters upon the symptoms scores for subjects from Morocco and the UAE will also be analysed. All analysis was performed using linear regression. Initially the separate effect of each variable upon this outcome was examined separately, and the results are summarised in the next table. (Table 35)

Variable	Category / Term	Coefficient (95% CI)	R^2	P-value
Age (**)	-	0.39 (0.23, 0.55)	0.04	**<0.001**
BMI (*)	-	0.17 (0.05, 0.29)	0.01	**0.006**
FEV1% Predicted (**)	**-**	-0.05 (-0.11, 0.00)	0.007	**0.04**
FVC% Predicted (**)	-	-0.09 (-0.16, -0.02)	0.01	**0.01**
Grip score (**)	Linear term	-0.45 (-0.62, -0.27)	0.07	**<0.001**
	Squared term	0.05 (0.02, 0.08)		
Smoking Status	Non/Ex-Smoker	0	0.005	0.08
	Smoker	0.23 (-0.03, 0.50)		

(*) Coefficients reported for a 5-unit increase in explanatory variable

(**) Coefficients reported for a 10-unit increase in explanatory variable

Table 35: Association physiological measurements and symptoms score (Univariate analysis)

The results of the univariate analyses indicated some evidence that all factors investigated were associated with the symptoms component of QoL. However, the results for smoking status were not quite statistically significant (p=0.08).

Both age and BMI were positively associated with symptoms score. In other words older subjects and those with a greater BMI had higher scores. A 10-year increase in age was associated with symptoms scores increasing by 0.4 units, whilst a BMI increase of 5-units was associated with scores increasing by 0.17 units.

Conversely, higher values of both FEV1% predicted and FVC% predicted value were associated with lower QoL symptom scores. A 10-unit increase in FEV1% predicted was associated with a decrease in symptom scores of 0.05 units, whilst a 10-unit increase in FVC% predicted resulted in 0.09 unit decrease.

The results suggested that there was a non-linear (i.e. a curved) relationship between total Muscle Grip score and symptoms score. Therefore, this relationship is best viewed graphically, and this relationship is shown below. (Figure 31)

The graph shows a decrease in QoL with increased TMG score, up to a score of around 80, after which there was little relationship with symptoms score for increased QoL.

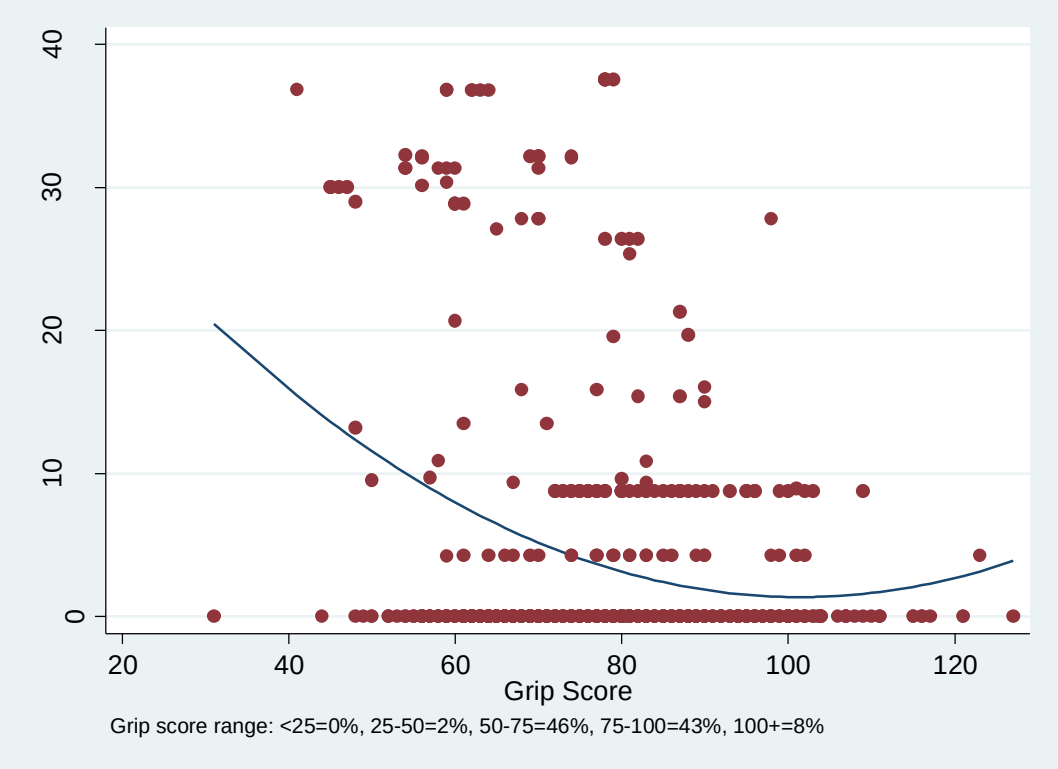

Figure 31: Relationship between TMG and symptom scores

A multivariate analysis was performed to look at the joint effect of the factors upon the QoL score. A backwards selection procedure was used to retain only the statistically significant variables, and the final model is shown in the next table. (Table 36)

Variable	Category / Term	Coefficient (95% CI)	P-value
Age (**)	-	0.26 (0.09, 0.43)	0.003
BMI (*)	-	0.22 (0.10, 0.34)	<0.001
FVC% Predicted (**)	-	-0.14 (-0.20, -0.07)	<0.001
Grip score (**)	Linear term	-0.42 (-0.60, -0.25)	<0.001
	Squared term	0.05 (0.02, 0.08)	
Smoking Status	Non/Ex-Smoker	0	<0.001
	Smoker	0.58 (0.32, 0.84)	

(*) Coefficients reported for a 5-unit increase in explanatory variable
(**) Coefficients reported for a 10-unit increase in explanatory variable

Table 36: Multivariate analysis of the factors associated with the symptom scores

The results of the multivariate analysis indicated that age, BMI, FVC% predicted score, TMG and smoking status were all significantly associated with the QoL symptoms component. After adjusting for these variables, there was no longer found to be any significant effect of FEV1% predicted.

As in the univariate analysis, older subjects and those with higher BMI values had higher QoL scores, whilst subjects with higher FVC% predicted values had lower symptoms scores. The coefficients for TMG score were also similar to the univariate analysis, suggesting a similar effect of this variable.

There was no strong evidence of an effect of smoking status in the univariate analysis. However, after adjusting for the other variables, this factor was now found to be highly significant. Current smokers had symptoms scores that were almost 0.6 unit higher than non or ex-smokers.

This final model had an R-square value of 0.14. This suggests that 14% of all variation in QoL can be attributed to the variables in this model. This is fairly similar

to that obtained from the control group for the total QoL. Again, it is much lower than the equivalent figure for the patient group.

3.2.2.2 Difference in Symptom SGRQ Scores

The next set of analysis compared the QoL symptom SGRQ scores between the three countries. The analysis was performed twice, firstly unadjusted, and then adjusted for potentially confounding factors. Adjustments in the second analysis were made for age, BMI, gender and smoking status.

A summary of the results is given in the next table. (Table 37) The figures are the regression coefficients, which represent the difference in QoL between each country and the baseline category (in this case UAE). The first p-value reported is the significance of the overall difference between countries. The subsequent p-values indicated the specific differences between pairs of countries. These latter set of p-values were given a Bonferroni adjustment to allow for multiple comparisons.

Country	**Unadjusted**		**Adjusted**	
	Coefficient (95% CI)	**p-value**	**Coefficient (95% CI)**	**p-value**
UAE	0	**<0.001**	0	**<0.001**
Morocco	-0.43 (0.76, -0.10)		-0.54 (-0.88, -0.19)	
UK	3.79 (3.51, 4.06)		3.67 (3.17, 4.18)	
UAE vs. Morocco		**0.03**		**0.009**
UAE vs. UK		**<0.001**		**<0.001**
Morocco vs. UK		**<0.001**		**<0.001**

Table 37: Differences in symptom scores between the three countries

The results indicated that there was an overall significant differences between three countries when no other factors were considered (the unadjusted results), and also after adjusting for potentially confounding factors.

Both analyses indicated that the highest scores were for the UK, which were significantly higher than those in Morocco and the UAE. On average, symptom scores were over 3.5 units higher in the UK than in the UAE.

There were also significant differences in QoL symptom scores between Morocco and the UAE. Both sets of analyses suggested lower scores in Morocco. In the adjusted analyses subjects from Morocco had scores that were 0.5 units lower than those in the UAE.

3.2.3 Analysis of the Activity SGRQ Scores for the Control Group

3.2.3.1 Factors Associated with Activity SGRQ Scores

The next set of analyses concerned the activity component of the SGRQ scores. The first objective was to examine the effect of various parameters upon the activity QoL scores. Due to missing data for some variables, the analyses were performed on subjects from the UAE and Morocco only.

All analyses were performed using linear regression. Initially the separate effect of each variable upon this outcome was examined separately, and the results are summarised in the next table. (Table 38) The figures reported are the regression coefficients, and also their corresponding 95% confidence intervals. For the continuous variables, the regression coefficients represent the change in the QoL for a given increase in that variable (size of increase indicated in the table). For the categorical variables, the regression coefficients indicate the difference in QoL between each category and a baseline category.Also reported are the R-square values. These indicate the proportion of the total variation in QoL that is explained by each predictor.

Variable	Category	Coefficient (95% CI)	R^2	P-value
Age (**)	-	0.11 (-0.13, 0.35)	0.001	0.38
BMI (*)	-	0.03 (-0.15, 0.22)	0.001	0.72
FEV1% Predicted (**)	-	-0.19 (-0.27, -0.12)	0.04	**<0.001**
FVC% Predicted (**)	-	-0.14 (-0.23, -0.03)	0.01	**0.01**
Grip score (**)	-	0.01 (-0.08, 0.11)	0.001	0.81
Smoking Status	Non/Ex-Smoker	0	0.05	**<0.001**
	Smoker	1.12 (0.73, 1.51)		

(*) Coefficients reported for a 5-unit increase in explanatory variable

(**) Coefficients reported for a 10-unit increase in explanatory variable

Table 38: Univariate analysis of factors associated with activity scores

The results of the univariate analyses indicated that FEV1% predicted, FVC% predicted and smoking status were all significantly associated with the QoL activity scores. However, there was no significant effect of age, BMI or TMG score upon QoL.

A higher FEV1% predicted and FVC% predicted value indicated lower QoL scores. A 10-unit increase in FEV1% predicted was associated with a decrease in activity scores of 0.19 units, whilst a 10-unit increase in FVC% predicted resulted in 0.14 unit decrease.

The results for smoking status indicated that current smokers had higher activity scores than non/ex-smokers. Current smokers had scores that were, on average, 1.1 units higher than non/ex-smokers.

A multivariate analysis was performed to look at the joint effect of the factors upon the QoL activity scores. A backwards selection procedure was used to retain only the statistically significant variables, and the final model is shown in the next table. (Table 39)

Variable	Category	Coefficient (95% CI)	P-value
Age (**)	-	0.37 (0.13, 0.61)	0.002
BMI (*)	-	0.23 (0.05, 0.41)	0.01
FEV1% Predicted (**)	-	-0.41 (-0.58, -0.25)	<0.001
FVC% Predicted (**)	-	0.29 (0.08, 0.50)	0.008
Smoking Status	Non/Ex-Smoker	0	<0.001
	Smoker	1.06 (0.66, 1.46)	
(*) Coefficients reported for a 5-unit increase in explanatory variable (**) Coefficients reported for a 10-unit increase in explanatory variable			

Table 39: Multivariate analysis of factors associated with the activity scores

The results of the multivariate analysis indicated that age, BMI, FEV1% predicted, FVC% predicted score and smoking status were all significantly associated with QoL activity scores.

Neither age nor BMI was significant in the univariate analyses, but after adjusting for the other variables, older subjects and those with higher BMI values had higher activity scores meaning lower QoL.

As in the univariate analysis, smokers had lower QoL, whilst subjects with higher FEV1% predicted scores had better QoL.

This final model had an R-square value of 0.11. This suggests that 11% of all variation in activity component of QoL can be attributed to the variables in this model. This suggests that almost 90% of the remaining variation is due to other sources.

3.2.3.2 Differences in Activity SGRQ Scores between the Control Groups

The next set of analysis compared the QoL activity scores between the three countries. The analysis was performed twice, firstly unadjusted, and then adjusted

for potentially confounding factors. Adjustments in the second analysis were made for age, BMI, gender and smoking status.

A summary of the results is given in the next table. (Table 40) The figures are the regression coefficients, which represent the difference in activity between each country and the baseline category (in this case UAE). The first p-value reported is the significance of the overall difference between countries. The subsequent p-values indicated the specific differences between pairs of countries. These latter set of p-values were given a Bonferroni adjustment to allow for multiple comparisons.

Country	**Unadjusted**		**Adjusted**	
	Coefficient (95% CI)	**p-value**	**Coefficient (95% CI)**	**p-value**
UAE	0	**<0.001**	0	**<0.001**
Morocco	0.80 (0.49, 1.11)		0.79 (0.46, 1.12)	
UK	2.81 (2.55, 3.07)		2.52 (2.04, 2.99)	
UAE vs. Morocco		**<0.001**		**<0.001**
UAE vs. UK		**<0.001**		**<0.001**
Morocco vs. UK		**<0.001**		**<0.001**

Table 40: Difference in activity scores between the three centres

The results indicated that there was an overall significant differences between three countries when no other factors were considered (the unadjusted results), and also after adjusting for potentially confounding factors.

Both analyses indicated that the highest scores were for the UK, which were significantly higher than those in Morocco and the UAE. On average, QoL scores were 2.8 units higher in the UK than in the UAE, and 2.5 units higher after adjusting for confounding factors. The scores were lowest in the UAE, significantly lower than in Morocco. Morocco had scores that were, on average, 0.8 units higher than in the UAE.

3.2.4 Analysis of the Impact SGRQ Scores for the Control Group

3.2.4.1 Factors Associated with Impact SGRQ Scores

The next set of analysis concerned the impact component of the QoL scores. All analyses were performed using linear regression. Initially the separate effect of each variable upon this outcome was examined separately, and the results are summarised in the next table. (Table 41)

Variable	Category / Term	Coefficient (95% CI)	R^2	p-value
Age (**)	-	0.21 (0.15, 0.26)	0.09	**<0.001**
BMI (*)	-	0.09 (0.05, 0.13)	0.03	**<0.001**
FEV1% Predicted (**)	-	-0.02 (-0.03, 0.00)	0.005	0.07
FVC% Predicted (**)	-	-0.04 (-0.06, -0.02)	0.02	**0.001**
Total Muscle Grip (**)	Linear term	-0.28 (-0.33, -0.22)	0.21	**<0.001**
	Squared term	0.03 (0.02, 0.04)		
Smoking Status	Non/Ex-Smoker	0	0.02	**0.001**
	Smoker	-0.15 (-0.24, -0.06)		

(*) Coefficients reported for a 5-unit increase in explanatory variable

(**) Coefficients reported for a 10-unit increase in explanatory variable

Table 41: Univariate analysis of factors' effect on impact scores

The results of the univariate analyses indicated some evidence that all factors investigated were associated with the impact component of QoL. However, the results for FEV1% predicted were not quite statistically significant (p=0.07).

Both age and BMI were positively associated with impact score. In other words older subjects and those with a greater BMI had higher scores. A 10-year increase in age was associated with impact scores increasing by 0.2 units, whilst a BMI increase of 5-units was associated with scores increasing by 0.09 units.

Conversely, higher values of both FEV1% predicted and FVC% predicted value were associated with lower QoL impact scores. A 10-unit increase in FEV1% predicted was associated with a decrease in impact scores of 0.02 units, whilst a 10-unit increase in FVC% predicted resulted in 0.04 unit decrease.

The results suggested that there was a non-linear (i.e. a curved) relationship between total grip score and symptoms score. Therefore, this relationship is best viewed graphically, and this relationship is shown below. (Figure 32)

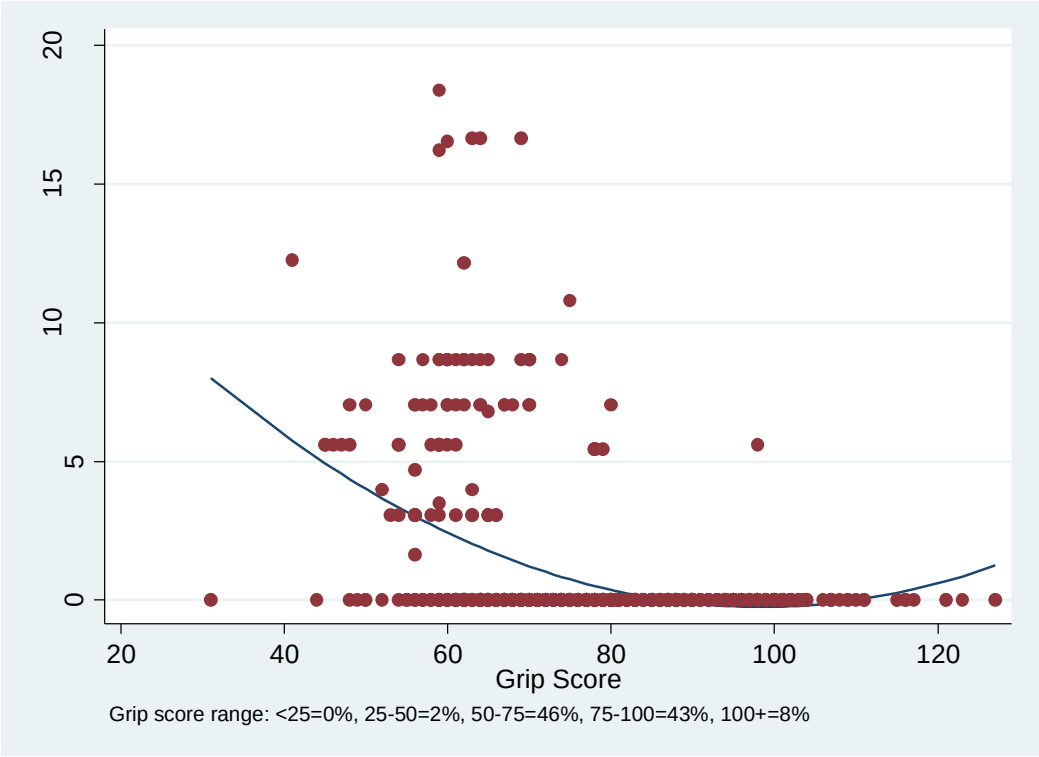

Figure 32: Relationship between Muscle Grip and impact SGRQ scores of control group

The graph shows a decrease in impact scores with increased TMG score, up to a score of around 80, after which there was little relationship with impact score for increased QoL.

The results for smoking status suggested that current smokers had lower impact scores. These were, on average, 0.15 units lower than non or ex-smokers.

A multivariate analysis was performed to look at the joint effect of the factors upon the QoL impact score. A backwards selection procedure was used to retain only the statistically significant variables, and the final model is shown in the next table. (Table 42)

Variable	Category / Term	Coefficient (95% CI)	P-value
Age (**)	-	0.11 (0.06, 0.17)	<0.001
BMI (*)	-	0.09 (0.05, 0.12)	<0.001
FVC% Predicted (**)	-	-0.06 (-0.08, -0.04)	<0.001
Grip score (**)	Linear term	-0.25 (-0.30, -0.19)	<0.001
	Squared term	0.03 (0.02, 0.04)	
(*) Coefficients reported for a 5-unit increase in explanatory variable (**) Coefficients reported for a 10-unit increase in explanatory variable			

Table 42: Multivariate analysis of factors associated with impact scores

The results of the multivariate analysis indicated that age, BMI, FVC% predicted score and TMG score were all significantly associated with the QoL impact component. After adjusting for these variables, there was no longer found to be any significant effect of FEV1% predicted or smoking status.

As in the univariate analysis, older subjects and those with higher BMI values had higher QoL scores, whilst subjects with higher FVC% predicted values had lower activity SGRQ scores. The coefficients for TMG score were also similar to the univariate analysis, suggesting a similar effect of this variable.

This final model had an R-square value of 0.30. This suggests that 30% of all variation in QoL impact scores can be attributed to the variables in this model.

3.2.4.2 Differences in Impact SGRQ Scores between the Countries

The next set of analyses compared the QoL impact scores between the three countries. The analysis was performed twice, firstly unadjusted, and then adjusted for potentially confounding factors. Adjustments in the second analysis were made for age, BMI, gender and smoking status.

A summary of the results is given in the next table. (Table 43) The figures are the regression coefficients, which represent the difference in impact scores between each country and the baseline category (in this case UAE). The first p-value reported is the significance of the overall difference between countries. The subsequent p-values indicated the specific differences between pairs of countries. These latter set of p-values were given a Bonferroni adjustment to allow for multiple comparisons.

Country	**Unadjusted**		**Adjusted**	
	Coefficient (95% CI)	**p-value**	**Coefficient (95% CI)**	**p-value**
UAE	0	**<0.001**	0	**<0.001**
Morocco	-0.33 (0.40, -0.26)		-0.33 (-0.88, -0.19)	
UK	0.44 (0.38, 0.50)		0.42 (0.32, 0.52)	
UAE vs. Morocco		**<0.001**		**<0.001**
UAE vs. UK		**<0.001**		**<0.001**
Morocco vs. UK		**<0.001**		**<0.001**

Table 43: Differences in impact scores between the three countries

The results indicated that there was an overall significant differences between three countries when no other factors were considered (the unadjusted results), and also after adjusting for potentially confounding factors.

Both analyses indicated that the highest scores were for the UK, which were significantly higher than those in Morocco and the UAE. On average, impact scores were 0.4 units higher in the UK than in the UAE.

There were also significant differences in QoL impact scores between Morocco and the UAE. Both sets of analyses suggested lower scores in Morocco. In both sets of analyses subjects from Morocco had scores that were 0.3 units lower than those in the UAE.

CHAPTER IV

DISCUSSION & CONCLUSION

The main goal of our study was to compare between the QoL of COPD patients in three different regions, and investigate the causative factors behind any differences that might be found. Due to the aetiological diversity and natural complexity of the COPD, it is vital for any researcher to maintain an eye on the whole picture while looking at the tiny details at the same time to end up with a sound judgment.

We would like to highlight few points regarding our study in general before we discuss our findings and provide an assessment for our data analysis results and the related factors in contrast to similar studies and our own observations.

4.1 COPD Patients

This study is believed to be the first study to compare the QoL of a group of COPD patients from three different regions: the United Kingdom, Morocco and the United Arab Emirates, using St Georges' Respiratory Questionnaire, muscle strength and lung function measurements as QoL dimensions. For the United Arab Emirates in particular, it is also believed to be the first study looking into the Quality of Life aspects of COPD patients.

Determining the extent of impact of measurable QoL dimensions on the overall QoL of COPD patients, while assessing people who live in different parts of the world with entirely different life styles, along with adjusting the data analysis for different demographic, socio-economical and disease factors were major tasks to carry out.

Nevertheless, the desire to obtain the most possible information out of the huge data we have collected was greater than any obstacle. As mentioned in the previous chapter, we had to analyse the data using several statistical methods in order to achieve the most significant results.

Impact of Studied Factors

Baring in mind that we are comparing between patients from three different countries, for that we had to follow a standardised systematic approach to minimise any possible bias and thoroughly examine all possible interactions between the various factors with QoL dimensions. We studied the different relationships between the several factors related to the QoL and assessed their degree of dependency, under high confidence levels, to come out with many interesting significant results. Afterward, we assessed the combined effect of those factors that proved to be significantly related to the QoL, using a multivariate analysis, to achieve yet more significant outcomes.

The interest in the QoL of COPD patients has increased recently because patients are more concerned about their symptoms, their physical function, their emotional status and their adaptation to the disease. The management of COPD should be aimed at improving patients' Quality of Life, not only by relieving their symptoms, but also by enhancing their functionality and helping them to lead happier lives.

The present study was specifically set out to analyse the vulnerable QoLof stable COPD patients, as well as the QoL of control groups in the three countries by comparison. We also assessed the relationship between their QoL and BMI, muscle strength, lung function and dyspnoea in order to point out more specific factors that influence the QoL of stable COPD patients.

Generally, in terms of differences between countries, the analysis of our results indicated that there were significant differences in all variables between the three countries, such as their age, BMI, FEV1% predicted, FVC% predicted, smoking status averages and gender.

The differences in general public culture, education, socio-economical status and health awareness are crucial points that should be taken in consideration all the way long, since they play important roles in explaining the reason behind many discrepancies and differences between variables among the three countries. For example, smoking was much higher in the UAE and Morocco where over 30% of patients smoked than in the UK where the figure was only 12%; this reflects the weak awareness regarding the general health and the bad effects of smoking in those countries.

Another example of the main variations, which was due to cultural and socio-economical differences in our study countries, is that all our recruited patients from the UAE and Morocco were males, whilst 30% of UK patients were females.

Although there was no significant difference between genders in terms of their QoL, which might be due to the small number of females recruited in this study. Our results confirmed the well supported statements that there is a significant association between the total QoL and the age, BMI, FEV1% predicted, FVC% predicted, TMG score and smoking status of any individual. These results were observed when each factor was assessed one at a time.

A part of our data analysis was exploring any combined effect of some variables on the overall QoL, which was done by carrying out a multivariate analysis. However, In order to achieve a significant outcome, we applied a reversed selection procedure to retain only the statistically significant variables.

The results of the multivariate analysis indicated that age, FVC% predicted score and TMG score were all significantly contributing to the overall QoL. After adjusting for these three measures, there was no real evidence of an effect of BMI, FEV1%

predicted and smoking status upon QoL. About half of all variations in QoL can be attributed to the combination of age, FVC% predicted and TMG score.

Age and Quality of Life

Some studies confirmed that QoL of COPD patients is affected by age. Stahl et al found that the COPD patients' QoL deteriorates with disease severity and age (Stahl et al, 2005), while another research by Engstrom and Ketelaars carried out two different studies to find out that there is no relationship between the QoL and age. (Engstrom et al, 2001, Ketelaars et al, 1997) Furthermore, in another study performed on 136 COPD patients from Greece to assess the impact of age on their QOL, the findings showed that younger patients had worse QoL. (Dimitropoulos, 2009)

In this current study, our results confirm the relationship between the age and the overall QoL in patients with COPD, with a decline in the QoL being associated with an older age in all the three centres studied, which agrees with many previous studies. (Martin et al 2008, Peruzza et al 2003, de Torres et al 2006 and Carrasco Garrido et al 2006). This finding is supported by the wide range of patients age included in this study; however, elderly patients might experience poor QoL due to other reasons beside the COPD, especially in Morocco and the UAE where the general public health is hindered. Another interesting finding, in this regard, was the significant relationship between age and country, which can be explained by the fact that people age at different levels in different countries.

We have noticed that patients from the UK are much older than those from Morocco and the UAE. We have accounted for this age difference for the analysis by adjusting the comparative statistics for age. In general, a number of factors could explain this

age differences including the general population census data where the percentage of population over 65 years old is higher in the UK than the other countries. This percentage is 15% in the UK (www.statistics.gov.uk), 5% in Morocco (http://commons.wikimedia.org) and less than 1% in Dubai (www.statisticsdubai.ae). One more specific reason that few elderly patients (over 60 years old) can be found in Dubai government hospitals, is that these hospitals are mostly frequented by low income people, being mainly foreign residents or immigrant workers. They are generally below 60 years of age and when they reach an older age, they would usually go back home. In fact, according to the census conducted by the Statistics Centre of Dubai, the population of the Emirate was about 1.4 million as of 2006 with approximately 71% of the Emirate's total population being foreigners mostly from India, Pakistan, Bangladeshi and Arab countries. With regards to Morocco, it is also the experience of the author to note a general attitude of the elderly people in Morocco towards illness is to stay home resisting consultation of medical care and would usually resort to traditional remedies or just cope with the disease.

Gender and Quality of Life

In order to look at the extent of the effect of gender on the QoL of COPD patients, we used T test which indicated that there is no significant difference between the mean symptom, impact and activity SGRQ scores for males and females.

In contrast, when assessing the gender differences in the QoL of a group of COPD patients, Katsutra and colleagues found that gender differences have an effect on the QoL with females having significantly worse QoL then males except in the symptom score. (Katsutra et al, 2007) De Torres et al compared gender differences in 53 men and women and reported that females had worse QoL, lower BMI, and

higher degree of dyspnoea than COPD males. (De Torres et al, 2006) Di Marco et al also reported a poor symptom related QoL in female patients compared with men. (Di Marco et al, 2006) In a previous study performed by De Torres and co-workers, it was reported that SGRQ scores in all domains were higher in female patients than men. The authors also observed that when they classified the patients by severity of obstruction into FEV1% greater and lower than 50%, only women with mild to moderate disease had higher scores in all domains of the SGRQ than the men. This is therefore suggesting that COPD females develop symptoms influencing the SGRQ at a younger age and with less degree of obstruction than men. (De Torres et al, 2005) Data suggests that women may actually be at greater risk of smoking-induced lung function impairment, more severe dyspnoea, and poorer health status for the same level of tobacco exposure than men. (Han et al, 2007) It is also suggested that the impairment in women's QoL can be due to their high prevalence of disability and chronic conditions. (Orfila et al, 2006) Other reports found that females have worse QoL than males. (Martinez et al 2007, Katsura et al 2007, Tashkin et al 1992, de Torres et al 2002 and Oga et al 2002)

In contrast, another study by Skumlien et al found no gender differences in pulmonary function (% of predicted) and SGRQ. Activity scores were only different for men and women for items concerning home management where women had changed their functional performance the most, particularly for the heaviest chores. No gender differences were noticed in dyspnoea scores. (Skumlien et al, 2006) Similar findings were suggested by Stahl et al; their study suggested that no significant differences were noticed in QoL with regards to gender, smoking status or socio-economic group. (Stahl et al, 2005)

A recent study of gender differences in five commonly used measures of QoL, from four nationally representative studies in the USA, indicated that US women on average have slightly lower self-reported QoL than men. The QoL gap is largely explained by sociodemographic and socioeconomic status (SES) differentials between men and women. All five measures of QoL showed similar gender differences prior to sociodemographic and SES adjustments and relatively similar patterns with adjustment. Income and marital status contributed the most to explaining gender differences in QoL across measures. (Cherepanov et al, May 2010)

Our findings are in agreement with the results of previous studies, suggesting that there was no difference in QoL between women and men. In our case these results are focusing on UK patients only as it was the only centre where we were able to perform the analysis by gender. Generally, women tend to be more sensitive to changes in their QoL (Juniper et al, 1992), therefore more attention should be devoted to assess the gender differences in the COPD patients and to study the effect of gender on the clinical manifestations of COPD.

Unfortunately, the comparison between COPD in men and women from the Middle East and North Africa was not possible due to the limited number of female patients seen during the data collection (only two and therefore excluded from the study). We believe that this is due to the small number of female smokers from both countries. In fact, according to the country profiles published by the World Health Organisation (WHO), the prevalence of smoking among females is 2% in Morocco, while no data is published for the United Arab Emirates concerning the smoking prevalence .(www.who.int/en/) Another reason from my experience, having lived in both countries, is the social and cultural pressure in these countries where women seen

smoking are discredited leading them to deny smoking, so COPD is poorly diagnosed in women in these countries.

BMI and Quality of Life

Looking at the BMI influences, it is known that malnutrition increases dyspnoea and exercise intolerance in COPD patients and hence the drop off in their QoL. Hesselink et al suggest that QoL is associated with body weight. (Hesselink et al, 2006) Salepci et al also reported that QoL is predicted by BMI in a group of COPD patients. (Salepci et al, 2007) Katsutra and colleagues found that patients with low BMI had poor QoL which was assessed by SGRQ and SF-36. (Katsutra et al, 2005) Our study did not find a significant relationship between the BMI and the total QoL scores when the effect of the other factors is taken into account (age, TMG, etc). However, it showed a significant relationship between BMI and impact QoL scores, with COPD patients with low BMI tending to have poor impact QoL. As mentioned in the introduction chapter, the reasons behind the weight loss in COPD patients is poorly understood, although we found that there is an effect of BMI on the impact scores, further studies are still needed to study this relationship and to confirm those findings.

The relationship between activity scores and BMI appears to differ between the countries. The social and financial status of patients from Morocco and the UAE could be influencing factors on their BMI and might not be specifically linked to the COPD condition. The data was collected from patients visiting government and public hospitals in Morocco and the UAE, who are mostly considered being of the low income society class; their social and financial status affect their nutrition (some

people cannot afford three meals a day or a balanced diet) and subsequently their BMI.

Muscle Strength and Quality of Life

Regarding muscle grip, some studies suggested that COPD patients have muscle dysfunction which limits their exercise capacity and their QoL like the one done by Agusti et al in 2003. (Agusti et al, 2003) In 2004, Coronell et al reported as well that COPD patients have impaired peripheral muscle function when compared to a healthy control group, suggesting that there might be other factors contributing to this impairment, including malnutrition, exposure to corticosteroids, tissue hypoxia, heart disease history, tobacco use, systemic inflammation and hormone alteration. (Coronell et al, 2004) Janaudis-Ferreira et al showed in 2006 that there are gender related differences regarding muscle strength in COPD patients with female patients seemed to experience decrease in thigh muscle function when compared to male patients. (Janaudis-Ferreira, 2006) A study carried out by Giampaoli et al on elderly men aged between 71 and 91 years old suggested that poor hand strength as measured by hand-grip is a predictor of disability in older people. (Giampaoli et al, 1999)

Our analysed data confirmed and supported the findings of previous studies concerning the relationship between the QoL of COPD patients and their muscle strength. We found a significant relationship between all the components of the SGRQ and the TMG of the subjects studied, where COPD patients with poor muscle strength were having poor QoL. We also noted that the UK patients had lower TMG than patients from the UAE and Morocco, but this can be due to the age range as patients from the UK were much older than the other groups or the fact that in the

UAE or Morocco even older people would still remain in activity with some heavy duties because of the economical conditions and absence of pension support. We believe that exercise training will improve the muscle function in COPD patients which will improve their exercise capacity as well as their QoL. In fact a study performed by McKeough and colleagues has shown an increase in the quadriceps muscle mass and strength following twice weekly training in COPD patients. (McKeougha et al, 2006)

Smoking and Quality of Life

Some studies have investigated the relationship between the smoking status and the QoL of COPD patients. Stahl et al reported that smoking status did not affect patients' QoL. (Stahl et al, 2005) Prigatano et al carried out a study and found that current smoking patients have lower QoL than ex-smokers. (Prigatano et al, 1984) Spencer and colleagues used the SGRQ and SF-36 to assess if smoking had an influence on the health status and its rate of deterioration, their results found that smokers had worse QoL than ex-smokers with no effect of smoking on the rate of deterioration in the QoL. Although current smokers had worse QoL than ex-smokers, it was not sure if smoking cessation was the cause for the better QoL. (Spencer et al, 2001) Another study found that smoking affected the QoL by causing COPD exacerbations although it did not directly cause QoL deterioration. (Havlucu et al 2005) But Mulder et al found that ex-smokers had poorer QoL than current smokers (Mulder et al, 2001) and in another study by Wijnhoven, current smoking was associated with better QoL compared to ex-smokers. (Wijnhoven et al, 2001) The explanation given was that subjects who do not quit smoking might be those with a less severe stage of disease. Wilson and colleagues compared the QoL of COPD between ex-smokers, light, moderate and heavy smokers and found that heavy

smokers had significantly better QoL than the other groups. (Wilson et al, 1999) A different study by Wilson et al performed on heavy smokers reported that there is a relationship of smoking with impaired QoL and this is more marked in females than in males. (Wilson et al, 2004) Tillmann and colleague suggest that these differences in the QoL between current and ex-smokers are relatively small and are explained by variation in age, housing and economic status. (Tillmann and Silcock, 1997)

Our results support those of Mulder and Wijnhoven, although none of them used the SGRQ to assess patients' QoL, where we found that ex-smokers had worse QoL than current smokers, and this was observed in all the three centres (the UK, Morocco and the UAE). This can be explained by the various factors that determine the extent of harm smoking can cause on health. Such factors might include the intensity of smoking, time since quitting smoking, the age at which the smoker quitted the habit, as well as the patients' life style. We couldn't calculate the pack years, due to the lack of some information about the intensity of smoking and how many cigarettes did the subjects smoke. A possible reason behind current smokers having worse QoL than ex-smokers might be that patients quitting smoking even in a very short period of time were considered as ex-smokers.

Lung Function and Quality of Life

Some studies found a weak or no relationship between pulmonary function and the QoL measurements. (Wijnhoven et al, 2001) However Ferrer et al suggested that both lung function and QoL should be used to determine patients with COPD. (Ferrer et al, 1997) Stahl et al also found a strong relationship between FEV1% predicted and the QoL in COPD patients, (Stahl et al, 2005) while other studies reported that there is a weak relationship between pulmonary function (FEV1) and the QoL in

COPD patients. (Ferrer et al 1996, Jones et al 1992, Jones et al 1989) Another study conducted by McGlone and colleagues found that there is a significant relationship between physical activity, disease severity which was assessed by spirometry and QoL of COPD patients. (McGlone et al, 2006)

According to our findings there was a significant relationship between FEV1% predicted and FVC% predicted and the QoL of COPD patients when used in the univariate analysis but when the effect of other variables was taken into account there appear to be no effect of the FEV1% predicted but the effect of FVC% predicted remained significant, with low pulmonary function associated with an impairment in the QoL. However it was suggested in a number of studies that an improvement in COPD patients' QoL does not always mean an improvement in their lung function.

Our results also showed a non linear relationship between FVC% predicted and SGRQ scores, which could be explained by a possible infection or deterioration of the condition. Although exacerbations were excluded from the study, but some patients came for a follow-up and/or some mild cough and cold like symptoms.

Differences in QoL between the Countries

Through the comparative study of the variables impacting the QoL of COPD patients in three different countries, our main hypothesis is that the COPD patients in the UK would have better QoL than the patients in the other countries. That assumption was based on the economical and social development situation of the countries and the more advanced health care system in the UK compared to the other countries. This study is believed to be the first one comparing the QoL of COPD patients between the UK, Morocco and the UAE. In terms of total SGRQ scores, the UK had better

QoL than Morocco and the UAE which validates our hypothesis. However due to the absence of previous studies comparing between the three countries in this field (our simply, to our knowledge, the absence of studies on the QoL of COPD patients in the UAE for example), we could not contrast our findings with any published literature.

When comparing all SGRQ domains (symptom, activity, impact and total scores), we found that patients in the UK had the lowest symptom scores followed by patients in Morocco then by patients in the UAE and the lowest symptom scores are the better the QoL is. A similar trend is seen with the impact scores with the UK patients having the lowest impact scores but followed by UAE patients then by Moroccan patients. However, the highest activity scores were seen in Moroccan and the UK patients (with similar scores) and the lowest scores were observed in patients from the UAE. So when looking at these aspects individually, no immediate conclusion can be reached but considering the total scores, a significant difference between the countries was observed (even after considering various contributing factors such as age, gender, pulmonary function, dyspnoea, BMI and TMG), leading to the validation of our hypothesis that the UK patients would have better QoL.

A further analysis to confirm the differences in QoL between the three countries was done; firstly unadjusted and then adjusted for factors associated with total QoL. The outcome figures were the regression coefficients, which represented the difference in QoL between each country and the UAE as a baseline category. The first significance level reported was the significance of the overall difference between countries. The subsequent significance levels, which were given a Bonferroni adjustment to allow for multiple comparisons, indicated the specific differences between pairs of countries.

The unadjusted results indicated that there was an overall significant difference between the three countries when no other factors were considered. The poorest Quality of Life was for the UAE patients with SGRQ score significantly higher than those in Morocco and the UK. Moreover, there was still a significant overall difference between the three countries when the significant factors were taken into account. However, there was no significant difference between Morocco and the UK.

Subsequently the interaction between country and each of the other variables was examined. The results suggested that QoL differences between countries do not vary depending on either age range or TMG score. However, the interaction between country and FVC% predicted turned out to be significant, which implies that the QoL difference between countries varies depending on the FVC% predicted values. Consequently, we quantified the effect of FVC% predicted upon the patients' QoL for each of the three countries to end up with a confirmation on the dependency of the QoL on FVC% predicted in the three countries with a significant level. The nature of the interaction suggests that for patients with low FVC% predicted values, the QoL scores are lowest in UAE and highest in Morocco. Conversely for patients with high FVC% predicted scores, the QoL scores are lowest in Morocco but highest in the UAE. The reasons behind this trend cannot be easily explained but we suspect that maybe this is due to the effect of the other factors such as age, smoking habit, muscle strength or BMI. Further investigation is needed to study the differences in the effect of lung function on the QoL between the countries.

One of the main reasons that a patient would seek a medical care is shortness of breath (dyspnoea) and it is an important predictor of QoL, therefore the management of COPD should be aimed at reducing the shortness of breath in these patients and

measurement of dyspnoea reveals the practical effects of the treatment on the patient's daily life. (Mahler et al 1995)

The correlation between dyspnoea and QoL in COPD was also indicated in other studies supportive of our hypothesis that COPD patients with low QoL would have severe shortness of breath. (Karapolat et al 2008; Miravitlles et al 2007; Rector et al 2006; Hu et al 2005; Gonzalez et al 2005) A study by Mannino has shown that the increase in the disease severity is accompanied by an increase in dyspnoea in these patients. (Mannino et al, 2002) A study carried out by Mahler in 1992 to examine the relationship between dyspnoea, QoL and pulmonary function in COPD patients found that dyspnoea ratings influence and predict general health status to a greater extent than do physiologic measurements. (Mahler et al, 1992) In 1995 Mahler and colleagues reported that the severity of dyspnoea but not the respiratory function was a significant predictor of various components of QoL. (Mahler et al, 1995)

Our results show that the total QoL scores were significantly correlated with dyspnoea (assessed by BDI): the higher the SGRQ scores (meaning a poor QoL) were, the worse was the dyspnoea in stable COPD patients from the UAE, Morocco and the UK. When both functional impairment and magnitude of task were included in the same regression model in a multivariate analysis, both were still statistically significant, although the effects of each factor were smaller. With these results, it can be assumed that dyspnoea symptoms will probably cause restrictions in the daily activities of patients.

In this study we found a strong collinearity between two components of the BDI: magnitude of task and magnitude of effort. This leads to a question about the purpose of including the two components in the BDI if they are nearly identical. This

seems to be a unique pattern found in our data since none of the articles reviewed fortify this collinearity. There are two possible explanations that can be given to this pattern: (1) a possible data entry mistake might have occurred when transferring the collected figures to the SPSS software, but this is unlikely since care was taking during this process and a cross check was performed after entering the data in the system; (2) another explanation is that some patients might have given the same answer to both questions because they are not making the distinction between “task” and “effort” as the meaning was not explicit enough for them or simply not willing to go into the details and probably taking the pessimistic approach, thus answering negatively to both questions.

Patients’ Awareness

From the extra questions that we asked the COPD patients, we could see a big difference in disease awareness between patients from the UK and those from Morocco and the UAE. For example when patients from the UAE and Morocco were asked if they knew that they had COPD, most of them were not fully aware of their condition as such and their answer was that they had Asthma. From the author’s point of view, this can be explained by the lack of communication between the consultants and the patients especially in the hospitals visited. As mentioned earlier the data collection was from government hospitals and it was observed that the consultants were too busy to take time to explain or educate the patients about their condition. It would also seem that the system is more focused on medication treatment than counselling (or continuous treatment). Another reason behind this is maybe that most of the subjects were illiterate, limiting their capability to understand their conditions and asthma is a word generally understood and linked to respiratory

problems whereas anything where pulmonary disease is mentioned would be linked to tuberculosis (TB).

When the patients were asked if they expected one-off treatment, those from the UK who answered “No” understood and were told that there is almost no cure for COPD and that the medication would only help to stabilise their condition. While those from the UAE or Morocco who were asked the same question answered with the general saying “God knows” but the answer was considered as a “No”.

Patients were asked if they are aware that the most common causes of an exacerbation are infections of the trachea and bronchial tree and air pollution. We observed that most of the UK patients were aware of that and would do the influenza vaccination to prevent them from any infection. The other groups of patients who were aware of that fact could not do much about it especially for those who get exposed to pollution either at work and could not change their job or where they live (popular areas), bearing in mind that the data was collected from two large cities in Morocco which are very polluted. Very few patients from Morocco had influenza vaccination and those who did were the few ones entitled for medical insurance and therefore they would pay very little for the flu shot (the normal cost of the flu vaccination is about 100 MAD= £7, which the majority of the patients would not be able to afford). Concerning patients from the UAE, only patients who knew about the flu vaccination and that it might prevent them from exacerbations would have it.

During the questioning of the patients from Morocco or the UAE about their treatment, we noted that patients did not seem to take their medication properly. The main reason behind that is that they are unable to afford their treatment as very few people are supported by health insurance and it is still seen as expensive to

subscribe to one. The consultants were asked about the protocol of managing COPD and according to them, they should theoretically follow the GOLD guidelines but unfortunately in the real life they are prescribing the medication according to the patients' situation (for example some patients would only afford to take salbutamol temporarily for 2 to 3 months then stop it).

Overall COPD patients from the UK were more aware of their condition and following their treatment (with a system that is supporting this) than patients from Morocco or the UAE. The impact of the socio-economical and cultural background of each region may affect the management of COPD and health related issues in general.

4.2 Control Group

The second phase of our study was to analyse the measured and collected data about the control group subjects from the UK, the UAE and Morocco, by examining the differences between the countries parameters. As mentioned earlier, data on some parameters was available for all three countries allowing us to do a comparison on the total QoL; however, other information (such as lung function and muscle strength measures) was only available for the UAE and Morocco. For these two countries, we were able to examine the effects of various variables upon QoL scores and as we did with the patients' data, a series of univariate analysis have been carried out independently to examine the individual effect of each variable upon the overall QoL outcome.

When we compared between the control group from the three countries, our results showed differences in their QoL, where the UK subjects had poorer QoL compared to the control groups from the UAE and Morocco. This might be due to the comparatively older age the UK subjects had that indicates lower QoL commonly. In

fact, the control group in the UK were clients of the Age Concern organisation whose aim is to provide leisure space for older people and improve their social life. Noting that the English Longitudinal Study of Ageing (ELSA) which collects a range of measures of well-being including CASP-19, used to measure the Quality of Life of older adults, suggested that the overall QoL increases between the age groups of 55-59 and 60-64 but then decreases with age. In other words, CASP-19 scores decrease from state pension age onwards with the fastest decline occurring after the age of 70. (English Longitudinal Study of Ageing, Wave 3, 2005/06) Another reason which could be behind the relatively low QoL of the UK control group subjects is the possibility of co-existing medical conditions apart from respiratory illness, as we excluded subjects who suffered from any respiratory disease.

Given these discrepancies in our UK control group data and since we could not generalise our control group scores to represent healthy individuals from the UK, we could not compare the Quality of Life between COPD patients and control group from the UK but we recommend further studies to be carried out in this field.

When we studied the difference in smoking status between the countries, the number of current smokers among the UAE control group subjects was considerably less than their counterparts in the UK and Morocco.

4.3 Limitation of the Study

A number of limitations of this study should be mentioned.

The data sample used for comparison between the countries consisted of males only due to the small number of COPD females found in Morocco and in the United Arab Emirates, as we have discussed earlier, with one reason being the low prevalence of smoking women in the population or the socio-cultural denial of this. Because our

study included predominantly men, the generalisation of the results to women with COPD may be uncertain.

As the sample in Morocco and the UAE was from public hospitals with subjects predominantly from the middle to lower socioeconomic scale, the results may not generalise to other populations (for example affluent patients of a private hospital or rural populations). For the United Arab Emirates in particular, only few UAE nationals were recruited which is due to the large number of expatriates living in the UAE and also the fact that most of local people would prefer to go to private hospitals/clinics. This sample is certainly not representative of the local people from the UAE neither it is representative of the entire expatriate population which is from different backgrounds and different aspirations.

The English version of the St George's Respiratory Questionnaire was used throughout the study even for non-English speakers. We paid attention to explaining all the items to the patients in their own language (mix of Arabic, French or Moroccan dialect). Although the questionnaire was administered by the same investigator (myself) and translated into the appropriate language directly to the patient, it was observed that some of the questions do not directly apply to subjects from the UAE or Morocco (e.g. if housework is limited because of chest trouble) as males from these centres rarely perform any of the housework activities stated in the questionnaire given the cultural and the social organisation of life.

Moreover, we suspect that some respondents might have overstated (or understated) their answers. This is in fact a general disadvantage of any survey related to personal or controversial topics where participants might not always say the truth.

Another possible limitation is about lung function measurement since as stated in the methodology chapter for the COPD patients from the UK we had to use the hospital readings for spirometry. Besides, some patients might have used bronchodilator (Salbutamol) some minutes before measuring lung function which may affect the results in some way.

The fact that we could not obtain lung function measurements and the muscle grip readings from the UK control group is also a limitation because the full comparison between the three groups was not possible. Besides, the control groups were of different profiles: clients of the Age Concern organisation in the UK, workers of the National Rail Network in Morocco and staff/ visitors of the hospitals in the UAE, so the results may not be extrapolable to the general healthy population.

4.4 Conclusion

To our knowledge this study is the first approach to compare the QoL of COPD patients between three different regions: The United Kingdom (Europe), Morocco (North Africa) and the United Arab Emirates (Middle East). Using St George's Respiratory Questionnaire and lung function measurements, as well as a hand grip dynamometer to measure the total muscle strength, this study also assessed and tested any possible differences in the QoL between the studied countries after taking into consideration the effect of other variables such as age, BMI, dyspnoea, smoking history and gender differences (but the latter factor only within the UK patients).

After careful studying and analysing of the collected data, we found out that the COPD patients in the UK had the lowest total SGRQ scores (meaning better QoL) than Morocco and the UAE. This finding supports our hypothesis that the COPD patients in the UK would have better QoL than the patients in the other countries.

The available literature studying the relationship between age, gender differences, lung function, BMI, dyspnoea and the QoL came out with variable results from confirming such relationship to discarding it. Our study also assessed the association between those parameters and the QoL in COPD patients. As a result, TMG, dyspnoea, age and FVC% predicted were found to be good predictors of the QoL and significantly associated with the QoL.

The results show that there is no significant gender difference in terms of total QoL and no significant difference between males and females within the UK for the effect of lung function, TMG, BMI and dyspnoea.

BMI had no effect on the QoL in our study, except for the activity and impact SGRQ scores.

Muscle strength is a good predictor of QoL in COPD patients according to our results. Due to the shortness of breath during exercise, COPD patients become inactive, stop exercising and their day-to-day activities are limited. Further studies are needed to confirm our findings and to assess the effect of the handgrip strength on the QoL as well as morphologic studies on the handgrip muscle since most of the existing studies are mainly performed on the quadriceps muscle.

Dyspnoea is one of the most powerful predictors of QoL in COPD. Its importance was expected and supported by all previous studies. Because the Baseline Dyspnoea Index (BDI) is a descriptive tool to measure activities modified due to shortness of breath, we suggest that BDI should be used in health care settings to measure qualitative assessment of dyspnoea in patients with COPD.

This study reported that current smokers have better QoL than ex-smokers and this statement was supported by many other studies which were discussed in the previous chapters. However, we do not believe that keeping a smoking habit would be an indication for a better QoL, since smoking influence on the QoL is affected by many other factors such as the intensity of smoking, time since quitting smoking, the age at which the smoker quitted the habit, as well as the patients' life style. We suggest designing more public health smoking cessation programs which will consider the varying characteristics of different segments of the smoking population. These programs should mainly target the population in Morocco or in the United Arab Emirates due to the lack of these programs in those countries.

Age should be taken into consideration when managing COPD patients, elderly patients usually have lower QoL than younger patients which could be due to other reasons than their COPD condition (for example most of their daily activities become limited).

Supported by an additional specific questionnaire, our study suggests that there is a real need to develop treatment strategies taking into account individual goals, requirements, cultural background and socio-economical status of the COPD patients.

On a Personal level, this study and experience allowed me to fulfil a number of objectives I had set myself through the PhD program:

1. I previously completed an MSc in Clinical Pharmacy and Medicines Management, and working on the QoL aspects is a continuation of my interest in the Clinical Pharmacy topics. Furthermore the QoL aspects are valid to be considered in any condition or disease.

2. This study allowed me to familiarise myself with COPD and respiratory conditions that caught my interest since a younger age as some family members suffered from acute asthma affecting their day-to-day life.
3. This study allowed me to work with clinics from the three different countries I have lived in and to travel between these countries to get to know some aspects of the medical care in each and be exposed to it in real life. This is obviously a valuable experience, thank you to the patients and the medical staff from the clinics.
4. Improve my statistical and analytical skills and put them into use in a concrete research project.

In the future I plan to invest some time in academic life, in parallel to some voluntary work through associations and local health organisations.

From the academic and research point of view, as mentioned in this discussion chapter, I believe that there are a number of topics that need further investigation. We mentioned for example that our study is not representative of the whole population of the UAE or Morocco given life style and the level of living differences across the population. Ideally I would like to work with students from the UK, Moroccan or the UAE universities to study the QoL of COPD patients in rural areas in Morocco versus patients living in cities (actually the majority of Moroccan population is living in rural areas and remote from any ongoing medical care). Equally in the UAE it is worth looking into the QoL of South Asian immigrants (Pakistan, India, etc) who are residents in the Middle East and those living in their country and study if country of origin, area of residence and ethnicity are factors influencing the QoL of COPD patients.

There are also some general topics such as the effect of smoking that need further research as we found different perspectives from previous studies about the QoL of smokers versus ex-smokers. As mentioned earlier, such research should include a number of factors such as age since quitting smoking or intensity of smoking.

I would like to work with health care professional to design more public health smoking cessation programs especially in Morocco and the United Arab Emirates due to their lack of these programs.

From a social and community point of view, I would like to approach the Moroccan Society of Respiratory Diseases (SMMR) (I met with the representatives of the association in the last ERS congress I attended and noted that there are opportunities to help the association to be more productive) and the ministry of health or the local office of WHO to design campaigns or programs in order to increase the awareness of patients and ultimately improve their QoL. Being exposed to the UK system and the UK patients through this study, I felt that there are a number of inspirations we could take from the UK system and the management of COPD and try to promote the same with the patients in the UAE and Morocco. One concrete example is the smoking cessation programs. Another possible action would also be to approach consultants and the hospitals to encourage their staff to use SGRQ to get to know more about the QoL of the patients instead of just focusing on medication treatment. We noted for example that spirometry is not systematically performed on patients from Morocco and the UAE as we have seen in the UK, and we would encourage the consultants to perform such measures alongside the use of SGRQ mentioned earlier.

Future research should apply the knowledge that has been gained from this work in the assessment of the Quality of Life of COPD patients.

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List of Abbreviations

ATS	American Thoracic Society
BMI	Body Mass Index
BDI	Baseline Dyspnoea Index
Centre1	United Arab Emirates
Centre 2	Morocco
Centre 3	United Kingdom
COPD	Chronic Obstructive Pulmonary Disease
CRDQ	Chronic Respiratory Disease Questionnaire
Df	Degree of freedom
EFH	Education For Health
ERS	European respiratory society
FEV1	Forced Expiratory Volume
FVC	Forced Volume Capacity
FEV1/FVC%	Forced expiratory ratio
FEV1% predicted	Forced Expiratory Volume in 1 second predicted for age and sex
FVC% predicted	Forced Vital Capacity predicted for age and gender
GOLD	Global initiative of Obstructive Lung Disease
iNOS	Nitric oxide synthase
Kg	Kilogram
LVRS	Lung Volume Reduction Surgery
MRC	Medical Research Council
M	meter
Mm	millimeter
NO	Nitric oxide

NHS	National Health Services
PaO2	Partial Pressure of Oxygen
PLE	Panlobular Emphysema
PEFR	Peak Expiratory Flow Rate
QWB	Quality of Well Being
QoL	Quality of Life
RVI	Royal Victoria Infirmary
SD	Standard Deviation
SE	Standard Error
SES	Socioeconomic Status
Std	Standard
SOLQ	Seattle Obstructive Lung Disease Questionnaire
SIP	Sickness Impact Profile
SaO2	Arterial Oxygen Saturation
SMMR	Societe Marocaines des Maladies Respiratoires
Sig	Significant p value
SGRQ	St Georges' Respiratory Questionnaire
SPSS	Software Package for Social Sciences
TDI	Transitional Dyspnoea Index
TMG	Total Muscle Grip
US	United States
UAE	United Arab Emirates
UK	United Kingdom
WHO	World Health Organization
Yrs	Years

Appendix 1: Patient Information Sheet

Chronic Lung Disease study
Patient information sheet

We would like to invite you to take part in this study, which investigates the effects of social support and stress on the wellbeing of patients with chronic obstructive lung disease. We would like you to read the information sheet and give us you permission to access your medical records, if this is appropriate

What is the purpose of the study?

We are investigating how support from families and friends help people with chronic lung disease to cope with their condition.

What will happen if I agree to take part in the study?

An investigator will ask you to fill some questionnaires and will help you to do this. The questionnaire will record information about your symptoms, how you feel about yourself, how you cope with your illness, and who helps you. This will take just few minutes to complete.

The investigator will get a copy of your lung function results from your medical records, and the questionnaires will be analysed.

Is the study voluntary?

Yes. If you do not want to take part in the study this will not affect your current or future treatment in anyway.

Will the information obtained in the study be confidential?

Yes the information gather will be treated with strict medical confidentiality. No one else will be given the results in any form that can identify a particular person.
Any written reports of the study will ensure that each person who takes part remains anonymous.

Will there be any risks or side effects associated with the study?

The study involves an interview only. Your medical investigations and treatment will not be changed in any way.

How long will the study last?

It will take only few minutes to fill in the questionnaire.

Will anyone else be told about my participation in the study?

A note will be made in your medical records, which are confidential. No one else will be told that you have taken part in the study

Will anyone else have access to my medical records?

Your lung function results will be copied and used in the study. The rest of your medical records will remain entirely confidential.

Who should I contact if I require further information about the study?

Dr M Shamssain. University of Sunderland, who is co-ordinating the study. Dr Shmassain's address is:

Dr M Shamssain
School of Health, Natural and Social Sciences
University of Sunderland
Darwing Building, Chester road
Sunderland, SR1 3SD

Tel 0191 5153784 or 5152525

Appendix 2: Patients Record Form

Investigator: Imane Ben Bihi Centre code: ------ Inclusion Date : ----/----/----

Patient Record

Patient Information				
Patient's ID ----------	Date Of Birth -----/-----/----	Male □ Female □	Height (M) ----------	Weight (Kg) ----------
Patient History				
Smoking classification: Smoker □ Never smoker □ Ex Smoker □				
If smoker or ex-smoker, how many cigarettes/day? ----------				
Drug History Previous or current treatment for COPD? Yes □ No □				
If yes, what is the medication used?				

Medical History	Overall, no significant history □
□ Hypertension □ Cardiac Failure □ Heart disease □ Stroke □ High cholesterol □ Ulcers □ Hepatitis □ Diabetes □ Thyroid disorder □ Kidney disorder	□ Visual abnormalities □ Allergies □ Tuberculosis □ Breast disease (cancer) □ Breast disease (benign) □ Arthritis □ Tuberculosis □ Liver disease □ Bleeding/clotting disorder □ Others: ----------

Medical Examination

Lung Function Test		1st Reading	2nd Reading	3rd Reading	Average
	PEF	----------	----------	----------	----------
	FVC	----------	----------	----------	----------
	FEV1	----------	----------	----------	----------
	FVC/FEV1	----------	----------	----------	----------
Muscle Strength		1st Reading	2nd Reading	3rd Reading	Average
	Right	----------	----------	----------	----------
	Left	----------	----------	----------	----------
	Right + Left	----------	----------	----------	----------

Appendix 3: St Georges' Respiratory Questionnaire (English)

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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continued…

St. George's Respiratory Questionnaire
PART 1

Questions about how much chest trouble you have had over the past 3 months.

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 3 months, I have coughed:	☐	☐	☐	☐	☐
2.	Over the past 3 months, I have brought up phlegm (sputum):	☐	☐	☐	☐	☐
3.	Over the past 3 months, I have had shortness of breath:	☐	☐	☐	☐	☐
4.	Over the past 3 months, I have had attacks of wheezing:	☐	☐	☐	☐	☐

5. During the past 3 months 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 3 months, 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 ☐

continued…

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	☐	☐

continued…

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	☐	☐

continued…

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	☐	☐

continued…

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.

Appendix 4: St Georges' Respiratory Questionnaire (Arabic)

أستطلاع سانت جورج التنفسى
النسخة العربية الأصلية

أستطلاع سانت جورج التنفسى

صمم هذا الأستطلاع لمساعدتنا فى تقييم مشكلتك من مرضك التنفسى ومدى تأثير ذلك على حياتك. فنحن نستعملة لأكتشاف أى الأوجه فى مرضك هى الأكثر سببا لمشاكلك وليس ما يظنه الأطباء والتمريض.

برجاء قراءة التعليمات بعناية والسؤال أذا لم تفهم شيئا. لا تستغرق وقتا طويلا لتقرر أجابتك.

قبل أستكمال باقى الأستطلاع برجاء وضع علامة فى صندوق واحد لوصف حالتك الصحية الحالية:

جيدة جدا	جيدة	متوسطة	سيئة	سيئة جدا
☐	☐	☐	☐	☐

قام بترجمة وإعداد وإختبار هذه النسخة العربية من اللغة الأنجليزية الدكتور / **محمد مصطفى عبد الهادى متولى**. مدرس الأمراض الصدرية بكلية طب أسيوط بجمهورية مصر العربية. ت محمول 0020123971614 بريد الكتروني melhadi@yahoo.com

أستطلاع سانت جورج التنفسى
الجزء الأول

أسئلة عن حجم المشاكل الصدرية التى واجهتها فى خلال الأربعة أسابيع السابقة:

برجاء وضع علامة (√) واحدة على الأجابة المطلوبة

	أغلب أيام الأسبوع	أيام كثيرة فى الأسبوع	بعض أيام الشهر	مع النزلات الشعبية	لا يوجد
1. فى خلال الأربع أسابيع الماضية.كان عندى السعال	☐	☐	☐	☐	☐
2. فى خلال الأربع أسابيع الماضية. كان عندى بصاق	☐	☐	☐	☐	☐
3. فى خلال الأربع أسابيع الماضية.كان ضيق التنفس	☐	☐	☐	☐	☐
4. فى خلال الأربع أسابيع الماضية.كان تزييق الصدر	☐	☐	☐	☐	☐

5. فى خلال الأربع أسابيع الماضية. كم عدد الأزمات التنفسية الشديدة التى تعرضت لها؟
برجاء وضع علامة (√) واحدة

☐ اكثر من 3 أزمات
☐ 3 أزمات
☐ أزمتين فقط
☐ أزمة واحدة
☐ لا شىء

6- ما هي أطول مدة أسوأ أزمة صدرية واجهتها؟
(برجاء الأجابة مباشرة عن السؤال السابع أن لم توجد أزمة سيئة)

برجاء وضع علامة (√) واحدة

☐ أسبوع أو أكثر
☐ 3 أيام أو أكثر
☐ يوم أو يومين
☐ أقل من يوم

7. فى خلال الأربع أسابيع الماضية.ما هى عدد الأيام الجيدة التى قضيتها بقليل من متاعب الصدر؟
برجاء وضع علامة (√) واحدة

☐ لاتوجد
☐ يوم أو يومين
☐ 3 أو 4 أيام
☐ كل الأيام جيدة تقريبا
☐ كل الأيام بالتأكيد

8. أن كنت تعانى من ضيق الشعب الهوائية, هل كان هذا أسوأ في الصباح؟

برجاء وضع علامة (√) واحدة

☐ لا
☐ نعم

أستطلاع سانت جورج التنفسى
الجزء الثانى

القسم الأول

كيف تصف حالة صدرك؟

برجاء وضع علامة (√) واحدة

- ☐ أهم مشكلة عندى
- ☐ تسبب لى مشاكل كثيرة
- ☐ تسبب لى بعض المشاكل
- ☐ لا تسبب مشكلة

لو كان قد تم توظيفك فى عمل ما

برجاء وضع علامة (√) واحدة

- ☐ حالة صدرى منعتنى من العمل
- ☐ حالة صدرى تتعارض مع عملى أو جعلتنى أغيرة
- ☐ حالة صدرى لا تتعارض مع عملى

القسم الثانى

أسئلة عن الأنشطة التى تجعلك مصابا بضيق تنفس هذه الأيام

برجاء وضع علامة (√) فى كل صندوق ينطبق عليك هذه الأيام

	صحيح	خطأ
الجلوس أو الرقود بدون حركة	☐	☐
الأغتسال أو أرتداء الملابس	☐	☐
المشى حول المنزل	☐	☐
المشى على مسطح خارجى	☐	☐
صعود السلم	☐	☐
المشى على سطح مرتفع لأعلى	☐	☐
لعب الرياضة أو الألعاب	☐	☐

أستطلاع سانت جورج التنفسى
الجزء الثانى

القسم الثالث

بعض الأسئلة الأخرى عن أعراض السعال و ضيق التنفس لديك هذه الأيام:

برجاء وضع علامة (√) فى كل صندوق ينطبق عليك هذه الأيام

	صحيح	خطأ
السعال عندى مؤلم	☐	☐
السعال عندى يجعلنى متعب	☐	☐
أصاب بضيق تنفسى عند الكلام	☐	☐
أصاب بضيق تنفسى عند الأنحناء	☐	☐
سعالى أو تنفسى يقلق نومى	☐	☐
أصاب بالأجهاد بسهولة	☐	☐

القسم الرابع

أسئلة عن بعض الآثار الأخرى التى قد تسببها لك مشكلة صدرك هذه الأيام

برجاء وضع علامة (√) فى كل صندوق ينطبق عليك هذه الأيام

	صحيح	خطأ
سعالى أو تنفسى يحرجنى أمام الناس	☐	☐
مشكلة صدرى تمثل أزعاجا لعائلتى أو أصدقائى أو جيرانى	☐	☐
أخاف او أصاب بذعر عندما لا أستطيع التنفس	☐	☐
أحس بأننى لا أسيطر على مشكلة صدرى	☐	☐
لا أتوقع أن تتحسن حالة صدرى	☐	☐
لقد أصبحت هشا وغير ذى نفع بسبب صدرى	☐	☐
التمارين غير آمنه بالنسبة لى	☐	☐
كل شىء يبدو لى مجهودا كثيرا	☐	☐

القسم الخامس

أسئلة خاصة بأدويتك, برجاء ترك هذه الأسئلة والأجابة عن القسم السادس أذا لم تكن تستعمل أدوية

برجاء وضع علامة (√) فى كل صندوق ينطبق عليك هذه الأيام

	صحيح	خطأ
أدويتى لا تساعدنى هذه الأيام كثيرا	☐	☐
أصاب بأحراج لأستعمالى أدويتى أمام الناس	☐	☐
عندى أعراض جانبية تضايقنى من أدويتى	☐	☐
أدويتى تتعارض بشدة مع حياتى	☐	☐

أستطلاع سانت جورج التنفسى
الجزء الثانى

القسم السادس

هذه الأسئلة عن مدى تأثر أنشطتك المختلفة بحالتك التنفسية.

برجاء وضع علامة (√) فى كل صندوق ينطبق عليك بسبب حالتك التنفسية

	صحيح	خطأ
أستغرق وقتا طويلا للأستحمام أو أرتداء ملابسى	☐	☐
لا أستطيع الأستحمام أو أستغرق وقتا طويلا	☐	☐
أمشى أبطأ من الآخرين أو أتوقف للراحة	☐	☐
أعمال المنزل تستغرق منى وقتا طويلا أو أتوقف للراحة	☐	☐
أذا صعدت السلم, لابد أن أبطىء أو أتوقف	☐	☐
أذا مشيت بسرعة, لابد أن أبطىء او أتوقف	☐	☐
تنفسى يجعل من الصعوبة أن أصعد التل أو أصعد السلم و أنا أحمل أشياءا	☐	☐
تنفسى يجعل من الصعوبة أن أحمل اشياءا ثقيلة أو أن أحفر فى الحديقة أو أسبح	☐	☐
تنفسى يجعل من الصعوبة أن أقوم بعمل يدوى صعب أو أجرى أو أقود الدراجة أو أسبح بسرعة	☐	☐

القسم السابع

نحب أن نتعرف على الآثار اليومية التى قد تسببها لك مشكلة صدرك دائما

برجاء وضع علامة (√) فى كل صندوق ينطبق عليك بسبب مشكلة صدرك

	صحيح	خطأ
لا أستطيع لعب الرياضة	☐	☐
لا أستطيع الخروج للتسلية	☐	☐
لا أستطيع الخروج لشراء احتياجاتى	☐	☐
لا أستطيع القيام بأعمال فى المنزل	☐	☐
لا أستطيع الحركة بعيدا عن سريرى أو الكرسى	☐	☐

أستطلاع سانت جورج التنفسى

هذه قائمة بالأنشطة التى قد تتسبب حالة صدرك فى منعك من ممارستها (برجاء ألا تضع أية علامات, فهى فقط للتذكرة بالطرق المختلفة التى تتأثر بها بسبب ضيق التنفس)

الذهاب للتمشية
عمل أشياء فى المنزل أو الحديقة
الممارسة الجنسية
الذهاب للجامع أو الكنيسة أو أماكن التسلية
الخروج فى الجو السيء أو الجلوس فى غرفة بها دخان
زيارة العائلة أو الأصدقاء أو اللعب مع الأطفال

برجاء كتابة أى أنشطة مهمة لاتتمكن من ممارستها بسبب حالة صدرك

.....
.....
.....
.....

برجاء وضع علامة الآن على صندوق واحد فقط يصف بدقة كيف تؤثر حالة صدرك فيك

- ☐ لا تمنعنى من عمل أى شيء أحب عملة
- ☐ تمنعنى من عمل شيء أو شيئين أحب عملهما
- ☐ تمنعنى من عمل أغلب الأشياء التى أحب عملها
- ☐ تمنعنى من عمل كل الأشياء التى أحب عملها

شكرا على أجابتك على هذا الأستطلاع. برجاء التأكد من أجابتك على كل الأسئلة قبل انتهائك

Appendix 5: SGRQ Item Weights

PART I

QUESTIONS ABOUT HOW MUCH CHEST TROUBLE YOU HAVE HAD OVER THE LAST YEAR

PLEASE TICK IN 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 last year, I have coughed	80.6	63.2	29.3	28.1	0
2) Over the last year, I have brought up phlegm (sputum)	76.8	60.0	34.0	30.2	0
3) Over the last year, I have had shortness of breath	87.2	71.4	43.7	35.7	0
4) Over the last year, I have had attacks of wheezing	86.2	71.0	45.6	36.4	0

5) During the last year, how many severe or very unpleasant attacks of chest trouble have you had :

more than 3 attacks..... 86.7
3 attacks..... 73.5
2 attacks..... 60.3
1 attack..... 44.2
no attacks..... 0

6) How long did the worst attack of chest trouble last:
(Go to Question 7 if you had no severe attacks)

a weak or more…..…… 89.7
3 or more days……..…… 73.5
1 or 2 days..... 58.8
less than a day…..... 41.9

7) Over the last year, in an average week, how many good days (with little chest trouble) have you had:

no good days..... 93.3
1 or 2 good days…..... 76.6
3 or 4 good days..... 61.5
nearly every day is good…….. 15.4
every day is good..... 0

8) If you have a wheeze, is it worse in the morning:

no……..... 0
yes..... 62.0

PART 2

SECTION 1:

HOW WOULD YOU DESCRIBE YOUR CHEST CONDITION? (PLEASE TICK IN ONE BOX ONLY)

the most important problem I have..... 83.2
causes me quite a lot a problems..... 82.5
causes me a few problems..... 34.6
causes no problem..... 0

IF YOU HAVE EVER HAD PAID EMPLOYMENT, PLEASE TICK ONE OF THESE:

my chest trouble made me stop work..... 88.9
my chest trouble interferes with my work or made me change my work..... 77.6
I my chest trouble does not affect my work..... 0

SECTION 2: QUESTIONS ABOUT WHAT ACTIVITIES USUALLY MAKE YOU FEEL BREATHLESS THESE DAYS.

FOR EACH ITEM, PLEASE TICK EITHER TRUE OR FALSE AS IT APPLIES TO YOU.

a. Sitting or lying still..... 90.6
b. Getting washed or dressed..... 82.8
c. Walking around the home..... 80.2
d. Walking outside on the level…..... 81.4
e. Walking up a flight of stairs..... 76.1
f. Walking hills..... 75.1
g. Playing sports or games..... 72.1

SECTION 3: SOME MORE QUESTIONS ABOUT YOUR COUGH AND BREATHLESSNESS THESE DAYS.

FOR EACH ITEM, PLEASE TICK EITHER TRUE OR FALSE AS IT APPLIES TO YOU.

a. My cough hurts..... 81.1
b. My cough makes me tired..... 79.1
c. I am breathless when I talk..... 84.5
d. I am breathless when I bend over……..... 76.8
e. My cough or breathing disturbs my sleep….. 87.9
f. I get exhausted easily..... 84.0

SECTION 4: QUESTIONS ABOUT OTHER EFFECT S THAT YOUR CHEST TROUBLE MAY HAVE ON YOU THESE DAYS.

FOR EACH ITEM, PLEASE TICK EITHER TRUE OR FALSE AS I'I` APPLIES TO YOU.

a. My cough or breathing is embarrassing in public…….....74.1
b. My chest trouble is a nuisance to my family, friends or neighbours.....79.1
c. I get afraid or panic when I cannot get my breath..... 87.7
d. I feel that I am not in control of my chest problem…… 90.1
e. I do not expect my chest to get any better..... 82.3
f. I have become frail or an invalid because of my chest…..... 89.9
g. Exercise is not safe for me..... 75.7
h. Everything seems too much of an effort……..... 84.5

SECTION 5: QUESTIONS ABOUT YOUR MEDICATION. IF YOU ARE RECEIVING NO MEDICATION GO STRAIGHT TO SECTION 6.
TO COMPLETE THIS SECTION PLEASE TICK EITHER TRUE OR FALSE AS IT APPLIES TO YOU.

a. My medication does not help me very much..... 88.2
b. I get embarrassed using my medication in public….. 53.9
c. I have unpleasant side effects from my medication.... 81.1
d. My medication interferes with my life a lot..... 70.3

SECTION 6: THESE ARE QUESTIONS ABOUT HOW YOUR ACTIVITIES MIGHT BE AFFECTED BY YOUR BREATHING. FOR EACH QUESTION, PLEASE TRUE IF ONE OR MORE PARTS APPLIES TO YOU BECAUSE OF YOUR BREATHING. OTHERWISE TICK FALSE.

a. I take a long tune to get washed or dressed..... 74.2
b. I cannot take a bath or shower, or I take a long time……..…..... 81.0
c. I walk slower than other people, or I stop for rests……..……..... 71.7
d. Jobs such as housework take a long time, or l have to stop for rests..... 70.6
e. If I walk up one flight of stairs, I have to go slowly or stop..... 71.6
f. If I hurry or walk fast. I have to stop or slow down..... 72.3
g. My breathing makes it difficult to do things like walk up hills; carrying things up stairs, light gardening such as weeding, dance, play bowls or play golf……..... 74.5
h. 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..... 71.4
i. My breathing makes it difficult to do things such as very heavy manual work, run, cycle, swim fast or play competitive sports..... 63.5

SECTION 7: WE WOULD LIKE TO KNOW HOW YOUR CHEST TROUBLE USUALLY AFFECTS YOUR DAILY LIFE.
PLEASE TICK EITHER TRUE OR FALSE AS IT APPLIES TO YOU BECAUSE OF YOUR CHEST TROUBLE.
(REMEMBERTHAT TRUE ONLY APPLIES TO YOU IF YOU CAN NOT DO SOMETHING BECAUSE OF YOUR BREATHING)

a. I cannot play sports or games..... 64.8
b. I cannot go out for entertainment or recreation..... 79.8
c. I cannot go out of the house to do the shopping..... 81.0
d. I cannot do housework..... 79.1
e. I cannot move far from my bed or chair..... 94.0

SECTION 8: 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 TI-IE DOG
DOING THINGS AT HOME OR IN THE GARDEN
SEXUAL INTERCOURSE
GOING OUT TO CHURCH, OR PLACE OF ENTERTAINMIQIT
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;

SECTION 9: 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……..... 0
It stops me doing one or two things I would like to do..... 42.0
It stops me doing most of the things I would like to do..... 84.2
It stops me doing everything I would like to do..... 96.7

THANK YOU FOR FILLING IN TI-IIS QUESTTONNAIRE. BEFORE YOU FINISH WOULD YOU CHECK TO SEE THAT YOU HAVE ANSWERED ALL TIE QUESTIONS.

SYMPTOMS COMPONENT

This consists of all the questions in Part 1. The weights for Questions 1-8 are summed. It will be noted that the questionnaire requests a single response to Questions 1-7. If multiple responses are given to a question then averaging the weights for the positive responses for that question is acceptable. We feel that is a better approach than losing an entire data set and have used this technique in calculating the results used in our validation studies. (Clearly a better approach is to prevent such multiple responses occurring, but it is difficult to prevent occasional accidents).

ACTIVITY COMPONENT

This is calculated from the summed weighs for the positive responses to Section 2 and Section 6 in Part 2 of the questionnaire.

IMPACTS COMPONENT

This is calculated from Sections 1; 3; 4; 5; 7. Again it will be noted from the questionnaire that a single response is required for the two parts of Section l and the last part of Section 7. In the case of multiple responses we have adopted the approach of meaning the weights for any multiple responses to these parts.

TOTAL SCORE

The Total score is calculated by summing the all positive responses in the questionnaire and expressing the result as a percentage of the weights for all items in the questionnaire (as shown on previous page).

HANDLING MISSED ITEMS

It is better not to miss items and any missing items are the fault of the experimenter, not the patient. We have examined the effect of missing items and recommend the following methods:

Part 1

Missed items are treated as if the answer was in the negative.

Part 2

The following approach may be used. Items in Sections 2, 3,4,5,6, and first part of section 7 all require a response of either ‘True’ or ‘False’. If neither box is ticked, the item should be coded as ‘missing’. If this approach is to be used, the scoring program should be written so that when an item is coded as ‘missing’, the weight for that item is subtracted from the total possible weight for that component of the questionnaire (i.e. either the Impacts or the Activity component) and from the Total weight.

We have very carefully tested this method of handling missing data and found that it is reliable for up to 10 missed items in Part 2 of the questionnaire.

CALCULATION METHOD FOR THE SGRQ

SUMMARY

Three component scores are calculated: Symptoms; Activity; Impacts.

One Total score is also calculated.

PRINCIPLE OF CALCULATION

Each questionnaire response has a unique empirically derived 'weight'. The lowest possible weight is zero and the highest is 100.

Each component of the questionnaire is scored separately in two steps:

i. The Weights for all items with a positive response are summed.

ii. The score is calculated by dividing the summed weights by the maximum possible weight for that component and expressing the result as a percentage:

Score = 100 x Summed weights from positive items in that component
Sum of weights for all items in that component
The Total score is calculated in similar way:
Score = 100 x Summed weights from positive items in the questionnaire
Sum of weights for all items in the questionnaire

Sum of maximum possible weights for each component and Total:
Symptoms 662.5
Activity 1209.1
Impacts 21 17.8
Total 3989.4
(Note: these are the maximum possible weights that could be obtained for the worst possible state of the patient).

EXAMPLE OF CALCLULATION
(FOR CHECKING COMPUTER PROGRAM)
Questionnaire Part 1
Positive responses to:
Question 1: I have coughed several days a week
Question 2: I have brought up sputum a few days a month
Question 7: In the last year in an average week nearly every day was a good day
Questionnaire Part 2
Positive responses to:
Section 1: A few problems.
Section 2: Walking up hills.
Playing sport or games.
Section 3: My cough hurts.
My cough or breathing disturbs my sleep.
Section 4: My cough or breathing is embarrassing in public.
Section 5: I have unpleasant side effects from my medication.
Section 6: My breathing makes it difficult to .... swim
Section 6: My breathing makes it difficult to .... play competitive sports
Section 7: I cannot play sports or games
Section 7: It stops me doing one or two things I would like to do.
Calculated scores:
Symptoms:
(Sum of weights=112.6)
Score= 17.0
Activity:
(Sum of weights= 282.1)
Score= 23.3 t
Impacts:
(Sum of weights= 465.6)
Score =22.0
Total:
(Sum of weights =860.3)
Score =21.6

Appendix 6: Base Line Dyspnoea Index

Baseline Dyspnoea Index

Functional Impairment

_____ Grade 4: *No Impairment.* Able to carry out usual activities and occupation without shortness of breath.

_____ Grade 3: *Slight Impairment.* Distinct impairment in at least one activity but no activities completely abandoned. Reduction, in activity at work *or* in usual activities, that seems slight or not clearly caused by shortness of breath.

_____ Grade 2: *Moderate Impairment.* Patient has changed jobs *and/or* has abandoned at least one usual activity due to shortness of breath.

_____ Grade 1: *Severe Impairment.* Patient unable to work *or* has given up most or all usual activities due to shortness of breath.

_____ Grade 0: *Very Severe Impairment.* Unable to work *and* has given up most or all usual activities due to shortness of breath.

_____ W: *Amount Uncertain.* Patient is impaired due to shortness of breath, but amount cannot be specified. Details are not sufficient to allow impairment to be categoried.

_____ X: *Unknown.* Information unavailable regarding impairment.

_____ Y: *Impaired for Reasons Other than Shortness of breath.* For example, musculoskeletal problem or chest pain.

Usual activities refer to requirements of daily living, maintenance or upkeep of residence, yard work, gardening, shopping, etc.

Magnitude of Task

_____ Grade 4: *Extraordinary.* Becomes short of breath only with extraordinary activity such as carrying very heavy loads on the level, lighter loads uphill, or running. No shortness of breath with ordinary tasks.

_____ Grade 3: *Major.* Becomes short of breath only with such major activities as walking up a steep hill, climbing more than three flights of stairs, or carrying a moderate load on the level.

_____ Grade 2: *Moderate.* Becomes short of breath with moderate or average tasks such as walking up a gradual hill, climbing fewer than three flights of stairs, or carrying a light load on the level.

_____ Grade 1: *Light.* Becomes short of breath with light activities such as walking on the level, washing, or standing.

_____ Grade 0: *No Task.* Becomes short of breath at rest, while sitting, or lying down.

_____ W: *Amount Uncertain.* Patient's ability to perform tasks is impaired due to shortness of breath, but amount cannot be specified. Details are not sufficient to allow impairment to be categorised.

_____ X: *Unknown.* Information unavailable regarding limitation of magnitude of task.

_____ Y: I*mpairment for Reasons Other than Shortness of Breath.* For example, musculoskeletal problem or chest pain.

Magnitude of Effort

_____ Grade 4: *Extraordinary.* Becomes short of breath only with the greatest imaginable effort. No shortness of breath with ordinary effort.

_____ Grade 3: *Major.* Becomes short of breath with effort distinctly submaximal, but of major proportion. Tasks performed without pause unless the task requires extraordinary effort that may be performed with pauses.

_____ Grade 2: *Moderate.* Becomes short of breath with moderate effort. Tasks performed with occasional pauses and requiring longer to complete than the average person.

_____ Grade 1: *Light.* Becomes short of breath with little effort. Tasks performed with little effort or more difficult tasks performed with frequent pauses and requiring 50-100% longer to complete than the average person might require.

_____ Grade 0: *No effort.* Becomes short of breath at rest, while sitting, or lying down.

_____ W: *Amount Uncertain.* Patient's exertional ability is impaired due to shortness of breath, but amount cannot be specified. Details are not sufficient to allow impairment to be categorized.

_____ X: *Unknown.* Information unavailable regarding limitation of effort.

_____ Y: *Impaired for Reasons Other than Shortness of Breath.* For example, musculoskeletal problem or chest pain.

Appendix 7: Poster 1 Presented at the ERS Congress (Copenhagen 2005)

University of Sunderland

Quality of Life in a group of COPD patients from the United Arab Emirates

Imane Ben Bihi, M.Sc [1], Mohammed Shamssain, Ph.D [1], Malcolm Farrow, Ph.D [1], Mirza Al Sayegh, M.D [2] and Sayed Nasir, M.D [3].
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Introduction

Chronic Obstructive Pulmonary Disease is disease state characterised by progressive, irreversible airway obstruction, and a gradual loss of the lung function[1]

WHO reported that COPD would be the 5th worse disease in Disability Adjusted Life Year (DALY) in 2020 and it was reported as 12th worse disease in 1990.[2]

COPD patients are usually affected by the disease and the health. Including emotional distress, dyspnea, peripheral muscle weakness, exercise intolerance, decreased Health-Related Quality of Life and the adaptation to the disease.[3]

No studies have been done on COPD patients from the UAE and the present study is the first study assessing the Quality of Life of COPD patients from the United Arab Emirates.

Aims and Objectives

To study the Quality of Life profile of COPD patients in the United Arab Emirates.

Methods

St. George's Respiratory Questionnaire (SGRQ) was used to evaluate Quality of Life. It is a 76 item questionnaire which measures three dimensions :

- Symptoms associated with pulmonary disease
- Activities likely to be limited by dyspnea
- Impacts on social and psychological functioning

Mahler Dyspnoea Index also called Base line Dyspnea Index (BDI) is a multidimensional instrument was used to assess the dyspnea symptoms at baseline, each index rates functional impairment, magnitude of task needed to evoke dyspnoea, and magnitude of effort needed to invoke dyspnoea. The above components were rated from 0 (severe) to 4 (unimpaired).

Lung function tests (FVC, FEV1, PEFR, FEV1/FVC ratio) were measured by Vitalograph spirometer.

Hand grip dynamometer was used to measure the muscle strength.

Patients' awareness of COPD was evaluated using modified questionnaire.

Results

A total of seventy three stable COPD patients were included in the study.

Mean (S.D) age, height and body weight were 56.3 (14.4) y, 170.6 (7.2) cm and 73.7 (13.4) kg, respectively. (Table1)

Mean symptom, activity, impact components of SGRQ and total scores were 64.5, 72.2, 43.4 and 45.7, respectively.

There was no significant difference in the lung function and the muscle strength between the smokers (n=27) and the ex-smokers patients (n=45). (Table1)

Patients with grade 3 Functional Impairment component of baseline Mahler Dyspnoea Index had significantly better Quality of Life (symptoms, activity, impacts and total scores) than patients with grade 2 Functional Impairment component. The same pattern was obseeved with Magnitude of Task and Magnitude of Effort components. (Table2)

Forty percent of patients were aware of having COPD, 94.5% were aware of their symptoms, 74% were aware that smoking is the primary cause of COPD, and 31.5% took irregular inhaled corticosteriods. (Table3)

Patients with the Quality of Life scores (Symptoms, impact, activity and the total percent) higher than fifty have a lower lung functioning and BMI than those with the Quality of Life scores lower than 50. (Table4)

Measurements	Mean±SD		
	All patients (n=73)	Smokers (n=27)	Ex smokers (n=45)
AGE	56.3±14.4	49.5±10.7	60.4±15
Height (cm)	170.6±7.2	170.8±8.4	170.2±6.4
Weight (kg)	73.7±13.4	74.3±15	73.2±12.7
FVC (L)	2.3±1.9	2.6±2.1	2.2±1.8
FEV1 (L)	1.9±1.3	1.8±1.2	1.9±1.4
FEV1/FVC (%)	65.0±24.6	73.6±22	59.4±24.9
PEF (L/min)	363.7±187.6	412.3±203.4	332.8±175.0
Right Grip (kg)	30.0±9.4	32.3±10.2	28.6±8.8
Left Grip (kg)	26.3±8.9	28.2±10.2	25.2±8.1
Total Grip (kg)	56.5±18	61.0±19.5	53.8±16.8

Table 1: Physical and lung function measurements in COPD patients from UAE

		Symptom % ± SD	Impact % ± SD	Activity % ± SD	Total % ± SD
Functional Impairment	Grade 4 (n=7)	48.1±23.7	42.8±36.8	29.2±23.2	36.5±24.7
	Grade 3 (n=31)	54.6±17.2	68.5±16.5	36.2±15.3	48.8±12.8
	Grade 2 (n=23)	67.3±16.9	76.5±16.4	45.4±14.4	58.9±13.4
	Grade 1 (n=9)	82.7±9.1	92.8±8.5	65.0±12.8	76.4±9.8
Magnitude of Task	Grade 4 (n=7)	49.5±20.2	61.4±35.7	34.6±24	45.2±25.3
	Grade 3 (n=28)	55.5±18.1	65.2±20.6	36.9±15.6	48.6±14
	Grade 2 (n=23)	64.2±15.8	73.6±15	42.0±15.5	55.4±13.4
	Grade 1 (n=13)	82.2±11.38	94.5±7.6	64.5±12.1	76.5±8.5
Magnitude of Effort	Grade 3 (n=29)	54.1±17.6	66.3±15.7	35.9±13.9	48.1±11.8
	Grade 2 (n=26)	66.6±15.9	74.6±21.3	44.3±15.8	57.4±14.9
	Grade 1 (n=10)	84.3±8	95.6±6.7	66.8±11.9	78.4±8.6

Table 2 : Mahler Dyspnea Scale in COPD patients from UAE

QUESTIONS	Prevalence % who responded positively
	UAE (n=73)
Q1 (Do you know that you have COPD ?)	39.7
Q2 (Do you know your symptoms ?)	94.5
Q3 (Do you know smoking is the primary cause of COPD ?)	74
Q4 (Do you know the most common causes of an exacerbation are infection of the tracheobronchial tree and air pollution ?)	17.8
Q5 (Do you expect simple, one-off treatment to cure the symptoms ?)	32.9
Q6 (Did you have influenza vaccination ?)	41.1
Q7 (Did you attend pulmonary rehabilitation ?)	6.8
Q8 (Do you take irregular inhaled corticosteriods ?)	31.5

Table3 : Extra questions to subjects studied from UAE

		FVC (L)	FEV1 (L)	FEV1/FVC (%)	PEF (L/min)	Total Grip (kg)	BMI
Symptom	<50 (n=16)	2.7±2.1	2.4±1.4	70.5±25.5	460.2±165.6	65.3±13.3	25.8±4.2
	>50 (n=55)	2.2±1.9	1.8±1.3	63.1±24.2	331±184.7	53.6±18.4	25.1±4.2
Activity	<50 (n=10)	2.5±1.4	2.4±1.1	73.3±24.4	514.5±145.6	66.1±17.8	25.6±4.1
	>50 (n=63)	2.3±2	1.9±1.4	63.6±24.5	339±183	55±17.6	25.2±4.2
Impact	<50 (n=46)	2.4±1.8	2.3±1.3	70.4±20.8	434.1±177.5	59.7±16.5	25.2±3.6
	>50 (n=25)	2.2±2.3	1.4±1.2	57.3±27.6	230.4±124.7	51±20	25.1±5.1
Total	<50 (n=24)	2.5±1.9	2.2±1.2	74.9±16.2	482.3±157.9	64.9±15.1	25.8±3.5
	>50 (n=47)	2.3±2	1.9±1.4	61.1±26.2	299.8±171.7	52.4±18.3	24.9±4.5

Table4 : Relationship between the Quality of Life and the physical & lung function measurements on UAE patients

Figure 1: Percent of positive responses

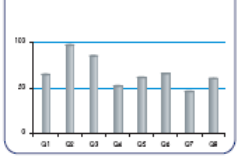


Figure 2 : Association between the QoL and the lung function measurements

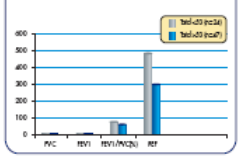


Figure 3: Association of QoL and the Total Grip

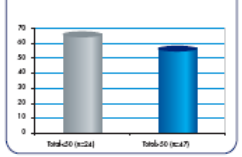
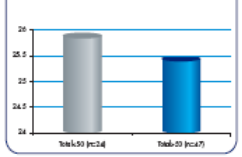


Figure 4 : Association of the QoL and the BMI



Conclusion

Patients with low lung function, BMI and muscle strength have low Quality of Life (low symptoms, activity, impact components and total scores).

Patients with Grade 1 functional impairment, magnitude of task and magnitude of effort have low Quality of Life (High impact, symptoms, activity and total scores).

The present study illustrates the Quality of Life in COPD patients in the UAE and their awareness of symptoms.

The results of this study can be used to compare the Quality of Life between these patients and patients from other countries.

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Appendix 8: Poster 2 Presented at the ERS Congress (Copenhagen 2005)

University of Sunderland

Association between Quality of Life and Muscle Strength and Body Mass Index in a group of COPD patients

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Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a disease process characterized by slowly progressive, irreversible airway obstruction[1].

The number of patients with COPD will be increasing with the increased number of elderly people and there is a great demand to find solution for problems associated with elderly people. Such efforts can improve Quality of Life of elderly people so that they can be more active.

A number of factors influence the HRQL: environment, nutrition, genes, smoking habit, possible treatment of respiratory disease, social class, age, perception of QoL and family relationships[2].

There are four important factors associated with HRQL: disease, personal characteristics, medical intervention and social and environmental characteristics.[3]

Methods

St. George's Respiratory Questionnaire (SGRQ) used to assess the Quality of Life. It is a 76 item questionnaire which measures three dimensions:

- Symptoms associated with pulmonary disease
- Activities likely to be limited by dyspnea
- Impacts on social and psychological functioning

Lung function tests (FVC, FEV1, PEFR, FEV1/FVC ratio) were measured by Vitalograph spirometer.

Hand grip dynamometer was used to measure the muscle strength.

The Body Mass Index (BMI) was calculated from body weight and height.

The data was analysed using the Software Package for Social Sciences (SPSS)

Results

A total of 100 COPD patients were included in this study.

Mean (S.D) age, height and body weight were 58 (13.1) y, 170.4 (7.3) cm and 70.6 (13.9) kg, respectively. (Table1)

There was no significant difference in the lung function and the muscle strength between the smokers (n=37) and the ex-smokers patients (n=61). (Table1)

Patients with the Total Muscle Grip less than 60 (n=59) had higher symptom, activity, impact and total scores than those with the TMG higher that 60 (n=41). (Table2)

Patients with BMI less than 25 (n=61) had high values of symptoms components than those with BMI more than 25 (n=39). Similar patterns were found with other components of Quality of Life. (Table2)

Measurements	Mean±SD		
	All patients (n=100)	Smokers (n=37)	Ex smokers (n=61)
AGE	58±13.1	52.8±11.1	61.2±13.4
Height (cm)	170.4±7.3	171.3±8.2	169.5±6.6
Weight (kg)	70.6±13.9	71.8±15.5	69.7±13.1
FVC (L)	2.2±1.8	2.6±1.9	2±1.6
FEV1 (L)	1.7±1.3	1.8±1.2	1.7±1.3
FEV1/FVC (%)	63.0±25.3	68.1±27.3	59.5±24.1
PEF (L/min)	333.5±292.4	377.8±203.9	307.1±181.0
Right Grip (kg)	26.3±8.6	29±9.2	24.5±7.9
Left Grip (kg)	29.4±9.3	32.7±9.8	27.3±8.5
Total Grip (kg)	55.9±17.6	62.2±18.2	51.9±16.3

Table1: Physical and lung function measurements in COPD patients

		Symptom Mean±SD	Activity Mean±SD	Impact Mean±SD	Total Mean±SD
Body Mass Index (BMI)	<25 (n=61)	66.7±17.1	78.1±21.2	47.2±20.6	59.8±17.9
	>25 (n=39)	55.3±19.6	71.1±22	40.3±17.8	52.2±16.9
Total Muscle Grip (TMG)	<60 (n=59)	66.6±17.7	83.0±16.5	50.9±18	63.4±15.4
	>60 (n=41)	56.0±18.9	64.5±23.7	35.7±18.8	47.8±17.3

Table2: Association of the BMI,TMG and QoL of COPD patients

Figure 1: Lung Function Tests in all patients, smokers and ex-smokers

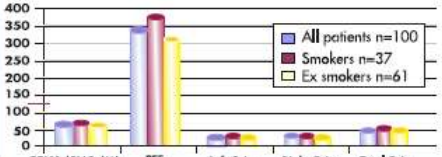


Figure 2: Association of the BMI and the QoL of COPD patients

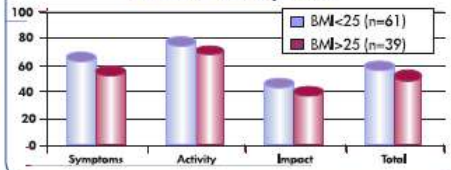
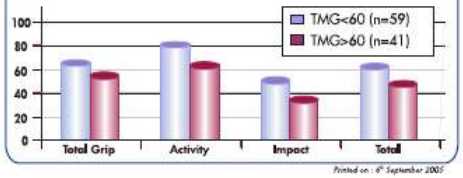


Figure 3: Association of the QoL and TMG of COPD patients



Printed on : 6th September 2005

Aims and Objectives

The association between the Quality of Life, Body Mass Index and the Total Muscle Grip in COPD patients has not been clearly reported. Our aim and objective are to study the association between Quality of Life, Muscle Strength and the Body Mass Index in a group of COPD patients.

Conclusion

Patients with low lung function measurements (FVC, FEV1, PEF, FEV1/FVC %) have poor Quality of Life.

Patients with poor Quality of Life have poor Muscle Strength and low BMI.

The study suggests that there is a strong association between Quality of Life and both BMI and Muscle Strength.

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Appendix 9: Poster Presented at the ERS Congress (Munich 2006)

University of Sunderland

Comparison of the Quality of Life of COPD Patients between the United Arab Emirates and the United Kingdom

Imane Ben Bihi, M.Sc 1, Mohammed Shamssain, Ph.D 1, Malcolm Farrow, Ph.D 1, Mirza Al Sayegh, M.D 2, Sayed Nasir, M.D 3, and Graham Burns, Chest Consultant 4
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Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable disease state characterised by airflow limitation that is not fully reversible.

The airflow limitation is usually progressive and is associated with an abnormal inflammatory response of the lunge to noxious particles or gases, primarily caused by cigarette smoking. (1)

COPD is known to cause dyspnea, peripheral muscle weakness, exercise intolerance, decreased Health-Related Quality of Life (HRQOL) and emotional distress.

Skeletal muscle dysfunction is an important complication of Chronic Obstructive Pulmonary Disease (COPD), which is associated with reduced Quality of Life, increased utilization of healthcare resources, and increased mortality. (2)

The GOLD guidelines have identified the goals of treatment for patients with COPD. These include the patients' goals of improved exercise tolerance and Quality of Life and also important clinical goals such as prevention of disease progression and minimization of symptoms. (3)

Aims and Objectives

- Compare the QoL of COPD patients in these two different countries/ regions.
- Study the association between QoL, BMI, Muscle strength, Lung function measurements and Dyspnea.
- Assess current modalities applied in managing and treating COPD patients.

Methods

Males and females aged above 45 years with stable COPD.

The Lung Function is assessed by using a hand handle Spirometer which is provided by the university.

The Muscle Strength is assessed using the hand grip Dynamometer which is provided by the university as well.

The Health Related Quality of Life of COPD patient is assessed using the English version of the St George's Respiratory Questionnaire (SGRQ) which is administered by the same investigator.

The Mahler Dyspnoea Index was used to assess the dyspnea symptoms at a fixed time.

Patients having acute exacerbation within two weeks and those with severe co-morbidities (e.g.: hemi-paralysis, severe vision impairment, etc) were excluded from the study.

Results

We studied 93 patients from UAE and 101 patients from the UK.

The mean ±SD age was 58.66 ± 15.04 y, BMI was 25.14 ± 3.97 in the UAE, 62, while in the UK the mean ±SD of age, BMI were 74.80 ± 7.27 y, 26.23 ± 4.05 respectively. (Table1)

Generally, there was no significant difference in the overall Quality of Life between the two centres, however when comparing each component of the Quality of Life, we observed that:

- The Symptom score in the UAE is markedly higher than the UK (p<0.002).
- The highest Activity score was observed in the UK.
- Lower Impact is seen in the UK than the UAE. (p<0.033)

	Mean ± SD Scores	
	UAE	UK
SYMPTOMS	60.67±22.06	50.96±16.53
ACTIVITY	72.92±23.37	88.66±14.64
IMPACT	3.48±21.23	39.97±16.53
TOTAL SCORE	5.27±20.22	4.98±13.57

Table 1 : Quality of Life of COPD patients

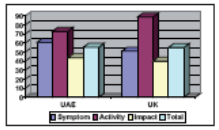

Figure 1:Quality of Life of COPD patients

Patients with BMI less than 22 had higher values of Symptoms than those with BMI more than 22. Similar patterns were found with other components of Quality of Life (Activity, Impact, and Total Scores) in the three countries. (Table2)

Patients with Total Muscle Grip below 60 had lower Quality of Life than those with Total Muscle Grip above 60; this was observed in all the countries. (Table 2)

		BMI		Total Muscle Grip	
		<22	>22	<60	>60
Symptoms	UAE	71.98±18.27 N=17	58±22.13 N=72	66.4±21.3 N=54	51.84±20.48 N=35
	UK	53.16±16.92 N=13	50.62±16.83 N=88	52.37±18.37 N=72	47.22±19.14 N=26
Activity	UAE	82±19.89 N=17	70.78±23.74 N=72	81.53±18.17 N=54	59.63±24.48 N=35
	UK	91.23±8.46 N=13	88.27±15.36 N=85	90.89±13.32 N=72	82.33±16.71 N=26
Impact	UAE	53.88±21.7 N=17	40.86±20.47 N=72	49.93±19.8 N=54	33.91±19.86 N=35
	UK	36.36±12.75 N=13	37.06±17.1 N=85	40.23±15.07 N=72	28.07±17.66 N=31
Total Score	UAE	65.41±18.73 N=17	52.81±19.52 N=72	62.4±17.74 N=54	44.68±19.22 N=35
	UK	55.76±9.5 N=13	54.86±14.13 N=85	57.65±12.28 N=72	47.69±14.72 N=26

Table 2: Association between the Quality of Life, BMI and the Total Muscle Grip

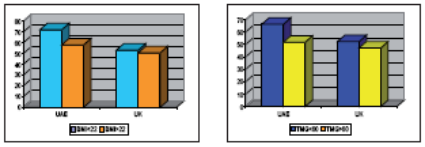

Figure 2 : Relationship between the QoL, BMI and TMG

The mean Total Muscle Grip was significantly higher in patients with Symptoms component below 50 than in patients with Symptoms component above 50. We found similiar relationship with other components of Quality of Life (Activity, Impact and Total Scores), in all the centres. (Table3)

The BMI was slightly higher (not significant) in patients with Symptoms component below 50 than in patients with Symptoms component above 50. We found similiar relationship with other components of Quality of Life (Activity, Impact and Total Scores), in all the centres.

The FVC and FEV1 were significantly higher in patients with Symptoms component below 50 than in patients with Symptoms component above 50. We found similiar relationship with other components of Quality of Life (Activity, Impact and Total Scores), in all the centres, While the association between the FEV1/FVC% was not significant.

		Symptoms		Activity		Impact		Total Score	
		<50	>50	<50	>50	<50	>50	<50	>50
FVC	UAE	2.6±1.11 N=30	1.91±1.04 N=63	2.65±.93 N=15	2.01±1.1 N=78	2.14±1.01 N=54	1.62±1.11 N=39	2.43±1 N=50	1.95±1.14 N=43
	UK	2.62±0.92 N=50	2.11±0.99 N=49	3.57±0.62 N=1	2.33±0.91 N=95	2.6±0.98 N=74	1.85±0.7 N=24	3.06±0.72 N=31	2.23±0.84 N=67
FEV1	UAE	1.77±.85 N=30	1.32±.54 N=63	1.93±.63 N=15	1.38±.64 N=78	1.54±.66 N=54	1.24±.81 N=39	1.73±.75 N=50	1.36±.61 N=43
	UK	1.83±0.81 N=50	1.52±.75 N=49	2.71±0.7 N=1	1.44±0.81 N=95	1.83±0.83 N=74	0.91±0.65 N=24	2.02±0.78 N=31	1.2±0.66 N=67
FEV1/ FVC%	UAE	69.05±20.67 N=30	69.11±27.33 N=63	71.07±20.83 N=15	67.63±17.32 N=78	69.06±25.76 N=54	66.61±25.6 N=39	73.04±21.16 N=50	64.88±27.8 N=43
	UK	81.17±18.2 N=50	80.26±20.46 N=49	59.63±15.45 N=1	86.78±19.47 N=95	81.36±19.72 N=74	88.48±21.31 N=24	84.47±17.04 N=31	80.8±20.14 N=67
Total Grip	UAE	63.33±11.9 N=30	51.48±18.2 N=63	64.38±14.77 N=15	53.19±17.3 N=78	59.74±15.2 N=54	47.36±16.7 N=39	65.34±13.8 N=50	50.38±17.9 N=43
	UK	69.49±8.71 N=50	42.71±15.74 N=49	64.35±27.29 N=1	59.15±8.83 N=95	69.32±9.91 N=74	38.95±15.85 N=24	63.83±9.79 N=31	62.9±9.5 N=67
BMI	UAE	25.01±3.82 N=30	24.95±4.12 N=63	26.64±3.52 N=15	25.04±4.07 N=78	25.27±3.43 N=54	24.8±4.76 N=39	25.68±3.2 N=50	24.78±4.34 N=43
	UK	26.75±3.94 N=50	25.69±4.13 N=49	20.03±4.07 N=1	26.15±4.23 N=95	26.49±4.31 N=74	25.45±3.16 N=24	26.91±4.61 N=31	25.82±3.79 N=67

Table3: Relationship between the Quality of Life, Physical and Lung Function measurements in COPD patients

In both groups, patients with grade 3 Functional Impairment components of baseline Mahler Dyspnoea Index had significantly better Quality of Life (Symptoms, Activity, Impact and Total Scores) than patients with grade 2 Functional Impairment component. The same pattern was observed with Magnitude of Task and Magnitude of Effort components. (Table4)

			Symptoms % ± SD	Activity % ± SD	Impact % ± SD	Total Scores % ± SD
Functional Impairment	Grade 4	UAE (n=13)	37.13 ± 21.1	41.3 ± 26.88	21.26 ± 19.87	29.99 ± 19.65
		UK (n=5)	37.94±21.21	63.21±26.36	8.33±1.94	29.88±11.74
	Grade 3	UAE (n=33)	53.14 ± 17.7	69.19 ± 16.55	36.38 ± 15.63	48.87 ± 12.95
		UK (n=25)	39.24±13.99	77.74±15.85	26.55±14.41	44.17±11.6
	Grade 2	UAE (n=24)	67.49 ± 16.57	76.97 ± 16.19	46.25 ± 15.4	59.47 ± 13.58
		UK(n=21)	52.97±17.64	89.28±8.36	36.4±11.25	55.18±8.13
	Grade 1	UAE (n=12)	81.55 ± 8.63	94.02 ± 7.78	66.7 ± 12.22	77.45 ± 9.18
		UK (n=90)	55.6±17.15	95.26±6.38	42.61±12.99	60.9±7.87
	Grade 0	UAE (n=4)	79.57 ± 19.24	100	68.3 ± 9.18	79.78 ± 7.56
		UK (n=18)	60.76±18.22	99.16±2.42	50.98±13.25	67.21±8.6
Magnitude of Task	Grade 4	UAE (n=13)	37.88 ± 19.73	51.4 ± 28.4	24.45 ± 22.07	34.85 ± 22.23
		UK (n=6)	49.94±23.84	69.14±26.78	12.12±11.33	35.69±16.09
	Grade 3	UAE (n=31)	54.37±18.71	66.79±20.48	36.72±15.6	48.76±13.85
		UK (n=20)	34.11±11.03	75.66±16.77	23.09±12.5	40.85±10.73
	Grade 2	UAE (n=23)	64.28±15.86	73.65±15	43.59±16.75	56.27±14.05
		UK (n=22)	52.01±16.17	87.33±8.85	37.41±11.55	54.96±7.82
	Grade 1	UAE (n=15)	80.44±13.29	95.26±7.31	66.33±12.83	77.44±8.93
		UK (n=31)	55.59±17.54	95.38±6.07	41.92±12.88	60.47±7.8
	Grade 0	UAE (n=5)	83.04±8.95	98.5±3.35	68.08±7.09	79.78±5.34
		UK (n=20)	59.77±17.53	98.53±3.78	50.39±13.39	66.54±8.89
Magnitude of Effort	Grade 4	UAE (n=12)	34.58±19.86	44.81±24.89	20.62±20.62	30.26±20.5
		UK (n=6)	49.94±23.84	69.14±26.78	12.12±11.33	35.69±16.09
	Grade 3	UAE (n=32)	53.14±18.11	67.78±16.03	35.8±13.95	48.37±11.74
		UK (n=22)	35.11±11.2	75.72±15.99	23.58±12.2	41.3±10.38
	Grade 2	UAE (n=26)	66.66±15.92	74.65±21.33	45.95±16.75	58.26±15.33
		UK (n=22)	51.04±17.17	89.15±8.42	39.12±11.36	56.26±7.42
	Grade 1	UAE (n=12)	81.66±12.03	96.38±6.3	68.36±12.41	79.06±9.01
		UK (n=29)	57.98±17.03	95.32±6.19	41.97±13.84	61±8.53
	Grade 0	UAE (n=6)	78.97±12.78	97.61±3.7	68.87±6.63	79.26±6.94
		UK (n=20)	58.42±17.44	98.53±3.78	49.79±12.84	66±8.47

Table 4: Mahler Dyspnea Index scale for COPD patients

Conclusion

This study suggests that there is a strong association between Quality of Life and both BMI and Muscle Strength. Patients with poor Quality of Life have poor Muscle Strength and low BMI.

The study also suggests significant association between the Health Status and Lung Function.

The present study can be used to plan strategies to improve Quality of Life in COPD patients and to investigate changes in body weight and Muscle Strength in these patients.

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