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# PUBLIC HEALTH RESEARCH

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## The Effects of Hospital Based Respiratory Physiotherapy an Intervention Study among COPD Patient in Al-Zawia City, Libya

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### ABSTRACT

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<b>Accepted</b>	17 January 2012
<b>Objective</b>	Chronic obstructive pulmonary disease (COPD) is a one of the major cause of death and disability worldwide. This study aimed to compare the quality of life (QOL), Activity of Daily Living (ADL), Pulmonary Function Test (PFT) and general health symptoms pre and after hospital-based respiratory physiotherapy program among COPD patients.
<b>Methods</b>	Pre and post intervention study was conducted between January and July 2010. A total of 54 subjects aged between 30 to 40 years old were recruited for this study using universal sampling method from Alzawia Teaching Hospital, Libya. Data collected were socio-demographic data, QOL (before and after the intervention) using the Short Form-36 (SF-36) questionnaire, ADL using the Barthel Index and the General Health Symptoms.
<b>Results</b>	The mean SF-36 score for QOL is 30.13 (SD = 8.06) and 63.46 (SD = 13.53) before and after the physiotherapy respectively (with the $p < 0.0001$ ). Patients' Activity of Daily Living mean scores are 70.18, (SD = 16.50) and mean = 88.89 (SD = 13.28) before and after program ( $p < 0.0001$ ). The general medical condition mean score after respiratory physiotherapy is 3.72 as compared to 4.96 before the respiratory physiotherapy ( $p < 0.0001$ ). Pulmonary Function Test shows improvement in actual/predicted FEV1 ratio in all 54 cases with mean improvement from 55.85 before to 81.67 after the pulmonary physiotherapy (with the $p < 0.0001$ ).
<b>Conclusions</b>	Hospital based respiratory physiotherapy program had significantly improved QOL, pulmonary function and activities of daily living among the subjects.
<b>Keywords</b>	pulmonary function – spirometry – quality of life – activities of daily living – respiratory physiotherapy

### INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a major cause of death and disability worldwide. The Global Burden of Disease Studies<sup>1-3</sup> found that COPD was the sixth commonest cause of death worldwide in 1990. In 2002, COPD became the 5<sup>th</sup> leading cause of death in the world, and it is expected to become the 4<sup>th</sup> leading cause of death by the year 2030<sup>4</sup>. Furthermore, COPD is recognised as the twelfth greatest cause of chronic morbidity, with a predicted increase to become the fourth most important disability-producing illness by 2020<sup>5</sup>. Burden of Lung Disease<sup>6</sup> studies indicate a higher prevalence of COPD than previously anticipated. Overall, the prevalence of COPD in the general population is estimated to be about 1% across all ages, rising steeply to 8–10% or higher in individuals aged 40 years or older<sup>7</sup>.

COPD is a costly disease<sup>8</sup>. In developed countries, exacerbations of COPD account for the greatest burden on the health care system. In European Union, the total direct costs of respiratory disease are estimated to be about 6% of the total health care budget, with COPD accounting for 56% (Euro 38.6 billion) of this cost of respiratory disease<sup>9</sup>. In the United States in 2002, the direct costs of COPD were \$18 billion and the indirect costs totalled \$14.1 billion<sup>10</sup>.

The British Thoracic Society define COPD as a slowly progressive disorder characterized by airflow obstruction (reduced FEV<sub>1</sub> and FEV<sub>1</sub>/FVC ratio) that does not vary markedly over several months of observation<sup>11</sup> but worse among smokers, exposure to noxious particle or gases<sup>12-13</sup>. Exposure to indoor pollution or biomass fuel can produce identical problems; especially cooking in poorly ventilated conditions are commonly affected<sup>14-16</sup>.

The presence of cough and sputum production, whether mucoid or purulent, however is not a specific predictor for the subsequent development of COPD.<sup>17</sup>

A major step forward came with the epidemiological studies<sup>18-19</sup> showed that death and disability were related to progressive deterioration in the FEV<sub>1</sub> (forced expiratory volume in 1 second) rather than persistent symptoms of cough and sputum production. Subsequent definitions have emphasized that COPD diagnosis requires the presence of airflow obstruction defined as a lower than normal ratio of FEV<sub>1</sub> to FVC (forced vital capacity) or vital capacity (normally <0.7)<sup>12</sup>.

Airflow obstruction in COPD arises as a result of narrowing, smooth-muscle hypertrophy, and fibrosis in the respiratory bronchioles<sup>20,21</sup>, loss of elastic recoil pressure due to pulmonary emphysema<sup>22,23</sup>. The FEV<sub>1</sub> reduction is mainly due to increase in resistance in the peripheral airways with a contribution from loss of elastic recoil. The treatment approaches fall into three broad areas: 1)

Prevention of disease progression, 2) Management of stable disease, and 3) Management of exacerbations<sup>12</sup>. The aim of effective bronchodilator are now possible with negligible side-effects by use of long-acting inhaled [beta] agonist or anti-cholinergic drugs<sup>24-29</sup>. Inhaled corticosteroids are still widely used in COPD, although the scientific basis of this approach remains contentious<sup>30-31</sup>. These drugs do not modify the rate of decline of lung function<sup>32-35</sup> but do reduce the number of exacerbations and decline in health status seen in patients with more severe disease<sup>36-37</sup>. Respiratory physiotherapy can be used at any stage of COPD and is very effective<sup>39-45</sup>.

Oral and nebulised corticosteroids accelerate the rate of improvement in lung function during an exacerbation, and that oral corticosteroids can reduce the length of the hospital stay<sup>49-52</sup>.

### OBJECTIVE

The objective of this study is to document the effect of respiratory physiotherapy on a sample of hospitalized patients in Al-Zawia City Libya. The improvement in the overall conditions of the inpatients, after the respiratory physiotherapy are judged, based on the improvement in QOL score, improvement in symptoms, the improvement in the PFT results and the improvement in ADL scores.

### METHODS

This is a pre and post interventional study which was conducted between the period January 2010 till July 2010. The study was conducted at Alzawia Teaching Hospital from where 54 subjects were recruited using universal sampling method from the department of physiotherapy. The inclusion criterias include Libyan, male and female above 30 years of age with confirmed COPD diagnosis from respiratory physician, and referred to the physiotherapy department for pulmonary physiotherapy.

Exclusion criteria include all coronary heart disease patients with limited exercise tolerance; patients with mental disability; patients who are unable to complete the questionnaire; persistent upper and lower limb injury (as the exercises training of respondents would include upper and lower limbs active movements) and symptoms of pain and musculoskeletal dysfunctions. The sample size of Kish (1965) was used to reach to a minimal sample of 70 samples. Ethical approval for this study was obtained from the Ethical Committee of UKMMC and Alzawia Teaching Hospital, Libya.

There were initially as many as 81 participants, but only 54 participants completed the pre and post physiotherapy sessions. The response rate was at 62.1% with many leaving as 33 patients did not come for further treatment and a few

defaulted in-patients stay. All eligible subjects (n=54) were given an explanation on the research project verbally by the researcher who is a Libyan trained and certified physiotherapist. Written consents were obtained after explanation through written information sheet and consent forms. The pulmonary function test was done by only one researcher in the study, thus limiting the kappa effect. The researcher will assess and fill in the PFT assessment form before and after the pulmonary physiotherapy.

Selected subjects undertook one hour long physiotherapy sessions twice a week for four weeks. Five different data collection forms were used to collect data. Firstly, the self administered questionnaire with standard SF-36 form to assess patient QOL. This is a quantitative scoring tool that uses the scores by eight domains. Secondly, the general health surveys form to keep track of the symptoms of COPD. Thirdly, PFT was measured via a standard spirometry machine and documented by the physiotherapist, using percentage data. Fourthly, the ADL form to assess the improvement before and after the pulmonary rehabilitation again using the scoring method. The fifth and the last form is to collect the respondents' socio-demographic profile. The first four questionnaires was administered twice, once before the start of pulmonary rehabilitation and secondly upon the completion of four weeks after respiratory physiotherapy. The fifth form for the socio-demographic data is filled only once by the patient. For the understanding of the questionnaire, it was earlier translated in Arabic language by a English trained Libyan academic lecturer in the hospital. This was later pre-tested for face validation among 10 patients in the same hospital prior to study initiation.

### Respiratory Physiotherapy

The regimen for respiratory physiotherapy consisted of a warm up session for 5 minutes, followed by exercise training. Exercise training consisted of four different components; upper arm exercises with breathing control for 5 minutes, followed by another upper arm exercise with breathing control. Both these exercises are repeated three times (to a total amounting to 30 min). This is followed by a 10 minute brisk walk inside or outside circuit with in between rest as it causes some breathlessness. The last exercise consists of a 10 minutes of stepping or stair climbing depending upon the level of tolerance. It is followed by 5 minutes cool down period.

### Data Analyses

The data was analyzed using SPSS version 17.0. Normality of the data was checked prior to the statistical analysis through Kolmogorov-Sminov. Descriptive and analytical statistical tests were

conducted to analyze the data. Level of significance was set at alpha level 0.05 and power at 80%. The statistical test used is the paired t-test.

## RESULTS

**Socio-demography:** In total, 54 subjects were enrolled for the research. Out of these 54 subjects, 47 % were female (n=25), whereas 53 % were male (n=29), with mean age 45 years (SD 12.3) and ranged between 30-76 years. In respect to education status, 25.5 % had graduated, whereas 21.2 % has no education at all.

**Quality of Life:** The SF-36 QOL original data was transformed using syntax file and the composite scores were then analyzed to compare QOL before and after the respiratory physiotherapy program. The result as shown in table 1, revealed that there was a significant difference in the scores before program (Mean = 30.13, SD = 8.06) and after program (Mean = 63.46, SD = 13.53) at  $t = -18.17$ ;  $p < 0.0001$ .

**Activity of Daily Living:** The ADL overall score revealed a significant difference before program (Mean = 70.18, SD = 16.50) and after program (Mean = 88.89, SD = 13.28) with  $t = -7.80$ ;  $p < 0.0001$ . Table 2 shows the results of for the ADL scores.

**General Health Condition:** For the general health and symptoms, they were assessed using a Health Condition Assessment form. The paired samples t-test result (table 3) shows a significant decrease in all problem/symptom faced by patient after undergoing the respiratory physiotherapy program for one month. The overall mean score after respiratory physiotherapy was 3.72 as compare to 4.96 before the respiratory physiotherapy ( $p$  value  $< 0.0001$ ).

**Pulmonary Function Test:** Results for PFT showed improvement in actual/predicted FEV1 ratio in all 54 cases with mean improvement from 55.85 from before to 81.67 after the respiratory physiotherapy ( $p$  value  $< 0.0001$ ). The results of the pulmonary function test before and after the respiratory physiotherapy program are shown in table 4.

Based on all the results, it is clear that there is significant improvement in the clinical conditions as well as QOL of COPD patients after they have undergone respiratory physiotherapy. This result suggests that the respiratory physiotherapy program has a positive effect on the COPD patient health status.

## Physiotherapy intervention in COPD

**Table 1** Patients' SF-36 Quality of Life

Total SF-36 Score	Mean	SD	t	P
Before	30.1	8.06	-18.17	<0.000
After	63.5	13.53		

**Table 2** Patients' Activity of Daily Living Score

Activities	Time	Mean	SD	p
Feeding	Before	9.0	2.24	< 0.001
	After	9.5	1.45	
Bathing	Before	3.5	2.29	< 0.001
	After	4.6	1.31	
Grooming	Before	4.2	1.78	< 0.001
	After	5.0	0.96	
Dressing	Before	7.7	3.17	< 0.001
	After	9.2	2.02	
Bowels	Before	6.5	2.70	< 0.001
	After	9.0	1.95	
Bladder	Before	6.8	2.43	< 0.001
	After	8.4	3.17	
Toilet Use	Before	6.9	2.80	< 0.001
	After	9.4	2.21	
Transfers	Before	9.2	3.90	< 0.001
	After	12.2	3.17	
Mobility	Before	10.3	3.17	< 0.001
	After	12.6	2.70	
Stairs	Before	5.7	2.24	< 0.001
	After	8.5	2.29	
<b>Overall Score</b>	<b>Before</b>	<b>70.1</b>	<b>16.50</b>	<b>&lt; 0.001</b>
	<b>After</b>	<b>88.8</b>	<b>13.28</b>	

**Table 3** Test for the COPD symptoms before and after Physiotherapy

Symptom	Time	Mean	SD	p
Symptom 1: Dyspnea	Before	4.4	0.56	<0.000
	After	3.6	0.58	
Symptom 2: Chronic Cough	Before	4.5	0.63	<0.000
	After	3.7	0.86	
Symptom 3: Anxiety	Before	4.6	0.76	<0.000
	After	3.7	0.82	
Symptom 4: Fatigue	Before	4.6	0.85	<0.000
	After	3.5	0.83	

Symptom 5: Depression	Before	4.7	0.80	<0.000
	After	3.6	0.96	
Symptom 6: Sputum Production	Before	4.8	0.71	<0.000
	After	3.5	0.78	
Symptom 7				<0.000
Activity	Before	4.7	0.84	<0.000
	After	3.7	0.81	
Wellbeing	Before	4.6	0.65	<0.000
	After	3.8	0.89	
General feeling of Wellbeing?	Before	4.6	0.76	<0.000
	After	3.6	0.82	
<b>Overall</b>				<0.000
	<b>Before</b>	<b>4.6</b>	<b>0.43</b>	<b>&lt;0.000</b>
	<b>After</b>	<b>3.7</b>	<b>0.59</b>	<b>&lt;0.000</b>

a=paired t-test

**Table 4** Patients Pulmonary Function Test Before and After Intervention

Pulmonary Function Test (actual/predicted)	Time	Mean	SD	p
FVC	Before	52.35	17.80	<0.0001
	After	81.78	19.67	
FEVI	Before	55.85	21.97	<0.0001
	After	81.67	21.31	
FEVI%	Before	56.32	22.90	<0.0001
	After	80.02	23.96	

### DISCUSSION

Respiratory physiotherapy is accepted non-pharmacological intervention for individuals with COPD and can improve both exercise capacity and quality of life (QOL)<sup>53</sup>. We looked at the Medical Outcomes Survey Short Form 36-item questionnaire (SF-36), a generic QOL measures, to detect changes in QOL in COPD patients after of respiratory physiotherapy. The similar results are shown by Lacasse et al. that the respiratory physiotherapy increases exercise tolerance, reduces symptoms, and improves health-related QOL in COPD patients<sup>54</sup>. These results suggest that respiratory physiotherapy program have a positive effect to patient's quality of life. The evidence base for this respiratory physiotherapy is well recognized and has been highlighted by professional societies<sup>55,56</sup> and by a recent Cochrane review<sup>57</sup>. Similarly our study result also shows that there is a significant improvement in the QOL scores among the subjects after the respiratory physiotherapy program.

An ADL questionnaire is a scale that can be used to assess pulmonary disability in elderly patients with chronic obstructive pulmonary disease<sup>58</sup>. Self-reported problems during daily physical activities and dependence with personal care assessed in 168 consecutive Dutch patients have documented the improvement after the respiratory physiotherapy<sup>59</sup>. Moreover, respiratory physiotherapy have shown improvement in the ADL performance, improved functional status, reduce psychological distress and enhanced quality of life<sup>60</sup>.

In our study we compared patients' ADL score before and after respiratory physiotherapy program and results revealed that there is a significant improvement in ADL score before and after respiratory physiotherapy program for all activities. Overall score also shows a significant difference before and after program.

Our study illustrates how a short term respiratory physiotherapy program inhibits the progression of airflow obstruction in COPD patients after the 4 weeks of respiratory physiotherapy by increased endurance time and work, and improved in the general quality of live. We used spirometry to assessment patients pulmonary function before and after respiratory physiotherapy. Spirometric testing is used to confirm the diagnosis of COPD. Typical abnormalities include a decrease in FEV<sub>1</sub> and a decrease in the ratio of FEV<sub>1</sub> to FVC. Other abnormalities include an increased residual volume and total lung capacity, and a limited and incomplete response in FEV<sub>1</sub> to bronchodilators (incomplete reversibility). Our study shows that respiratory physiotherapy improved FEV<sub>1</sub>, FVC, with a significant difference in pulmonary function

before and after program for all pulmonary function parameters.

Previous studies have also shown similar improvement in FVC which may have been due to improved respiratory muscle function and a reduction in small airways disease<sup>34</sup>. FEV<sub>1</sub> is by far the most frequently used index for assessing airway obstruction, bronchoconstriction or bronchodilatation; FEV<sub>1</sub> expressed as a percentage of the Vital Capacity is the standard index for assessing and quantifying airflow limitation. The improvement in FEV<sub>1</sub> in our 54 respondent cases was statistically significant with increased mean score 55.85 to 81.67; before and after respectively. We noted a significant inhibition of the progression of airways obstruction occurring after the 4 weeks of respiratory physiotherapy compared with FEV<sub>1</sub> before.

In earlier reports, regular exercise was noted to protect against diseases associated with chronic inflammation<sup>62</sup>, this inflammation is considered as an important element in the pathogenesis of COPD. The contribution of respiratory physiotherapy for reduction of FEV<sub>1</sub> declined, adding an additional beneficial effect of respiratory physiotherapy for COPD patients. FEV<sub>1</sub> decline may serve as a predictor of death risk from COPD. Therefore respiratory physiotherapy should be considered as a disease progress modifier as it enables the remaining lung tissue to regain its minimal functions and tolerance.

In patients with COPD, dyspnea and a reduced capacity for work are two of the most disabling symptoms experienced<sup>63-65</sup>. In our study the result of comparing the health conditions before and after patient undergoing respiratory physiotherapy, yielded that there is a significant decrease in all COPD symptoms as dyspnea, chronic cough, anxiety, fatigue, depression, sputum production, activity and general feeling of wellbeing which faced by patient after undergoing the program for one month. This result suggests that the program really does a positive effect to patient health status.

Study done by Ries et al. showed the definite benefits of an hospital and home-based comprehensive respiratory physiotherapy program in symptom of patients with COPD as compared with patients who received only routine of therapy, such as optimisation of medication<sup>66</sup>.

### Study Limitation

The study is very dependent on agreeable respondents that have the potential to improperly exhale and inhale for the spirometry tests. The patients participation are also compromised due to the exercises done during physiotherapy that limit cooperation and full participations in the 4 weeks program. Patients that are on other types of

medication may synergistically enhance the effects of therapy, providing biased results.

## CONCLUSION

We are able to demonstrate that our inpatient research samples that respiratory physiotherapy improved outcomes after it is administered to the inpatients with COPD. Clinically relevant improvement, evident by the improvement in pulmonary function tests and health outcomes in term of QOL measurements are demonstrated. With these results we would like to advocate that respiratory physiotherapy programs should be set up and implemented in all the inpatient facilities and lower level of resources. Libya, a developing country with conservative society, needed more explanatory data and researches to persuade a policy change that lead to early COPD detections and the set-ups of mitigating strategies such as COPD rehabilitation programs. Such program can improve patient's pulmonary function, patient's quality of life and can make a significant difference in activity of daily living score for all activities.

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