

# Quality of Life and Social-Economic Characteristics of Greek Male Patients on Long-Term Oxygen Therapy

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**BACKGROUND:** Chronic obstructive pulmonary disease (COPD) profoundly impacts patients' functional status, especially in the advanced stages, when long-term oxygen therapy (LTOT) is implemented. **OBJECTIVE:** To determine the health-related quality of life (HRQOL) in patients with COPD and using LTOT, and assess the relationship of socioeconomic characteristics and pulmonary function test results to HRQOL scores. **METHODS:** We studied a group of 85 patients with COPD and hypoxemia who were on LTOT, and a control group of 48 patients with stable COPD but without hypoxemia. All subjects were asked to rate their dyspnea on the Modified Medical Research Council dyspnea scale, and to take the Medical Outcomes Study Short Form (SF-36), the General Health Questionnaire (30 questions), and a questionnaire (which we developed for this study) to measure their independence in activities of daily living (ADL). We also conducted pulmonary function tests and arterial blood gas analyses, and recorded socioeconomic characteristics. **RESULTS:** The subjects' socioeconomic status was moderate to low. HRQOL was impaired in patients on LTOT, especially in the physical function domain, and most of the examined dimensions correlated with the severity of dyspnea and psychological status. There was a significant association between ADL score and SF-36 score in the vitality and physical domains, but there was no significant association between HRQOL score and spirometry or blood gas values. **CONCLUSIONS:** HRQOL in patients with COPD and on LTOT is low and is influenced by dyspnea, mental status, and incapacity, rather than by physiological variables. We recommend a multidimensional therapeutic approach that targets symptom-control and ADL support to improve the patient's overall HRQOL. *Key words:* chronic obstructive pulmonary disease, COPD, long-term oxygen therapy, LTOT, health-related quality of life, HRQOL, dyspnea, activities of daily living, ADL, pulmonary function tests, blood gases analysis, socioeconomic, Greece, Greek. [Respir Care 2008;53(8): 1048–1053. © 2008 Daedalus Enterprises]

## Introduction

It is well established that chronic obstructive pulmonary disease (COPD) has a high impact on health-related qual-

ity of life (HRQOL).<sup>1</sup> In patients with COPD the lower quality of life becomes obvious even in the mild stages of the disease, and the main contributors are considered to be the disease severity and the deterioration of respiratory function.<sup>2,3</sup> In recent years HRQOL has been one of the major studied outcomes in patients with COPD, and several studies have addressed the impact of disease severity<sup>4-6</sup> and treatment on HRQOL.<sup>7</sup>

As COPD progresses, respiratory failure is a common manifestation, and long-term oxygen therapy (LTOT) is a well established therapy that can improve survival. Although several studies have evaluated HRQOL impairment in patients with COPD and hypoxemia,<sup>8,9</sup> there have been conflicting results about the impact of respiratory impairment on quality of life,<sup>10-12</sup> and the impacts are often regarded as negligible. But LTOT is a demanding

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The authors report no conflicts of interest related to the content of this paper.

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therapy for both the patient and the community, because LTOT requires financial and social support and the coordination of a multidimensional team for success.<sup>13,14</sup>

We evaluated HRQOL in patients with COPD on LTOT, and examined their physical and mental status and socioeconomic characteristics, to identify important aspects of implementing LTOT at home and to reinforce health care for patients with severe COPD.

## Methods

### Patients

We studied 85 consecutive patients with COPD and hypoxemia in the out-patient clinic of the 2nd Chest Clinic at G. Papanikolaou General Hospital in Thessaloniki, Greece, at their regular follow-up visits. The inclusion criteria were an established diagnosis of COPD and no exacerbations for at least the past 1 month. They had been using LTOT for a mean  $\pm$  SD  $4.6 \pm 3.0$  y. The control group consisted of 48 out-patients with stable COPD but without hypoxemia. Patients were classified according to COPD disease stages, as recommended by the European Respiratory Society.<sup>15</sup>

### Study Design

All the subjects underwent anthropometric measurements, spirometry (Ganshorn LF8, Medizin Electronic, Niederlauer, Germany) and arterial blood gas analysis (PRS15, Radiometer, Copenhagen, Denmark) sampled while the subject breathed room air.

We collected data on demographics, smoking habits, economic status, education background, occupation, family status, and their oxygen source (concentrator or liquid oxygen) and daily LTOT use.

We assessed independence in activities of daily living (ADL) with a questionnaire that we designed for this study; it evaluated domestic and physical activities at home and outside the home, including self-care, home management, housekeeping, eating, personal care, dressing upper body, putting on shoes, rising and lying down, doing the laundry, traveling by car or bus, and shopping. Each domain was rated on a 0–10 scale, and the score depended on how much support the patient needed to complete each activity (0 = totally incapacitated, 10 = fully active).

Dyspnea was assessed with a Greek translation of the Modified Medical Research Council (MRC) dyspnea scale, which rates perceived breathlessness as follows: 1 = shortness of breath during strenuous exercise, 2 = shortness of breath during hurrying, 3 = walking slower than people of the same age, 4 = need to stop after walking 100 yards on

level ground, 5 = breathlessness that prohibits leaving the house.<sup>16</sup>

Quality of life was evaluated with the 36-question Medical Outcomes Study Short Form (SF-36), which is a widely used generic measure of functional health and wellbeing.<sup>17</sup> The SF-36 items are grouped into 8 domains: physical functioning, pain, general health, emotional wellbeing, role-emotional (perceived disruptions of daily routine due to emotional problems), role-physical (perceived disruptions in daily routine due to physical problems), social functioning, and vitality (energy/fatigue). Each domain is rated on a scale from 0 (worst condition) to 100 (best condition). The 8 SF-36 domains are hypothesized to form 2 distinct higher-order clusters, according to the physical and mental-health variance they have in common. The physical functioning, role-physical, bodily pain, and general health physical domains compose the physical component summary. The emotional wellbeing (mental health), role-emotional, social functioning, and vitality domains compose the mental component summary.<sup>17</sup> We compared the SF-36 HRQOL data from our study subjects to published SF-36 assessments of normal Greek persons.<sup>18</sup>

We used a Greek version of the 30-question General Health Questionnaire (GHQ)<sup>19</sup> to assess mental status. The GHQ examines anxiety, depression, anti-social behavior, and psychosomatic symptoms. A score  $\leq 4$  is considered normal.

Patients completed the questionnaires on their own, except patients who were illiterate or had visual problems, who were assisted by trained nurses. The aim of the study was explained to both the patients and the caregivers, and we obtained verbal consent for completing the questionnaires. The study design was approved by our hospital's ethics committee.

### Statistical Analysis

The calculations were performed with statistics software (SPSS version 15, SPSS, Chicago, Illinois). We used Student's *t* test for the anthropometric, pulmonary function, and SF-36 mean scores. Comparison of ADL independence scores was via Wilcoxon test for 2 independent samples. We calculated the Pearson correlation coefficients for the respiratory function variables and the HRQOL, GHQ, and ADL scores.

We performed a hierarchical multiple linear regression analysis with SPSS's "enter" method. The averaged SF-36 physical component summary and mental component summary scores were the dependent variables, and the regressors (independent variables) were added in 2 blocks. The first was the MRC dyspnea scores. The second was the GHQ and ADL scores.

## Results

### Patient Characteristics

All the subjects were in stable condition, at least 1 month past their most recent exacerbation or hospitalization. Eighty percent of the LTOT group had severe COPD, and 20% had moderate COPD. In the control group 30% had severe COPD, 36% had moderate COPD, and 34% had mild COPD.

In the LTOT group 14 patients (16%) continued to smoke, 51 patients (60%) were ex-smokers, and 20 patients (23%) had never smoked. Thirty-one patients (64%) in the control group were smokers and 17 patients (35%) were ex-smokers. Patients in the LTOT group were mostly retired, with rather low education level and monthly income, whereas fewer patients in the control group were retired, and most of them had a higher education level and monthly income (Table 1).

### Oxygen Use

Fifty-six percent of the LTOT subjects used an oxygen concentrator, and 44% used liquid oxygen. Thirty-six LTOT subjects (81%) used a portable oxygen source. The mean  $\pm$  SD daily oxygen-use time was  $15.5 \pm 5.0$  h.

Table 2 shows the anthropometric and pulmonary function data. The LTOT patients were older and had worse respiratory impairment than the control group. There was no difference in body mass index between the 2 groups, but the MRC dyspnea and ADL scores were significantly lower in the LTOT group.

Table 3 compares the mean SF-36 scores from our LTOT and control groups. Table 4 compares the mean SF-36 scores from our subjects to those from Greek normals. Table 5 shows the correlation coefficients and *P* values for the comparisons of the SF-36 scores and the age, MRC dyspnea score, ADL score, and GHQ score values.

The HRQOL measurements were low in most SF-36 domains, compared to the Greek normals,<sup>18</sup> with the exception of the pain score in both groups and emotional-well being in the control group. Nevertheless, the only statistically significant difference between the patient groups was in the physical function domain.

There was no statistical correlation between any of the SF-36 domain scores and the ADL score in terms of the source of oxygen (Table 6).

One hundred six patients (75 of 85 in the LTOT group and 31 of 48 in the control group) completed the GHQ questionnaire. Fifty-three patients (70%) in the LTOT group had a GHQ score  $\geq 5$ . In the control group 53% had an abnormal GHQ score.

The bivariate correlations between the SF-36 subscores, age,  $P_{O_2}$ , and FEV<sub>1</sub> were not significant. The ADL scores

Table 1. Patient Demographics

	LTOT Group (%)	Control Group (%)
Marital status		
Married	73.4	88.6
Single	6.6	4.7
Widowed	20.0	6.7
Education		
Illiterate	29.3	20.9
Elementary school	49.3	44.3
Secondary school/higher education	21.4	34.8
Occupational status		
Retired	91.8	69.2
Other	8.2	30.8
Monthly incomes		
€500–1,000	30.6	69.1
< €500	69.4	30.9

LTOT = long-term oxygen therapy

Table 2. Respiratory Function Values and Activities of Daily Living and Dyspnea Scores

	LTOT Group	Control Group	<i>P</i>
Age (mean $\pm$ SD y)	70.7 $\pm$ 8.4	63.5 $\pm$ 10.6	< .001
BMI (mean $\pm$ SD kg/m <sup>2</sup> )	28.6 $\pm$ 6.7	28.5 $\pm$ 6.1	.91
FEV <sub>1</sub> (mean $\pm$ SD % predicted)	38.39 $\pm$ 16.2	56.7 $\pm$ 16.2	< .001
FVC (mean $\pm$ SD % predicted)	52.4 $\pm$ 18.0	73.0 $\pm$ 18.0	< .001
FEV <sub>1</sub> /FVC (mean $\pm$ SD)	52.1 $\pm$ 14.0	60.9 $\pm$ 14.7	.001
$P_{aO_2}$ (mean $\pm$ SD mm Hg)	48.8 $\pm$ 5.5	73.2 $\pm$ 10.6	< .001
$P_{aCO_2}$ (mean $\pm$ SD mm Hg)	47.0 $\pm$ 8.2	38.5 $\pm$ 3.6	< .001
ADL score (mean $\pm$ SD)	74.5 $\pm$ 37.3	97.4 $\pm$ 2.0	.001
MRC dyspnea score (mean $\pm$ SD)	3.2 $\pm$ 1.2	2.5 $\pm$ 1.2	.05

LTOT = long-term oxygen therapy

BMI = body mass index

FEV<sub>1</sub> = forced expiratory volume in the first second

FVC = forced vital capacity

ADL = activities of daily living score on the ADL-assessment questionnaire we designed for this study

MRC = Modified Medical Research Council dyspnea scale score

correlated strongly with the physical function scores. The MRC dyspnea and GHQ scores showed a strong and broad relationship to most of the SF-36 subscores and, consequently, to both the physical component summary and mental component summary scores (see Table 5).

A hierarchical multiple linear regression analysis of the influence of important respiratory measurements, MRC dyspnea, ADL, and GHQ scores on the summed SF-36 physical and mental component summary scores showed that initially MRC dyspnea emerged as predictor of HRQOL ( $\beta$  coefficient  $-0.364$ , 95% confidence interval  $-10.01$  to  $-2.27$ ,  $P = .002$ ). However, when ADL and GHQ were

Table 3. Medical Outcomes Study Short Form (SF-36) Scores

SF-36 Domain	LTOT Group (mean $\pm$ SD)	Control Group (mean $\pm$ SD)	<i>P</i>
Physical Function	38.9 $\pm$ 29.4	54.9 $\pm$ 33.8	.05
Role physical	36.0 $\pm$ 42.4	43.5 $\pm$ 47.0	.35
Pain	82.1 $\pm$ 25.4	85.6 $\pm$ 23.8	.43
General Health	47.2 $\pm$ 19.3	48.4 $\pm$ 16.7	.73
Emotional well-being	52.1 $\pm$ 22.3	64.6 $\pm$ 17.7	.74
Social function	47.2 $\pm$ 47.9	53.9 $\pm$ 48.0	.52
Role emotional	60.8 $\pm$ 29.6	61.5 $\pm$ 29.3	.44
Vitality	57.4 $\pm$ 23.1	54.9 $\pm$ 23.6	.62

added to the regression model, the only significant predictor was GHQ score ( $\beta$  coefficient  $-0.390$ , 95% confidence interval  $-1.12$  to  $-0.232$ ,  $P = .003$ ).

### Discussion

Our results indicate that patients with COPD using LTOT experience marked impairment of HRQOL and psychological status. Our subjects' mean HRQOL was low, as indicated by the SF-36 scores, and the lowest values were in the oxygen-dependent patients. However, the only significant difference between the groups was in the physical function domain, despite the administration of LTOT.

Several studies have used the SF-36 to evaluate quality of life in patients with severe COPD. Our results are comparable with those of Ferreira et al,<sup>11</sup> although the SF-36 values were slightly better in almost all domains in our LTOT group, and in the physical function and physical role domains in our control group. Unlike the results from Ferreira et al<sup>11</sup> and others,<sup>8,9</sup> we found no association between the physical component summary or the mental component summary and age, indices of airflow limitation, or blood-gas abnormalities. This lack of association leads us to question what other factors limit HRQOL, such as dyspnea. Indeed, the severity of dyspnea was an important limiter of HRQOL in our subjects, as evidenced by the strong relationship between MRC dyspnea score and the SF-36 physical and mental components summary scores. This suggests that patients with COPD perceive dyspnea as the leading symptom of the disease and that dyspnea severely affects their HRQOL. Similar results have been reported from others,<sup>4,5</sup> although some researchers used different dyspnea-measurement instruments. Such results led to the hypothesis that dyspnea might be a reliable and independent index of disease severity.<sup>20,21</sup> Our results support that concept (dyspnea emerged as a predictor of lower quality of life) and suggest that dyspnea control should be a key component of COPD therapy.

Dependence in ADL was more profound overall in the LTOT group than in the control group. There are several

reasons for activity restrictions in these patients, such as the degree of disease severity, dyspnea, and advanced age. Also, the oxygen source they used may be a cause of daily restriction, but, in agreement with other reports,<sup>22</sup> we found no impact of oxygen source on HRQOL, and there was also no difference in ADL independence between patients who used an oxygen concentrator versus a liquid oxygen source. Our ADL questionnaire gathers detailed information about the incapacity/incapacity for self-care, and the ADL score had a strong relationship to the SF-36 physical component summary and vitality. However, the restriction in daily activities did not emerge as an indicator of reduced HRQOL at all. Conversely, GHQ, which measures mental status, had a strong relationship to HRQOL.

Many patients with COPD have psychological problems. Although the general pattern of psychological disturbances in patients with COPD does not differ from that in other chronic diseases, ordinary psychological problems, such as somatoform or personality disorders, are quite common in patients with COPD, and can induce a "vicious circle" with the patient's dyspnea and associated functional incapacity.<sup>23</sup> Depression and anxiety are the most prevalent and consistent psychological disturbances, especially in oxygen-dependent patients with COPD, and these symptoms are often under-recognized.<sup>24,25</sup> We measured psychological status with the GHQ instrument, with which a score  $\geq 5$  indicates the possibility of severe mental illness. The percentage of the LTOT group with pathological GHQ scores was high, and the high scores in the vast majority of patients with COPD indicated that they were at high risk to develop anxiety, depression, antisocial behavior, and somatoform disorders. It is noteworthy that the disturbed psychological status and the severity of dyspnea have significant relationship with the most SF-36 domains and with the physical component summary and the mental component summary, and may be regarded as predictors of HRQOL impairment. Our results agree with other studies, that the severity of symptoms and the impairment of psychological status are more important determinants of HRQOL than is the impairment of pulmonary function.<sup>6,21</sup>

There is little information concerning the socioeconomic status of patients with COPD in Greece, and the impact of the disease on their HRQOL. Most of our patients were retired, had a low education level, low monthly income, and lived with their families. The majority of them were from the same social class, indicated by similarities in their monthly income, their previous jobs, and education level. Our data also accord with other reports with respect to the economic differences between countries.<sup>3,6,11</sup>

It has been suggested that patients from higher social classes and higher financial level should be able to more successfully deal with the problems from the disease progression. We did not observe any influence of socioeco-



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Table 4. Medical Outcomes Study Short Form (SF-36) Scores of Normal Greek Subjects Versus LTOT Subjects

SF-36 Domain	Normal Greek Subjects <sup>18</sup> (mean $\pm$ SD)	LTOT Group (mean $\pm$ SD)	<i>P</i> (LTOT vs normal)	Control Group (mean $\pm$ SD)	<i>P</i> (control vs normal)
Physical Function	80.76 $\pm$ 25.62	38.9 $\pm$ 29.4	< .001	54.9 $\pm$ 33.8	< .001
Role physical	79.74 $\pm$ 37.32	36.0 $\pm$ 42.4	< .001	43.5 $\pm$ 47.0	< .001
Pain	72.98 $\pm$ 31.66	82.1 $\pm$ 25.4	.9	85.6 $\pm$ 23.8	.9
General Health	67.46 $\pm$ 23.54	47.2 $\pm$ 19.3	< .001	48.4 $\pm$ 16.7	< .001
Emotional well-being	68.23 $\pm$ 21.21	52.1 $\pm$ 22.3	< .001	64.6 $\pm$ 17.7	.9
Social function	82.05 $\pm$ 28.12	47.2 $\pm$ 47.9	< .001	53.9 $\pm$ 48.0	< .001
Role emotional	81.53 $\pm$ 36.31	60.8 $\pm$ 29.6	< .001	61.5 $\pm$ 29.3	< .001
Vitality	66.53 $\pm$ 22.9	57.4 $\pm$ 23.1	< .01	54.9 $\pm$ 23.6	< .001

LTOT = long-term oxygen therapy; NS = difference not significant

Table 5. Comparison of Medical Outcomes Study Short Form (SF-36) Scores to Age, MRC Dyspnea Score, ADL Score, and GHQ Score

SF-36 Domain	Pearson Correlation Coefficient					
	Age <i>r</i> ( <i>P</i> )	P <sub>O<sub>2</sub></sub> <i>r</i> ( <i>P</i> )	FEV <sub>1</sub> <i>r</i> ( <i>P</i> )	MRC Dyspnea <i>r</i> ( <i>P</i> )	ADL <i>r</i> ( <i>P</i> )	GHQ <i>r</i> ( <i>P</i> )
Physical function	0.056 (.65)	0.065 (.60)	−0.028 (.82)	−0.333 (.005)	0.360 (.003)	0.437 (< .001)
Role physical	−0.177 (.14)	0.007 (.96)	−0.196 (.11)	−0.345 (.004)	0.162 (.19)	−0.206 (.09)
Pain	−0.097 (.43)	−0.069 (.58)	−0.201 (.07)	−0.086 (.49)	0.161 (.19)	−0.184 (.13)
General health	0.097 (.43)	0.100 (.96)	−0.170 (.17)	−0.056 (.65)	0.135 (.27)	−0.206 (.09)
Emotional well-being	0.176 (.15)	−0.018 (.89)	−0.237 (.054)	−0.304 (.012)	0.212 (.07)	−0.553 (< .001)
Social function	0.092 (.46)	−0.033 (.89)	−0.105 (.39)	−0.298 (.014)	0.182 (.14)	−0.425 (< .001)
Role emotional	−0.108 (.46)	−0.178 (.79)	−0.048 (.70)	−0.253 (.04)	0.119 (.33)	−0.313 (.009)
Vitality	−0.007 (.96)	0.010 (.94)	−0.121 (.33)	−0.271 (.03)	0.250 (.04)	−0.294 (.001)
PCS	−0.103 (.40)	−0.006 (.096)	−0.234 (.055)	−0.331 (.006)	0.293 (.01)	−0.367 (.002)
MCS	−0.058 (.64)	−0.072 (.56)	−0.140 (.25)	−0.349 (.003)	0.225 (.065)	−0.505 (< .001)

LTOT = long-term oxygen therapy

FEV<sub>1</sub> = forced expiratory volume in the first second

MRC = Modified Medical Research Council dyspnea scale score

ADL = activities of daily living score on the ADL-assessment questionnaire we designed for this study

GHQ = General Health Questionnaire score

PCS = Physical Component Summary score from the Medical Outcomes Study Short Form SF-36 domains

MCS = Medical Component Summary score from the Medical Outcomes Study Short Form SF-36 domains

nomic background on HRQOL, but the insignificant differences in the economic statuses of our patients prevents us from drawing conclusions regarding the effect of financial level. This limitation didn't allow us to establish differences in oxygen use relative to education and financial status. The daily oxygen use was adequate in general, except in patients who used a portable oxygen source. In addition, some of the patients (in both groups) continued to smoke. These findings point out the need for a strict follow-up, based on the patient's education and socioeconomic status, to better control the conditions of LTOT.

To the best of our knowledge there have been no previous published data on the HRQOL of Greek patients with COPD using LTOT, despite the fact that the overall prevalence of COPD seems to be high in Greece.<sup>26</sup> Furthermore, there are few available data concerning the ap-

Table 6. Comparison of Medical Outcomes Study Short Form (SF-36) Score, Oxygen Source, ADL Score, and Income

SF-36 Domain	SF-36 vs ADL ( <i>P</i> )	SF-36 vs Income ( <i>P</i> )
Physical Function	.53	.24
Role Physical	.59	.32
Pain	.38	.38
General Health	.35	.16
Emotional wellbeing	.48	
Social function	.79	.84
Role emotional	.51	.32
Vitality	.07	.86
ADL Oxygen Source	.26	.36

ADL = activities of daily living score on the ADL-assessment questionnaire we designed for this study

plication of the Greek SF-36 to patients with chronic illness,<sup>27</sup> and none of them have included patients with COPD.

A possible limitation of our study was our use of only one questionnaire (SF-36) to investigate quality of life. The SF-36 is valid to assess HRQOL in patients with COPD, but the fact that it is a generic instrument might explain the absence of correlation between the pulmonary function status and quality of life domains in our patients. Our ADL independence questionnaire may also be considered a limitation of the study, since it was designed especially for the study and has not been validated.

Our patient population included only men, but this finding was random, because patients who entered the study were consecutive and fulfilled specific inclusion criteria. The study population was also rather mixed in age, and the LTOT group was older overall. Although there was no relationship between HRQOL and age or pulmonary function status, these aspects, and sex, deserve further investigation, and the results should be interpreted bearing in mind gender characteristics, especially concerning psychological aspects.

## Conclusions

Quality of life is impaired in patients with COPD using LTOT, especially in the physical function domain. Dyspnea and psychological status was profoundly associated with the overall quality-of-life perception. Furthermore, the change in HRQOL was associated with GHQ score and it was independent of FEV<sub>1</sub>. Although, LTOT seems to slightly improve aspects of quality of life in patients with COPD, a multidimensional therapeutic approach should also include dyspnea control and psychological support.

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