Determinants of health-related quality of life in patients with chronic obstructive pulmonary disease

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Abstract

Background **– The consequences of chronic obstructive pulmonary disease (COPD) on daily life, encapsulated by the term "health-related quality of life" (HRQL), are important in determining appropriate home care. There is a need to understand the relative contribution of respiratory impairment, physical disability, coping, age, and socioeconomic variables on HRQL.**

Methods **– Patients with COPD were recruited on admission to a pulmonary rehabilitation centre. Respiratory impairment was assessed by lung function tests and physical disability was evaluated by a 12 minute walking test. HRQL was assessed by means of the St George's Respiratory Questionnaire (SGRQ) measuring "symptoms", "activity", and "impact". Because the SGRQ does not include a measure of "well being", this was taken from the medical psychological questionnaire for lung diseases. The COPD coping questionnaire and a questionnaire covering basic socioeconomic variables were also used.**

Results **– One hundred and twenty six patients of mean (SD) age 65 (9) years and mean (SD) forced expiratory volume in one second (FEV_1) 39 (9)% predicted were included. The scores on the SGRQ indicated severe impairment. Correlations were found between lung function parameters, 12 minute walking test, and the HRQL "activity" and "impact" components. Coping strategies were correlated with the "activity", "impact", and "well being" components. No correlations were found between age, socioeconomic variables, and HRQL. FEV_1, 12 minute walking test, and the coping strategies "avoidance" and "emotional reaction" were the best predictors of HRQL.**

Conclusion **– In patients with COPD methods of improving physical performance and teaching adequate coping strategies should be considered in order to improve HRQL.**

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Keywords: quality of life, chronic obstructive pulmonary disease, home care.

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In many western countries it is generally believed that the number of patients suffering from chronic obstructive pulmonary disease (COPD) will increase. Most patients with COPD are treated at home, and it is therefore important to understand the consequences of the disease on the patient's daily life as perceived by health-related quality of life (HRQL) and functional status. Functional status relates to the ability to perform tasks of daily life, while HRQL refers to the more subjective experience of the impact of the disease on the quality of one's life. Because COPD often affects older retired people, task performance may be less important than the ability to enjoy life.[1] Previous studies have shown that the relationship between respiratory impairment, reflected by pulmonary function, and HRQL measures in patients with COPD is negligible.[2–5] Significant correlations have been found between physical disability and HRQL,[6–8] but other studies have shown no such correlation.[9 10] Other factors must therefore affect HRQL. Previous studies have indicated strong correlations between HRQL, age and socioeconomic status,[2 4] and psychological factors including coping behaviour. Social factors such as social support are also reported to be determining factors of HRQL.[11–13] Different investigators have underlined the complex interrelationship between various factors and HRQL. A direct comparison of the results of different studies is, however, not feasible because study designs, settings, populations, and variables, as well as methods of analysis, differ.[1] We have therefore studied the contribution of physical disability, coping strategies, age and socioeconomic variables, and lung function to HRQL in patients with COPD. A better understanding of the factors that determine HRQL should lead to improved care for such patients.

Methods

PATIENTS

Patients entered the study on admission to a pulmonary rehabilitation centre. Criteria for inclusion were diagnosis of COPD according to ATS guidelines,[14] and age between 40 and 80 years. Patients who could not perform the 12 minute walking test or who suffered from other severely disabling illnesses unrelated to their respiratory disease such as cardiovascular, neurological, and locomotor diseases were excluded from the study. Written informed consent was obtained from each participant. The study protocol was approved by the local ethics committee.

MEASUREMENTS AND DATA COLLECTION

For each patient lung function parameters, exercise performance, HRQL, coping, age, and socioeconomic variables were assessed on admission to the pulmonary rehabilitation centre.

Lung function parameters

Forced expiratory volume in one second (FEV_1) was measured with a pneumotachograph (CompactBody, Jaeger, Wurzburg, Germany). Measures were performed according to the European Respiratory Society (ERS) guidelines and expressed as a percentage of reference values.[15] Spirometric values were assessed before and after administration of a bronchodilator (salbutamol 800 µg). Irreversibility was defined according to the ERS guidelines[15] and all patients fulfilled this criterion of irreversibility. The transfer coefficient for carbon monoxide (TLCO) was obtained by measuring the diffusion capacity of carbon monoxide (KCO) using the single breath method (Masterlab, Jaeger, Wurzburg, Germany) and dividing this by the alveolar volume. Respiratory muscle strength was determined from the maximal inspiratory mouth pressure (PImax) as described by Black and Hyatt.[16] For the purpose of this study PImax is expressed as a positive value.

Exercise performance

Exercise performance was evaluated by a 12 minute walking test which was performed in a hospital corridor 100 metres long. Patients were asked to walk as far as possible in 12 minutes. They could determine their own pace, even stop if necessary, and they were instructed that at the end they should feel as though they could not have walked any further. No encouragement during the test was given. As learning effects have been noticed to occur quickly with repeated walking tests,[17] the patients performed one practice 12 minute test.

HRQL

This was assessed by means of the St George's Respiratory Questionnaire (SGRQ). The SGRQ has demonstrated an adequate interrater reliability and reproducibility and the ability to quantify change over time.[6] It consists of 76 items and measures three components: "symptoms" ($\alpha = 0{\cdot}60$), "activities" ($\alpha = 0{\cdot}82$), and "impact" ($\alpha = 0{\cdot}71$). A high Cronbach's α indicates a high level of homogeneity of the items within that scale. The "symptoms" component contains items on the level of symptomatology including frequency of cough, sputum production, wheeze, and breathlessness. The "activity" component is concerned with physical activities that either cause or are limited by breathlessness. The "impact" component covers such factors as employment, being in control of health, panic, medication need and side effects, and the disturbance of daily life. The three components of HRQL are scored separately in the range 0–100% with a score of zero indicating no impairment. Because the SGRQ does not include a psychological dimension, the "well being" component of the medical psychological questionnaire for lung diseases (MPQL) was added to the HRQL questionnaire.[18] The MPQL scales were validated and a high internal reliability was found. "Well being" consists of 13 items ($\alpha = 0{\cdot}92$) and measures mainly the state of mind including anxiety. Patients were asked whether they agreed (1), did not know (2), or disagreed (3) with the described items. The MPQL scores range from 13 (very unfavourable) to 39 (very favourable), but are inverted for the purpose of this study for the sake of consistency with the SGRQ. In other words, in this study a low score implied that the patient felt good.

To assess coping strategies the COPD coping questionnaire (CCQ) was used. This is derived from the asthma coping questionnaire[19] and measures "avoidance" (16 items, $\alpha = 0{\cdot}82$), "rational action" (12 items, $\alpha = 0{\cdot}85$), and "emotional reaction" (6 items, $\alpha = 0{\cdot}64$). The CCQ scale scores range from 1 to 4. Subjects were asked whether they (1) hardly ever, (2) sometimes, (3) often, or (4) very often showed the behaviour described. In addition, a questionnaire was specifically developed for this study in order to ascertain basic socioeconomic variables (age, sex, household composition, social class).

DATA ANALYSIS

Pearson's product moment correlation coefficients (r) were determined to examine the degree of correlation among lung function variables, 12 minute walking test, coping, and HRQL scores. Differences between age, sex, composition of household (alone/together), and social class (low-medium/high) with respect to HRQL were tested using t tests for continuous variables and χ^2 tests for categorical data.

To identify the study variables most predictive of HRQL, stepwise multiple regression analyses were performed. Only variables that showed a significant correlation ($p<0{\cdot}05$) with HRQL were used as independent variables in the regression analyses. Dependent variables for this model were the HRQL components "activity", "impact", and "well being". All analyses were performed using the Statistical Package for Social Sciences (SPSS).

Results

One hundred and forty eight patients were recruited at the Pulmonary Rehabilitation Centre Hornerheide between October 1992 and April 1994. Twenty two patients could not perform a walking test and therefore 126 patients entered the study. Lung function and demographic details are shown in table 1.

Table 2 shows that the mean scores for the components of HRQL indicate severe impairment and a poor sense of well being. The scores for the coping scales indicate that these patients use more rational coping strategies and less avoiding and emotion-focused strategies.

Table 1 Patient characteristics (n = 126)

Characteristics	*n (%)*
Sex	
Men	96 (76)
Women	30 (24)
Social class[1]	
Low	111 (88)
Medium to high	15 (12)
Composition of household[2]	
Alone	43 (34)
Together	83 (66)
	Mean (SD)
Age (years)	65 (9)
FEV_1 (% predicted)	39 (18)
Kco (% predicted)	66 (23)
Pimax (kPa)	6·9 (2·3)

FEV_1 = forced expiratory volume in one second (pre-bronchodilator), Kco = transfer coefficient for carbon monoxide, Pimax = inspiratory mouth pressure.
[1] According to the occupational index ITS low = unskilled labourer, skilled labourer, lower employee and housewife, and medium to high = self-employed, medium and higher employee.
[2] Alone = living alone, together = living with partner, parent(s), child(ren) or brother(s)/sister(s).

Table 2 HRQL and coping scores

	Mean (SD)	*Difference (95% CI)*
HRQL	64 (18)	61 to 68
Symptoms[1]		
Activity[1]	68 (20)	64 to 71
Impact[1]	46 (16)	44 to 50
Well being[2]	31 (6)	30 to 32
Coping[3]		
Avoidance	2·40 (0·53)	2·28 to 2·45
Rational action	3·04 (0·54)	2·93 to 3·12
Emotional reaction	1·73 (0·49)	1·65 to 1·82

[1] SGRQ scores range from 0 to 100%, zero score indicating no impairment.
[2] MPQL scores well being: 13 (very favourable) to 39 (very unfavourable).
[3] CCQ scale scores range from 1 to 4 (hardly ever, sometimes, often, very often).

In order to investigate the multiple relationships between various factors with the components of HRQL, correlation coefficients were computed (table 3). No significant correlations were found between physiological parameters and the HRQL "symptoms" component and "well being". However, significant correlations were found between FEV_1, Pimax, and the "activity" component. Significant correlations were also found between Pimax and "impact". The 12 minute walking test alone showed a significant negative correlation with the "activity" and "impact" components of HRQL. The coping dimension "avoidance" was negatively correlated with the components

Table 3 Pearson's correlation coefficients (r) between HRQL components "activity", "impact", and "well being" and respiratory function, 12 minute walking test, and coping dimensions (n = 126)

	Health-related quality of life		
	"Activity"[1]	*"Impact"*[1]	*"Well being"*[2]
FEV_1 (% predicted)	−0·24**	−0·06	−0·03
Pimax (kPa)	−0·20*	−0·23**	−0·00
Kco (% predicted)	−0·16	−0·02	−0·05
12 minute walking test (m)	−0·39***	−0·36***	−0·02
Coping			
Avoidance	−0·22*	−0·20*	0·04
Rational action	0·16	0.11	−0·04
Emotional reaction	0·10	0·36***	−0·48***

[1] Low score represents no impairment.
[2] Low score represents favourable state of well being.
* p<0·05; ** p<0·01; *** p<0·001.
FEV_1 = forced expiratory volume in one second; Kco = transfer coefficient for carbon monoxide; Pimax = inspiratory mouth pressure.

Table 4 Results of a stepwise multiple regression analysis with the HRQL components "activity", "impact", and "well being" as the dependent variables

	Cumulative R^2	*F ratio*	*Beta*
Activity			
12 minute walking test	0·15	22·12	−0·39
FEV_1	0·23	18·88	−0·29
Impact			
Emotional reaction	0·10	10·74	0·47
12 minute walking test	0·25	15·70	−0·36
Avoidance	0·31	14·19	−0·27
Well being			
Emotional reaction	0·20	11·84	0·21

FEV_1 = forced expiratory volume in one second. Only those variables are presented that showed a significant (p<0·05) independent influence on the dependent variable.

"activity" and "impact". Furthermore "emotional reaction" was positively correlated with "impact" and negatively with "well being". HRQL components showed no significant relationship with age, sex, social class, or composition of household.

Three separate stepwise multiple regression analyses were used to identify variables that best predict HRQL (table 4). As there were no significant correlations between "symptoms" and the independent variables, no regression analysis was performed on this component of HRQL. Using "activity" as the dependent variable, first FEV_1 and then 12 minute walking test entered the equation. Pimax and "avoidance" were eliminated as they provided no additional prediction to the independent variables already in the equation. FEV_1 and 12 minute walking test accounted for 23% of the variance of "activity". With "impact" as the dependent variable, "emotional reaction", 12 minute walking test, and "avoidance" successively entered the equation, which accounted for 31% of the variance. Pimax was deleted as it no longer contributed significantly to the regression. In the stepwise regression analysis with "well being" as the dependent variable and FEV_1, 12 minute walking test, "avoidance" and "emotional reaction" as independent variables, only "emotional reaction" reached statistical significance and explained 20% of the variance.

Discussion

This study gives insight into factors that determine the four components of HRQL: "symptoms", "activities", "impact", and "well being". Significant correlations were found between FEV_1, the 12 minute walking test, coping strategies and the HRQL components "activity", "impact", and "well being". However, of the lung function parameters analysed only FEV_1 explained part of the variance regarding "activity". These results are consistent with previous investigations, indicating a relatively weak relationship between pulmonary function and HRQL in patients with COPD.[2 3 5 9 10 20]

The 12 minute walking test correlated negatively with the HRQL components "activity" and "impact" and partly explained the variance in these components. This indicated that patients with better results on the walking test had less restricted activities and that the disease

had less impact on their daily life. It is believed that the 12 minute walking test provides information about daily functioning.[21–23] Many studies have shown that a programme of regular exercise improves walking distance and the well being of patients with COPD in the absence of significant lung function changes.[8 21 24–26] Our data emphasise that exercise performance is relevant to daily functioning and HRQL in this group of patients. However, exercise capacity failed to account for all the variability in HRQL.

Several studies have underlined the importance of adequate coping strategies for patients with COPD[27–29] and our study confirms the contribution of coping behaviour in HRQL. Significant negative correlations were found between the coping dimension "avoidance" and the HRQL components "activity" and "impact". Furthermore, "avoidance" explained part of the variance in "impact". This indicates that patients who tend to deny their disease experience less limitation in their activities and are less influenced by the disease in daily life. "Emotional reaction" was correlated with "impact" and "well being" and also explained part of the variance in these components of HRQL. The negative correlation between "emotional reaction" and "well being" suggests that coping in a very emotional way is not favourable for the feeling of well being. This is in line with previous findings which found that patients with COPD who participated in an exercise programme used fewer emotion-focused coping strategies than those who did not exercise.[30–32] Curtis *et al* found that depression and emotional dysfunction play a prominent role in COPD.[1] In addition, Folkman and Lazarus[33] suggested that both personal and situational factors influence coping and that all coping strategies can be related to positive adaptational outcomes. Because coping with COPD involves an adjustment to limitations, knowledge about how people actually adjust to their disease is needed. Future research on coping should aim to refine patterns that affect a positive adaptation process on a chronic irreversible disease.

In contrast to the findings of McSweeny *et al*,[2] our data suggest that age is probably not an important determinant of HRQL in patients with severe COPD as no significant correlations were found between age and the different HRQL components. It is possible that older people consider their limitations a normal consequence of their age.

According to some authors the socioeconomic status might affect HRQL.[2 4] It is suggested that more affluent patients may be able to deal better with the effects of the disease because they have more material resources available. Similarly, patients in lower social positions may not seek medical help promptly, may be exposed to more environmental hazards, and may smoke more.[2 4] However, we found no relationship between sex, social class, composition of household, and the HRQL components. This accords with the results of Prigatano *et al* who reported that changes in work, home life, marriage, personal and social life, and finances could not account for HRQL differences in patients suffering from COPD.[4] A possible explanation might be the fact that patients with severe COPD must adjust to psychosocial losses such as elimination of productive work. The mean age of this study population was 65 years, and most patients had retired early due to the severity of the disease. They might have developed new attitudes and have adjusted their lifestyle a long time before the study. It would be useful in the future to examine further the relationship between socioeconomic variables and HRQL in younger patients with COPD.

Some limitations of our study should be mentioned. Only patients who were able to perform a walking test were included. In this respect it is a selected sample because some really severe cases have been excluded and their HRQL scores might have been even worse. Furthermore, the explained variance of the components of HRQL is modest. This underlines that HRQL in COPD is never a simple function of disease severity. Multiple interrelated factors play a part in HRQL and patients might use different adjustment strategies at different stages of the disease. Finally, this study was carried out in a population of older patients with severe COPD. Further research is needed in younger patients with more moderate COPD.

In conclusion, FEV_1, 12 minute walking test, "avoidance", and "emotional reaction" are determinants of HRQL in patients with severe COPD. It is known that many patients with COPD remain severely disabled in spite of optimum medical treatment to improve lung function. In these patients the value of exercise training and teaching adequate coping strategies should be considered. Further longitudinal studies are needed to disentangle the cause and effect relationships suggested by the present findings in order to unravel the complex interrelationship in HRQL. Our data indicate that home care programmes for patients with COPD should focus attention on improving and maintaining physical performance and developing adequate coping strategies.

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