Quality of life and hospital re-admission in patients with chronic obstructive pulmonary disease

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Abstract
Background – There is some evidence that quality of life (QOL) in patients with chronic obstructive pulmonary disease (COPD) may predict clinical outcomes and use of resources. This study examined whether QOL scores could prospectively predict re-admission for COPD or death within 12 months of an original admission, and whether QOL scores predicted home nebuliser provision.
Methods – The study was carried out in all acute medical wards of Aberdeen Royal Infirmary, Woodend and City Hospitals, Aberdeen over 12 months. A total of 377 patients admitted with an exacerbation of COPD were identified in this time, 111 of whom were not included in the study because they refused the interview or died before discharge. The remaining 266 patients completed the St George's Respiratory Questionnaire (SGRQ). Information on spirometric parameters, nebuliser provision at discharge, provision of domiciliary oxygen, and re-admission within 12 months was collected from patient notes.
Results – The mean age of the patients was 68 years and 53% were men. The mean (SD) forced expiratory volume in one second (FEV_1) was 38.8 (18.0)% predicted and forced vital capacity (FVC) was 58.9 (23.8)% predicted. Higher (worse) scores on the SGRQ were significantly related to re-admission for COPD in the next 12 months (difference = 4.8, 95% CI 1.6 to 8.0). Patients who were re-admitted and died from COPD did not differ in SGRQ scores from those who were re-admitted and survived for more than 12 months. Re-admission was not related to sex, age, or pulmonary function. One hundred and thirty eight patients did not have a home nebuliser before admission. Of these, 14 were provided with a home nebuliser at discharge. Patients provided with nebulisers had significantly worse SGRQ scores and worse FVC. The 41 patients given domiciliary oxygen did not differ in SGRQ or spirometric parameters. Logistic regression analysis of the three SGRQ subscales (Symptom, Impact and Activity), adjusting for lung function, age and sex, showed that all three subscales were significantly related to hospital re-admission and that Impact scores were related to nebuliser provision. Women did not differ from men in Symptom scores on the SGRQ but differed markedly on the Activity and Impact scales.
Conclusions – It is concluded that poor scores on the SGRQ, a QOL scale which measures patient distress and coping, are associated with re-admission for COPD and use of resources such as nebulisers, independent of physiological measures of disease severity.

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Quality of life (QOL) scales assess the impact of illness and experience of health among individuals. These scales include general "well being" measures such as the Sickness Impact Profile (SIP)[1] and the General Health Survey (SF-36)[2] and measures especially designed for respiratory disease such as the Chronic Respiratory Questionnaire (CRQ)[3] and the St George's Respiratory Questionnaire (SGRQ).[4] Respiratory QOL measures focus on the patient's experience of symptoms, how far symptoms such as breathlessness limit daily life activity, and how much distress the disease causes the patient.[5 6] Jones *et al*[7] argue that QOL measures are particularly relevant to the management of patients with chronic obstructive pulmonary disease (COPD) because much of this care is palliative and directed to improving patients' experience of health and well being.

Studies have found that QOL of patients with COPD improves after intervention such as taking part in pulmonary rehabilitation programmes.[8–10] However, improvement in QOL does not correlate very strongly with changes in physiological indicators.[6 11 12] The relation of QOL to improvement in exercise tolerance has varied in different studies. Wijkstra found that, while both QOL and exercise tolerance improved after rehabilitation, the improvements were not correlated.[13] These weak relationships between QOL and physiological measures raise the question of whether QOL scores have real clinical significance. However, Traver[14] found that, among patients with severe COPD, those who used more acute services had significantly higher (worse) SIP scores although assessed symptom severity did not differ, and Siu[15] found that the SF-20 predicted admission to hospital in elderly patients. Cox *et al*[16] carried out a randomised trial of a three month rehabilitation

Table 1 Target population: all patients admitted over 12 months to Aberdeen hospitals with a diagnosis of COPD

St George's interview	266
Refused interview	61
Not interviewed (deaf or confused)	12
Died during admission	38
Not identified during first 48 hours of admission	101
Total	478

Table 2 St George's Respiratory Questionnaire (SGRQ): descriptive statistics (n=266)

	Mean	Median	SD	Range
Total SGRQ	52.7	53.4	13.1	10.9–80.5
SGRQ Symptoms	78.0	80.2	14.7	24.0–100.0
SGRQ Impact	43.7	43.7	16.5	0–84.3
SGRQ Activity	54.4	57.1	13.6	0–81.5

programme for 88 patients with COPD and asthma, all of whom seemed to show excessive impairment for their level of pulmonary function in terms of hospital admissions and days of inactivity. He followed these patients for two years and found that initial improvement in pulmonary function in the intervention group was not maintained in the long term, but improvement in "experienced invalidity" was maintained over two years with an accompanying significant reduction in days in hospital for the intervention patients.

From these studies it appears that poor QOL may be related to a greater likelihood of admission to hospital. If QOL is related to risk of hospitalisation, then bringing about change in QOL, even without associated physiological change, may have important consequences for effective use of resources. Ketelaars *et al*[12] have recently shown that scores on the SGRQ are related to "coping strategies" of patients with COPD, with those who use a coping strategy of avoidance or denial having better QOL scores.

As part of an audit of inpatient care of patients with chronic respiratory disease we decided to included a QOL measure which would allow us to test whether those patients who had worse QOL were at greater risk of being admitted again in the next 12 months. Nebuliser provision is also likely to reflect the impact of illness on daily activities and distress of patients, so we decided to investigate whether this related to patient QOL. Review of the literature suggested that the SGRQ was a validated QOL measure which would be easy to administer and score. We therefore carried out a study to see if scores on this QOL measure would be associated with clinical outcomes and use of resources.

Methods

The study was carried out during a 12 month audit (March 1991 to February 1992) of care of patients admitted with an exacerbation of COPD to any acute medical ward of hospitals in Aberdeen. Two respiratory nurses identified patients with COPD by contacting wards (in the respiratory unit and eight non-respiratory units) after their receiving days. From hospital computer records 478 patients had a primary discharge diagnosis of COPD during the study, of whom 101 were not identified during the first 48 hours of their hospital stay and not approached for interview. They did not differ from those studied in pulmonary function, age, or outcome over the following 12 months. The remaining 377 (79%) patients were identified for the study during their stay in hospital, 266 of whom completed the SGRQ (61 patients refused the interview, 12 were unable to be interviewed because of deafness (7) or confusion (5), and 38 patients died during their admission and were excluded from the analysis; table 1). This non-interviewed group also did not differ from those studied in pulmonary function, age, or outcome over the following 12 months. Data were collected from patient notes on spirometric indices, provision of nebuliser and domiciliary oxygen before admission and at discharge, and follow up after discharge. After one year all case records were re-examined for re-admissions and deaths.

The SGRQ contains 76 items which ask patients to review the past 12 months for frequency of respiratory symptoms, impact or distress caused to them by symptoms, and limitations of activity because of symptoms. Answers to SGRQ items are weighted and total SGRQ score and scores on the three subscales (Symptom frequency, Impact, and Activity) are calculated by adding these weights.[17] Scores are then converted to percentages by dividing the weighted score obtained by the total possible weighted score. The higher the score the poorer the quality of life. A difference of 4% is taken to be clinically significant on the total or subscales.[17] The results of the SGRQ were not made known to doctors during the study.

Statistical analysis was carried out using SPSS-PC. SGRQ scores were normally distributed and *t* tests were used to compare group means. Spearman correlation coefficients were calculated. Logistic regression was used to establish odds ratios for re-admission and nebuliser provision, adjusting for age, sex, and lung function (where patients did not have spirometric results mean substitution was used).

Results

The mean (SD) age of the 266 patients was 68 (9.1) years (range 44–92); 141 (53%) were men. There were 50 current smokers (19%), 194 former smokers (73%), 20 (8%) had never smoked, and for two patients this item was not answered. One hundred and eighteen patients (44%) were in the care of respiratory medicine consultants during their initial hospital admission and 148 in the care of consultants in

Table 3 Outcomes over 12 months and total SGRQ score (n=266)

	Study group		Total SGRQ scores	
	No.	%	Mean (SD)	Range
No further admission (survived)	129	49	51.4 (12.9)	10.9–75.7
COPD admission (survived)	92	35	56.4 (12.1)	23.5–80.5
COPD death	17	6	55.3 (9.6)	36.5–74.6
Death, not re-admitted or not COPD	23	9	46.2 (13.3)	13.3–70.0
No records at follow up	5	2	37.2 (21.8)	15.9–71.1

Table 4 Mean SGRQ scores and pulmonary function by re-admission and survival status, provision of nebuliser, and provision of domiciliary oxygen (n=238)

	No further COPD admission and survived (n=129)	Further COPD admission or death (n=109)	Difference	95% CI	p value
Total SGRQ	51.4	56.2	4.8	1.6 to 8.0	0.003
SGRQ Symptoms	76.4	81.3	4.9	1.2 to 8.5	0.009
SGRQ Impact	42.4	48.0	5.6	1.6 to 9.6	0.004
SGRQ Activity	53.6	56.9	3.3	0.2 to 6.9	0.04
FEV$_1$ (% pred) (n=168)	39.4	38.2	1.2	−4.3 to 6.7	0.7
FVC (% pred) (n=157)	58.6	59.2	0.6	−8.2 to 6.8	0.9
No nebuliser on admission (n=138)	*No nebuliser at discharge (n=124)*	*Nebuliser at discharge (n=14)*			
Total SGRQ	50.2	60.1	9.9	2.6 to 17.2	0.001
SGRQ Symptoms	76.3	82.8	6.5	−1.6 to 14.7	0.10
SGRQ Impact	40.8	52.8	12.0	3.0 to 21.0	0.01
SGRQ Activity	52.4	60.7	8.3	0.8 to 16.6	0.05
FEV$_1$ (% pred) (n=98)	41.0	37.0	4.0	−8.5 to 16.5	0.5
FVC (% pred) (n=92)	63.8	45.9	17.9	3.3 to 32.5	0.02
	No domiciliary O$_2$ (n=197)	*Domiciliary O$_2$ (n=41)*			
Total SGRQ	53.5	54.0	1.5	−4.9 to 4.0	0.8
SGRQ Symptoms	78.9	77.1	1.8	−6.9 to 3.1	0.4
SGRQ Impact	44.6	45.6	1.0	−6.7 to 4.5	0.4
SGRQ Activity	55.3	54.3	1.0	−3.7 to 6.5	0.6
FEV$_1$ (% pred) (n=168)	39.2	37.1	2.14	−5.1 to 9.4	0.6
FVC (% pred) (n=157)	60.1	53.4	6.7	−1.4 to 14.9	0.10

FEV$_1$=forced expiratory volume in one second; FVC=forced vital capacity.

other specialities. Spirometric tests were performed by 168 patients, mainly those in the care of respiratory specialists. The mean (SD) forced expiratory volume in one second (FEV$_1$) was 38.8 (18.0)% predicted and forced vital capacity (FVC) was 58.9 (23.8)% predicted. The mean (SD) SGRQ score was 52.7 (13.1), range 10.9–80.5 (table 2).

Seventeen patients were admitted to hospital and died from COPD in the 12 months following the audit. There was no significant difference in SGRQ score between these patients and those re-admitted for COPD who survived for 12 months (difference=1.1, 95% CI −5.0 to 7.3, p=0.7). These 17 deaths from COPD were grouped with the 92 COPD re-admissions as "re-admitted for COPD or COPD death in 12 months". Another 23 patients either died from non-COPD causes (five cardiac failure, three carcinomas, one gastrointestinal haemorrhage) or died without a hospital re-admission in the following 12 months and with no stated cause of death in their notes. These patients had a better score on the SGRQ than all other groups (difference=7.4, 95% CI 1.5 to 13.4, p=0.01). For

this reason they were excluded from further analysis. For five patients the notes could not be found at follow up, leaving 238 patients in the final analysis (table 3).

Table 4 shows differences in total SGRQ scores and scores for the three subscales between those re-admitted (and/or died from COPD related causes) and those not re-admitted. Both the total SGRQ score and the subscale scores were significantly different between the two groups, with differences ranging from 3.3 to 5.6. The largest difference (5.6) was in the Impact subscale which measures the distress caused to patients by their condition. Neither FEV$_1$ nor FVC distinguished between re-admissions and those not readmitted. Age, sex, and current smoking status did not relate to risk of re-admission.

One hundred patients (42%) had home nebulisers before coming into hospital and continued with their use after returning home. These patients had significantly worse SGRQ scores (56.9 versus 51.2, 95% CI 2.5 to 8.8). Of the 138 patients without a nebuliser on entry, 14 were prescribed a nebuliser at discharge. Provision of a home nebuliser at discharge was significantly related to total SGRQ score (p<0.001) and to the Impact and Activity subscales (table 4). Nebuliser provision was significantly related to spirometric results (FVC, p=0.01). Age, sex, and current smoking status did not relate to nebuliser provision.

Forty one patients had domiciliary oxygen, the use of which did not relate to SGRQ score or spirometric results. Examination of the SGRQ subscales showed that symptoms did not vary with age but QOL impact was significantly greater for younger patients (table 5). Women also reported more impact and restriction of activity than men without reporting significantly more symptoms (table 6).

Logistic regression analysis was used to establish odds ratios for the relation between SGRQ subscales and re-admission and nebuliser provision. Odds ratios were adjusted

Table 5 Correlations between SGRQ scores, lung function, and age

	SGRQ Total	SGRQ Symptoms	SGRQ Impact	SGRQ Activity
FEV$_1$ (% pred)	0.07	−0.00	0.09	0.03
FVC (% pred)	0.01	−0.04	0.04	−0.12
Age	−0.17**	−0.10	−0.19**	−0.07

FEV$_1$=forced expiratory volume in one second; FVC=forced vital capacity.
** p<0.01.

Table 6 Relationship between SGRQ scores and sex

	Men (n=123)	Women (n=115)	Difference	95% CI	p value
Total SGRQ	51.1	56.2	5.1	1.9 to 8.2	0.001
SGRQ Symptoms	77.7	79.7	2.0	−5.7 to 1.6	0.28
SGRQ Impact	42.1	47.9	5.8	1.7 to 9.7	0.005
SGRQ Activity	52.1	58.3	6.2	2.9 to 9.9	0.001

Table 7 Estimated odds ratios for re-admission or nebuliser provision on the subscales of the SGRQ

SGRQ subscale*	Re-admission within 12 months (n=238)	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[1][3]
Symptoms	1.13 (1.03 to 1.25)	1.14 (1.04 to 1.26)
Impact	1.12 (1.03 to 1.22)	1.14 (1.05 to 1.25)
Activity	1.10 (0.99 to 1.23)	1.13 (1.01 to 1.25)
	Nebuliser provision at discharge among patients without nebuliser on entry (n=138)	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[2][3]
Symptoms	1.19 (0.95 to 1.50)	1.21 (0.95 to 1.54)
Impact	1.25 (1.04 to 1.51)	1.25 (1.03 to 1.51)
Activity	1.30 (0.99 to 1.70)	1.35 (0.99 to 1.83)

* Odds ratios show the effect of a five point change on each scale.
[1] Adjusted for age, % predicted FEV_1 and FVC, sex, and nebuliser provision (at discharge and before entry to hospital).
[2] Adjusted for age, % predicted FEV_1 and FVC, and sex.
[3] Mean substitution was used for the 70 cases where no spirometric data were available.

for effects of age, sex, and lung function. For adjusted odds ratios, Symptoms, Impact and Activity were all significantly related to re-admission and Impact was also related to nebuliser provision (table 7).

Over the 12 months following the audit 55% of patients with nebulisers were re-admitted compared with 45% of patients without nebulisers (p<0.01). This difference was no longer significant when SGRQ score was controlled for in a logistic regression analysis.

Patients in the care of respiratory physicians did not differ in Symptom QOL but had worse Impact QOL (difference = 4.4, p = 0.03) and worse Activity QOL (difference = 3.2, p = 0.05) and were more likely to be re-admitted (53% versus 40%, p<0.05).

Discussion

These results show that patients with poor QOL are at greater risk of hospital re-admission after an initial admission and that patients are also more likely to be provided with home nebulisers if they have poor QOL. The results also suggest that patients are likely to be referred to respiratory specialists if they have poor QOL. We did not find that percentage predicted FEV_1 or FVC was related to re-admission within 12 months among this group of patients. The results of this study suggest that, in patients whose range of lung function is restricted, differences in QOL are more significantly related to clinical decisions and use of resources than are differences in pulmonary function.

QOL scales are designed to measure psychological impact and subjective experience of patients, but all QOL scales also have a symptom component. It might be the symptom measure component of the total score which predicts risk of admission to hospital rather than the more subjective components measuring distress and daily life limitation. Because the SGRQ provides separate subscale scores for Symptoms, Impact and Activity we were able to test which aspects of QOL best discriminated differences in outcome between patients. Although all scales showed differences

between patients, the Impact subscale showed the largest differences in re-admission to hospital and nebuliser provision. Among this group of patients with COPD, all of whom had quite high symptom scores, those with greater distress and poorer coping were more likely to be re-admitted and provided with nebulisers. This was so, even though the patients were under the care of a large number of consultants in both respiratory medicine and other specialities.

Activity limitation as assessed by the Activity subscale of the SGRQ subscale was relatively poorly related to re-admission to hospital or nebuliser provision. The Activity scores did show that significant differences in self perceived activity limitation exist between men and women and older and younger patients. Women with COPD feel they are more limited in activities than do men, and women experience greater distress from their illness without reporting any worse levels of symptoms. The patients who were relatively younger also showed most signs of suffering from the psychological impact of their disease. The greater distress caused by COPD to these groups has been previously reported.[18]

Patients with a home nebuliser were more likely to be re-admitted to hospital over the following 12 months but when we controlled for SGRQ score the relationship between nebuliser and re-admission was no longer significant, showing that the greater number of admissions among patients with a home nebuliser was unlikely to be due to the provision of a nebuliser per se. This illustrates how a valid QOL measure can be used to correct for differences between patients when investigating differences in outcome.

Assessing patient coping and the impact of disease on patients is a normal part of the clinical interview and it is not surprising that poor quality of life should be related to decisions to admit to hospital or to provide support such as home nebulisers. QOL measures can reflect this clinical assessment, but at present such scales do not have great enough sensitivity to be used as determinants of clinical decisions. Guyatt, however, found that patients were more reluctant to volunteer information about the emotional impact of illness[19] than about symptoms, and he has suggested that QOL scales should provide a way of eliciting areas of distress for patients.

Poor QOL in patients with COPD has previously been linked to greater use of health resources[14] and the study by Cox *et al*[16] suggests that, when QOL improves, even though lung function does not, consultations and hospital admissions decrease. The results of our study are compatible with those of Cox *et al* in showing that poor QOL is associated with a greater chance of admission and of nebuliser provision. Thus QOL outcomes, even when there is no physiological improvement, may be important in assessing the success of interventions in patients with COPD. The SGRQ appears to distinguish patients who cope relatively well, despite having high symptom levels, and to show that this good coping has clinical con-

sequences. This therefore offers the possibility of using QOL scales to identify patients who cope poorly and directing interventions to them.

Ketelaars *et al*[12] have recently shown the complex relationship that exists between the subscales of the SGRQ and measures of coping and physical performance. They have commented that "longitudinal studies are needed to disentangle the cause and effect relationships suggested by (their) findings". The present study shows that, in a longitudinal study, QOL is associated with hospital admission in patients with moderate to severe limitations in lung function. We do not yet know how strongly QOL would predict hospital admission among a milder group of patients, but the studies previously described suggest that poor QOL plays a part in increasing risk of hospitalisation at all levels of physiological impairment. We conclude that the results of this study suggest an important area of research into patient experience of COPD and its impact on clinical decision making and the use of resources.

1 Bergner M, Bobbitt RA, Carter WB, Gilson BS. The Sickness Impact Profile: development and final revision of a health status measure. *Med Care* 1981;**19**:787–805.
2 Stewart AL, Hays RD, Ware JE Jr. The MOS short-form general health survey. Reliability and validity in a patient population. *Med Care* 1988;**26**:724–35.
3 Guyatt GH, Berman LB, Townsend M, Pugsley SO, Chambers LW. A measure of quality of life for clinical trials in chronic lung disease. *Thorax* 1987;**42**:773–8.
4 Jones PW, Quirk FH, Baveystock CM, Littlejohns P. A self-complete measure of health status for chronic airflow limitation. The St George's Respiratory Questionnaire. *Am Rev Respir Dis* 1992;**145**:1321–7.
5 Juniper EF, Guyatt GH, Ferrie PJ, Griffith LE. Measuring quality of life in asthma. *Am Rev Respir Dis* 1993;**147**: 832–8.
6 Schrier AC, Dekker FW, Kaptein AA, Dijkman JH. Quality of life in elderly patients with chronic nonspecific lung disease seen in family practice. *Chest* 1990;**98**:894–9.
7 Jones PW, Quirk FH, Baveystock CM. Why quality of life measures should be used in the treatment of patients with respiratory illness. *Monaldi Arch Chest Dis* 1994;**49**:79–82.
8 Toshima MT, Kaplan RM, Ries AL. Experimental evaluation of rehabilitation in chronic obstructive pulmonary disease: short-term effects on exercise endurance and health status. *Health Psychol* 1990;**9**:237–52.
9 Emery CF, Leatherman NE, Burker EJ, MacIntyre NR. Psychological outcomes of a pulmonary rehabilitation program. *Chest* 1991;**100**:613–7.
10 Goldstein RS, Gort EH, Stubbing D, Avendano MA, Guyatt GH. Randomised controlled trial of respiratory rehabilitation. *Lancet* 1994;**344**:1394–7.
11 Wijkstra PJ, TenVergert EM, van der Mark TW, *et al.* Relation of lung function, maximal inspiratory pressure, dyspnoea, and quality of life with exercise capacity in patients with chronic obstructive pulmonary disease. *Thorax* 1994;**49**:468–72.
12 Ketelaars CAJ, Schlosser MAG, Mostert R, Huyer Abu-Saad H, Halfens RJG, Wouters EFM. Determinants of health related quality of life in patients with chronic obstructive pulmonary disease. *Thorax* 1996;**51**:39–43.
13 Wijkstra PJ, Van Altena R, Kraan J, Otten V, Postma DS, Koeter GH. Quality of life in patients with chronic obstructive pulmonary disease improves after rehabilitation at home. *Eur Respir J* 1994;**7**:269–73.
14 Traver GA. Measures of symptoms and life quality to predict emergent use of institutional health care resources in chronic obstructive airways disease. *Heart Lung* 1988;**17**: 689–97.
15 Siu AL, Reuben DB, Ouslander JG, Osterweil D. Using multidimensional health measures in older persons to identify risk of hospitalization and skilled nursing placement. *Quality of Life Res* 1993;**2**:253–61.
16 Cox NJ, Hendricks JC, Binkhorst RA, van Herwaarden CL. A pulmonary rehabilitation program for patients with asthma and mild chronic obstructive pulmonary diseases (COPD). *Lung* 1993;**171**:235–44.
17 Jones P, Quirk FH, Baveystock CM. The St George's Respiratory Questionnaire. *Respir Med* 1991;**85**:25–31.
18 Kinsman RA, Yaroush RA, Fernandez E, Dirks JF, Schocket M, Fukuhara J. Symptoms and experiences in chronic bronchitis and emphysema. *Chest* 1983;**83**:755–61.
19 Guyatt GH, Townsend M, Berman LB, Pugsley SO. Quality of life in patients with chronic airflow limitation. *Br J Dis Chest* 1987;**81**:45–54.