to continue when a patient dies or moves away. Over-prescribing of oxygen has a significant financial impact. There are guidelines for oxygen prescribing but they are only specific about LTOT duration and target oxygen partial pressure. The results suggest ambulatory oxygen is commonly prescribed in generous measure.

Pulmonary rehabilitation: assessment and outcome

P41 SHOULD SMOKERS BE ALLOWED TO ATTEND PULMONARY REHABILITATION?

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Pulmonary rehabilitation has an established role in the treatment of chronic lung disease reducing dyspnoea, improving both quality of life and exercise tolerance. However, although NICE guidelines state that smoking cessation is an integral part of pulmonary rehabilitation the inclusion of current smokers is a contentious issue, with many programmes precluding their attendance.

Patients and Methods: We have therefore analysed results from an established twice weekly, 7-week pulmonary rehabilitation programme comparing chronic obstructive pulmonary disease patients who are ex-smokers with current smokers. Forty-six patients were recruited, forming two study groups that were matched for age, sex, lung function and breathlessness (MRC score). All patients completed pre and post-incremental shuttle walk test (ISWT), endurance shuttle walk test (ESWT), predicted VO_2 max (pVO_2) quality of life questionnaire (QOL) and FEV_1.

Results: The mean age was 65 years (range 55–77), 14/23 men per group; FEV_1 mean 0.92 litres predicted, range 0.35–1.88 litres. Both groups showed significant post compared with pre improvements in ISWT, ESWT and predicted VO_2 max. However, significant QOL scores were only seen in the current smokers group, whereas improvements in FEV_1 were only seen in the non-smoking group. When comparing post-rehabilitation improvements no significant differences were seen in all measures between groups.

Analysis of Data: This study demonstrates that physical improvements made by smokers are just as great as non-smokers. Interestingly, current smokers showed a significantly greater improvement in pre to post-rehabilitation QOL than non-smokers, although this was not significant between groups. An explanation of this could be the non-stigmatic environment of pulmonary rehabilitation and the self-efficacy that they are enrolling in something positive associated with their chronic lung disease. This study provides evidence that smokers should not be excluded from pulmonary rehabilitation. Furthermore, the benefits of pulmonary rehabilitation coupled with the core concept of smoking cessation may enhance the overall rehabilitation of this subgroup.

P42 REDUCED 6-MINUTE WALKING TEST PERFORMANCE IN CURRENT SMOKERS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Introduction: Six-minute walking test (SMWT) performance has previously been related to anthropomorphic characteristics, including body mass index (BMI, which incorporates elements of height and weight), as well as quadriceps strength and peak oxygen consumption. Reduced SMWT distances have been described among current compared with ex-smokers with peripheral vascular disease. Reduced quadriceps endurance in otherwise healthy smokers has also been reported.

Hypothesis: We hypothesised that SMWT distance would be reduced in the presence of current tobacco smoke exposure in chronic obstructive pulmonary disease (COPD).

Methods: Records of COPD patients attending for SMWT assessment at a clinical rehabilitation hospital in The Netherlands were analysed. Variables of interest related to exercise capacity and the SMWT were identified: anthropomorphic data (age, sex, BMI, fat-free mass index; FFMI); measures of activity and activity-related dyspnoea (MRC dyspnoea scale score, St George's respiratory questionnaire activity domain, quadriceps strength); pulmonary function (FEV_1, TLCO, RV/TLC ratio, resting PaO_2) and peak incremental cycle exercise capacity (Wpeak). Quadriceps strength was quantified by maximal isometric voluntary contraction strength (QMVC). Arterial carboxyhaemoglobin levels of ⩾2% were used to indicate active smoke exposure.

Results: Complete data were identified for 221 subjects (63% men) with a mean (SD) age of 64 years (10) and median MRC dyspnoea

Abstract P42 Table The effect of smoking status on SMWT distance

	Group mean (SD) (n = 221)	Regression-coefficient (95% CI) (model r^2 = 0.55)	p Value
Constant	–	814.40 (644.70 to 984.10)	<0.001
Age (years)	63 (10)	−1.24 (−2.52 to 0.47)	0.059
Sex (F/M)	–	−36.74 (−66.96 to −6.52)	**0.017**
BMI (kg/m^2)	24.9 (3.9)	−6.20 (−9.27 to −3.13)	**<0.001**
FEV_1 % predicted (%)	47.1 (16.8)	−0.77 (−1.84 to 0.30)	0.160
TLCO % predicted (%)	50.5 (17.7)	0.30 (−0.49 to 1.09)	0.453
RV/TLC ratio (%)	55.0 (10.0)	−2.12 (−3.75 to −0.49)	**0.011**
Resting PaO_2 (kPa)	9.43 (1.36)	1.45 (−6.99 to 9.89)	0.735
Wpeak % predicted (%)	75.8(31.2)	1.58 (0.91 to 2.26)	**<0.001**
MRC dyspnoea scale (1–5)	3(2–4)*	−19.20 (−31.92 to −6.45)	**0.003**
SGRQact score (aU)	65.6(19.6)	−1.04 (1.76 to −0.32)	**0.005**
QMVC (kg)	31.6(9.9)	2.26 (0.78 to 3.73)	**0.003**
Smoke exposure (ex-current)	–	−23.63 (−45.57 to −1.69)	**0.035**

Multiple linear regression coefficients with accompanying p values, describe the change in SMWT distance (in metres) per unit change in the group/covariable. Significant p values shown in bold. Descriptive variables shown for reference as mean (SD). *Indicates median (interquartile range). BMI, body mass index; QMVC, maximal isometric voluntary contraction strength; SGRQ, St George's respiratory questionnaire; SMWT, 6-minute walking test; Wpeak, peak incremental cycle exercise capacity.

Abstract P41 Table Effects of pulmonary rehabilitation on current smokers and ex-smokers

Group	ISWT mean % increase	ISWT	ESWT mean % increase	ESWT	VO_2 max mean % increase	VO_2	QOL mean % increase	QOL	FEV_1 mean % increase	FEV
CS	22.2	0.001	51.1	0.001	14.1	0.002	19.5	0.001	6	0.188
XS	12.2	0.006	42	0.023	4	0.008	4	0.335	12.6	0.009

CS, current smokers; ESWT, endurance shuttle walk test; ISWT, post-incremental shuttle walk test; QOL, quality of life; XS, ex-smokers.

scale score of 3. Mean (SD) % predicted FEV_1 was 47.1% (16.8). 44% of subjects had an carboxyhaemoglobin level of ⩾2%; this group had a significantly reduced SMWT compared with those with a low carboxyhaemoglobin level (−33 m, 95% CI −63 m to −4 m; p = 0.026). The table shows group data and the result of a multiple linear regression analysis: allowing for the dependence of the SMWT on the variables described, subjects with an carboxyhaemoglobin level ⩾2% still had a significantly shorter SMWT distance. The independent effect of sex was removed when FFMI was substituted for BMI; current exposure to tobacco smoke remained significantly related to SMWT performance (p = 0.010).
Conclusions: SMWT performance is independently related to the degree of resting hyperinflation and clinical measures of activity related dyspnoea in COPD. Current exposure to tobacco smoke was associated with a reduced SMWT performance of 24 m and appeared independent of FFMI or quadriceps strength.

P43 ASSESSING THE BENEFIT OF EDUCATION IN PULMONARY REHABILITATION: THE DEVELOPMENT OF A QUESTIONNAIRE

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Introduction: Currently few questionnaires exist that assess knowledge and satisfaction with the education component of pulmonary rehabilitation. The aim of this study was to develop a questionnaire that could be used to assess the benefit of education in pulmonary rehabilitation.
Methods: Stage 1: The questionnaire (section A: knowledge—three components; section B: satisfaction) was developed following focus groups of patients with chronic obstructive pulmonary disease (COPD), a review of relevant literature and consultation with healthcare professionals and patients with COPD. Stage 2: The questionnaire was piloted in 30 patients with COPD for content and readability. Stage 3: The test–retest reliability was assessed in 20 patients with COPD. The mean (SD) time between visits was 7 days (1). Stage 4: The questionnaire was assessed for plain English and reading age using the drivel defence and simple measure of gobbledygook (SMOG) indices. The drivel defence index calculates the number of sentences below and above 20 words and provides potential alternative words. The SMOG index estimates the years of education required to understand written text.
Results: Section A had good test–retest reliability. 16/18 questions had an ICC >0.70 (range 0.64–0.92). The three components of section A showed good internal consistency (Cronbach's alpha range 0.67–0.97). Section B could only be completed by those patients who had previously attended pulmonary rehabilitation (n = 10). Wilcoxon signed rank test showed no significant difference between the scores on the two occasions for section B. Amendments were made to the questionnaire following results from the initial drivel defence and SMOG indices. The final drivel defence index showed that the mean length of question was 16 words and 19/24 questions were below 20 words. The final SMOG index showed that the majority of questions required an education level of secondary school education or below. The mean (SD) length of time taken to complete the questionnaire was 7 minutes (2).
Conclusion: The questionnaire is short, easy to administer and reliable. Further research focusing on the responsiveness of the questionnaire is underway.

P44 FATIGUE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE UNDERTAKING PULMONARY REHABILITATION

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Background: Fatigue is an important symptom described by patients with chronic obstructive pulmonary disease (COPD), but can be difficult to quantify and assess. We explored fatigue in such patients attending pulmonary rehabilitation and hypothesised that fatigue scores would attenuate following pulmonary rehabilitation.
Methods: We evaluated 33 patients (11 men), median age (range) 65 years (49–80), mean (SD) FEV_1 % predicted 42.5% (14.7) and body mass index 26.1 kg/m^2 (7.4), as part of a larger study investigating comorbidities in patients with COPD undertaking pulmonary rehabilitation. The multi-dimensional fatigue inventory,[1] which determines fatigue scores for five domains of fatigue (each scored out of 20, with a higher score indicating more fatigue), was completed in addition to standard outcome measures pre and post-pulmonary rehabilitation. The multidisciplinary pulmonary rehabilitation programme has previously been described. To date, 19 patients have completed pulmonary rehabilitation and are representative of the 33 baseline patients.
Results: At baseline, general and physical fatigue together with feelings of reduced motivation and activity were worse than previously published data in healthy individuals of similar age, see table;[2] mental fatigue was similar. All domains of fatigue, except mental, were related to total quality of life (St George's respiratory questionnaire); and depression (hospital anxiety and depression score; HADS) was related to general and physical fatigue and reduced activity, all p<0.05 but not anxiety (HADS). Only feelings of reduced activity (r = −0.371) and reduced motivation (r = −0.359), both p<0.05, were related to the incremental shuttle walk test (ISWT). With pulmonary rehabilitation, mean (95% CI) change in general fatigue was −2.1 (−0.3 to −3.9), feeling of reduced activity −2.6 (−0.7 to −4.5) and reduced motivation −1.8 (−0.01 to −3.57), with a similar trend to improved physical fatigue, p = 0.05. Clinical parameters such as age, FEV_1 % predicted, body mass index and ISWT did not predict change in any of the fatigue domains.
Conclusions: Several domains of fatigue are increased in patients with COPD and improved by pulmonary rehabilitation in parallel with other accepted outcome measures such as the St George's respiratory questionnaire and post-incremental shuttle walk test distance. The lack of association with other clinical parameters highlights either the complex subjective nature of fatigue or its independent contribution to the patients' welfare.

Abstract P44 Table

	Patients with COPD	Reported healthy control data (2)
General fatigue	15.0(3.9)	8.16 (3.8)
Physical fatigue	16.21(3.9)	6.47 (3.2)
Feeling of reduced activity	14.09(4.9)	6.72 (3.0)
Reduced motivation	11.61(4.0)	6.66 (2.4)
Mental fatigue	7.88(4.4)	6.53 (3.0)

Data reported as mean (SD). COPD, chronic obstructive pulmonary disease.

1. **Smets EM,** *et al*. *J Psychosom Res* 1995;**39**:315.
2. **Barendregt PJ,** *et al*. *Ann Rheum Dis* 1998;**57**:291.

P45 DOES THE HOSPITAL ANXIETY AND DEPRESSION SCORE AT THE OUTSET OF PULMONARY REHABILITATION AFFECT OUTCOME?

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Background: Pulmonary rehabilitation has established itself as integral to the management of patients with chronic obstructive pulmonary disease (COPD) and offers benefit to patients with other chronic lung diseases. Depression is common in patients with chronic lung disease. Does depression allow similar outcomes with pulmonary rehabilitation—can patients accept the multidisciplinary input or should the depression be treated first? Withers *et al*

Abstract P45 Table Mean (95% CI) change in each outcome parameter

Parameter	Initially depressed	Not depressed	p Value
Δ symptom SGRQ	−10.6 (−16.9 to −4.2)	−8.6 (−11.4 to −5.7)	0.642
Δ activity SGRQ	−11.9 (−16.7 to −7.0)	−3.7 (−5.7 to −1.7)	0.007
Δ impact SGRQ	−17.9 (−25.9 to −9.9)	−8.4 (−10.5 to −6.3)	0.005
Δ total SGRQ	−14.9 (−19.9 to −9.8)	−7.0 (−8.6 to −5.3)	0.002
Δ ISWT (m)	68.2 (28.3 to 108.2)	51.1 (41.8 to 60.3)	0.237

ISWT, incremental shuttle walk test; SGRQ, St George's respiratory questionnaire.

(1999) studied some outcomes in patients with severe COPD, n = 95. We explored various outcomes in an unselected group of patients entering pulmonary rehabilitation.
Methods: 206 consecutive records of patients entering pulmonary rehabilitation (mid-2006–end 2007). Details of the multidisciplinary 20 session pulmonary rehabilitation programme have been detailed before. Hospital anxiety and depression score (HADS) and the St George's respiratory questionnaire (SGRQ) together with the incremental shuttle walk test (ISWT) were conducted pre and post-pulmonary rehabilitation.
Results: 185 completed pulmonary rehabilitation, with a similar proportion of depressed/non depressed dropping out. Of the 185 (103 men, mean age 67 years, 80% with a primary diagnosis of COPD), 21 (11%) had depression (HADS ⩾11). At the outset, patients with depression had worse SGRQ (activity, impact and total) and shorter ISWT. Improvements in SGRQ were greater in the depressed group, whereas ISWT changes were similar (see table). 17/21 patients who were initially depressed had HAD scores <11 at completion.
Conclusions: Multidisciplinary pulmonary rehabilitation offers benefits of a similar or greater benefit in patients with chronic lung disease who are depressed compared with those not depressed.

P46 COMMUNITY PULMONARY REHABILITATION IN OCTOGENARIANS

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Introduction and Objectives: Most guidelines state that old age is not a valid exclusion criterion for pulmonary rehabilitation. This is based on historical data demonstrating that pulmonary rehabilitation leads to similar improvements in exercise capacity in older patients compared with younger patients with similar lung function abnormalities. However, these studies involved a small number of patients in either an inpatient rehabilitation or hospital-based outpatient setting. The objective of the present study was to determine whether octogenarian chronic obstructive pulmonary disease (COPD) patients gain similar benefits to younger patients from community-based pulmonary rehabilitation.
Methods: All COPD patients over the age of 80 years (elderly) participating in a community pulmonary rehabilitation programme in Lambeth and Southwark between the years 2004 and 2007 were included in the study. The control group consisted of COPD patients under the age of 65 years participating in the same classes (control). Outcomes were defined as changes in incremental shuttle walk distance (ISW) and breathlessness (as measured by the chronic respiratory disease dyspnoea domain; CRQ-D) pre and post-pulmonary rehabilitation.
Results: There were 99 patients in the elderly group (47 men, mean age 82.9 years, FEV_1 57.4% predicted) and 250 patients in the control group (106 men, mean age 58.4 years, FEV_1 51.4% predicted). Elderly showed smaller improvements in ISW and CRQ-D than controls (see table).
Conclusions: Octogenarian COPD patients show smaller improvements in exercise capacity and dyspnoea following community pulmonary rehabilitation compared with patients under the age of 65 years. This warrants further investigation.

Abstract P46 Table

	Elderly	Control	p Value
Mean (SD) ISW change (m)	35 (47)	85 (94)	<0.001
Mean (SD) CRQ-D change	0.17 (1.32)	0.78 (1.17)	<0.001

CRQ-D, chronic respiratory disease dyspnoea domain; ISW, incremental shuttle walk distance.

P47 THE EFFECT OF INCLUDING A CLINICAL PSYCHOLOGIST IN PULMONARY REHABILITATION ON COMPLETION RATES AND HOSPITAL RESOURCE UTILISATION IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Introduction and Objectives: Pulmonary rehabilitation programmes for patients with chronic obstructive pulmonary disease (COPD) commonly report high attrition rates. Completion of pulmonary rehabilitation is associated with functional benefits and decreased acute exacerbations requiring admission. In contrast, we have previously shown that patients who do not complete pulmonary rehabilitation are more likely to be admitted with acute exacerbations of COPD and also have higher self-reported levels of anxiety and depression (*Thorax* 60 (Suppl II): ii67). The aim of this study was to assess the impact of including a clinical psychologist in pulmonary rehabilitation on patient-related outcomes including admissions and bed-days.
Methods: Outcomes for patients with moderate to severe COPD (n = 52, mean (SD) age 70.1 ± 7.9 years, FEV_1 0.86 ± 0.89 litres) who attended a traditional-style pulmonary rehabilitation programme were retrospectively compared with outcomes for COPD patients (n = 25, mean (SD) age 69.8 ± 8.8 years, FEV_1 1.13 ± 0.52 litres) who attended a series of pulmonary rehabilitation programmes modified to include a cognitive behavioural therapy-based psychological component aimed at addressing psychosocial issues and building patient empowerment and self-efficacy. Outcomes included completion rate, functional measures (6-minute walk or shuttle walk test, MRC dyspnoea score), emotional measures (chronic respiratory questionnaire, hospital anxiety and depression score) and measures of hospital resource utilisation (hospital admission rate and bed-day utilisation in the year following pulmonary rehabilitation).
Results: For all patients who completed pulmonary rehabilitation, with or without a psychological component, there were significant ($p<0.05$) improvements in functional and emotional outcome measures other than anxiety. However, the inclusion of a targetted psychological component in pulmonary rehabilitation was associated with a highly significant ($p = 0.02$) improvement in completion rates from 50% to 92%. Completion of pulmonary rehabilitation was, in turn, associated with a signficantly ($p = 0.05$) lower mean annual admission rate in the year following pulmonary rehabilitation (0.2 admissions/patient/year for completers compared with 1.4 admissions/patient/year for those who did not complete) and consequently a significantly lower bed-day usage (2.6–3.2 bed-days/patient/year for completers compared with 15–18.5 bed-days/patient/year for non-completers in the 12 months following pulmonary rehabilitation).
Conclusions: Inclusion of psychological input into pulmonary rehabilitation improves the quality of patient care and experience by facilitating completion of the programme. This study indicates

Abstract P48 Table

	December–February	March–November	p Value
Take-up rate %	62	68	0.07
Completion rate %	81	83	0.57
Mean (SD) ISW change	54 (66)	63 (82)	0.19
Mean (SD) CRQ-D change	0.47 (1.38)	0.64 (0.75)	0.17

CRQ-D, chronic respiratory disease dyspnoea domain; ISW, incremental shuttle walk distance.

that there are, in addition, clear cost-benefits in terms of hospital resource utilisation.

P48 DOES SEASONAL VARIATION INFLUENCE THE EFFICACY OF PULMONARY REHABILITATION?

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Introduction and Objectives: There are hypothetical reasons why pulmonary rehabilitation may be less effective in winter months. Poor weather may discourage patients from uptake of pulmonary rehabilitation and regular attendance of classes. The higher incidence of exacerbations and hospitalisations may reduce completion rates and response to pulmonary rehabilitation. The objective of this study was to assess the efficacy of pulmonary rehabilitation in the winter months (December to February) compared with the rest of the year by comparing uptake rates, completion rates, improvements in incremental shuttle walk distance (ISW) and changes in the chronic respiratory questionnaire dyspnoea score (CRQ-D).
Methods: All patients referred to the Lambeth and Southwark pulmonary rehabilitation team between the years 2004 and 2007 were included in the study. All appropriate patients were offered pulmonary rehabilitation at one of seven hospital or community programmes. Each programme consisted of two supervised sessions per week for 8 weeks. Take-up rate was defined as the percentage of appropriate patients who consented to and started a pulmonary rehabilitation programme. Completion rate was defined as the percentage of patients starting pulmonary rehabilitation who completed a minimum of eight sessions. Uptake and completion rates were compared between winter and other months using Fisher's exact test. Changes in ISW and CRQ-D pre and post-pulmonary rehabilitation were compared between winter patients and other patients using unpaired t tests.
Results: In total, 1222 patients were assessed and deemed appropriate for pulmonary rehabilitation, with 817 patients starting pulmonary rehabilitation and 675 patients completing. No statistically significant difference was found between take-up rates, completion rates, mean ISW improvement and CRQ-D change between winter months and the rest of the year (see table).
Conclusions: There is no evidence to suggest that pulmonary rehabilitation is less efficacious in the winter months.

P49 DOES DISEASE OR CHRONIC OBSTRUCTIVE PULMONARY DISEASE SEVERITY AFFECT OUTCOME OF PULMONARY REHABILITATION?

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Introduction: There is limited evidence for the relationship between the severity of chronic obstructive pulmonary disease (COPD) and benefit from pulmonary rehabilitation. ACCP/AACVPR guidelines (2007) report benefit for "any stable patient with COPD disabled by respiratory symptoms" and ATS/ERS guidelines (2006) suggest that rehabilitation is beneficial for MRC grades 3–5. COPD patients comprise the largest proportion of referrals for pulmonary rehabilitation but there is increasing evidence that pulmonary rehabilitation is beneficial for patients with other chronic lung diseases (ACCP/AACVPR guidelines 2007).
Aim: To evaluate the effectiveness of pulmonary rehabilitation on exercise tolerance by disease, both COPD and non-COPD, and by classification of COPD severity (NICE COPD guidelines, 2004).
Method: Pre and post-pulmonary rehabilitation endurance shuttle walk test (ESWT) data were analysed for all our patients completing pulmonary rehabilitation from October 2002 to March 2008. Data were analysed for within-group change and between group differences.
Results: See table. Three groups contained outliers with considerably higher than average improvements and therefore these patients were excluded from analysis.
Conclusion: Every group achieved a significant improvement in ESWT, with no difference in percentage change between groups, despite expected differences in actual distances walked. All groups had large variance with the greatest in the severe COPD group. These data confirm that all types of patient, both non-COPD and COPD of all severities, benefit equally from PR, but with wide variation in individual outcome.

P50 DOES SITE AFFECT OUTCOME OF PULMONARY REHABILITATION?

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Introduction: Previous published work from another UK centre demonstrated a significant difference in pulmonary rehabilitation outcome between three different sites, where client groups were the same and therapists differed. ATS/ERS guidelines (2006) suggest pulmonary rehabilitation is effective across various settings. Our service spans three sites; two acute and one community hospital, with different therapists at each site.

Abstract P49 Table ESWT pre and post-pulmonary rehabilitation

	Non-COPD	Mild COPD	Moderate COPD	Severe COPD
Outliers excluded	n = 0	n = 2	n = 1	n = 1
n = 281	n = 15	n = 78	n = 121	n = 66
Mean (SD) pre-PR ESWT (m)	542 (379)	514 (470)	405 (369)	352 (313)
Mean (SD) post-PR ESWT (m)	988 (610)	798 (505)	722 (541)	644 (832)
Mean change ESWT (m)	446 (522) p = 0.006*	284 (356) p = 0.000*	303 (469) p = 0.000*	291 (737) p = 0.000*
Mean (SD) % change ESWT	134 (173)	113 (126)	155 (219)	147 (273)
Median (range) % change ESWT	65§ (−58 to 488)	63§ (−51 to 667)	68§ (−100 to 1000)	50§ (−89 to 1300)

*Wilcoxon signed rank test. †No significant difference in percentage change between groups (Kruskal–Wallis, p = 0.738). COPD, chronic obstructive pulmonary disease; ESWT, endurance shuttle walk test; PR, pulmonary rehabilitation.

Abstract P50 Table ESWT pre and post-pulmonary rehabilitation by site with baseline FEV_1

n = 303	Site 1 n = 106	Site 2 n = 86	Site 3 n = 110
Mean % predicted FEV_1 (SD)	42 (18.53)*	44 (20.69)*	47 (17.8)*
Mean (SD) distance walked on ESWT pre-PR (m)	390 (369)†	333 (297)†	498 (430)†
Mean (SD) change ESWT (m)	322 (694)†	268 (378)†	322 (407)†
Mean (SD) % change ESWT	217 (383)‡	173 (449)‡	144(245)‡
Median (range) % change ESWT	99 (−81.37 to 2650)	51 (−89.47 to 3233)	72 (−73.68 to 1967)

Between site: *p = 0.034, p = 0.013, ‡p = 0.186; within site: †p = 0.000. ESWT, endurance shuttle walk test; PR, pulmonary rehabilitation.

Aim: To evaluate the effectiveness of pulmonary rehabilitation outcome in the endurance shuttle walk test (ESWT) across three different sites within the same service.
Method: Pre and post-pulmonary rehabilitation ESWT data were analysed for all patients completing pulmonary rehabilitation in October 2002–March 2008 both within and between sites.
Results: Complete data were available for n = 303; analysed with Wilcoxon signed-rank test for within and Kruskal–Wallis for between-site data.
Conclusion: A significant improvement in ESWT was demonstrated at each site. There was no significant difference in percentage change between sites, despite a significant difference in baseline spirometry and ESWT. This may be accounted for by differences in socioeconomics around the three sites. All sites had large variance in baseline levels and outcome post-pulmonary rehabilitation. This service is well supported by senior clinicians, with regular team meetings to ensure consistency between programmes, which may account for our findings.

P51 IMPROVING ACCESS TO PULMONARY REHABILITATION FOR CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS FROM A LOCAL BLACK AND MINORITY ETHNIC GROUP

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Backgound: Pulmonary rehabilitation (PR) is an integral part of the management of patients with chronic obstructive pulmonary disease (COPD). However, the provision of PR is limited and often catering for patients from black and minority ethnic (BME) groups can be difficult. Tower Hamlets is a culturally diverse area of east London, where 34% of the population is Bangladeshi. Service data showed that in 2006–7, only 5% of all PR referrals were for Bangladeshi men. In 2007 new measures were put in place to improve access to PR for Bangladeshi patients with COPD. An audit was carried out to establish whether more Bangladeshi men were able to attend PR, following the introduction of these new measures.
Method: The design of an existing PR programme in Tower Hamlets was adapted for the Bangladeshi male population. User involvement, via a focus group meeting, was important in informing change. Changes included creating single sex classes, held in a mosque, using bilingual rehabilitation support workers, omitting music during exercising, modifying education sessions and maintaining regular telephone contact with patients. Promotional work to publicise this service was also carried out in local GP surgeries. Data were collected before and after the new measures were introduced, for 2006–7 and 2007–8, respectively.
Results: The number of Bangladeshi men completing a PR programme increased by eight times following the introduction of changes to the PR service.
Conclusion: Adapting PR to suit a BME group better brought about improved equality in service provision to patients with COPD in Tower Hamlets. By making small changes to the PR programmes, many more male Bangladeshi patients with COPD were able to access PR. This suggests that a similar model would also be effective in enabling Bangladeshi women to participate in PR programmes.

Abstract P51 Table Comparison of PR service data for 2006–7 and 2007–8

	2006–7	2007–8
No of PR referrals for Bangladeshi men	14 (5.1%)	84 (12.8%)
No of Bangladeshi men assessed for PR	2	53
No of Bangladeshi men completed PR	2	16

PR, pulmonary rehabilitation.

P52 IS SUPERVISED COMMUNITY-BASED PULMONARY REHABILITATION EFFECTIVE IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE?

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Introduction and Objectives: The majority of pulmonary rehabilitation (PR) programmes in the UK occur in hospital-based outpatient settings. Potential advantages include cost-effectiveness, a safe clinical environment and availability of trained staff. However, limited space and exercise facilities may restrict the capacity of hospital-based PR programmes. Community-based PR programmes have the potential to increase capacity and improve accessibility for patients. Although there is a supportive evidence base for PR, the most recent meta-analysis identified only one study that was based in the community. The objective of the present study was to determine whether community-based PR leads to clinically significant improvements in exercise capacity and breathlessness, and how the magnitude of these improvements compare with PR in a hospital setting.
Methods: Chronic obstructive pulmonary disease (COPD) patients referred to the Lambeth and Southwark Pulmonary Rehabilitation Team between the years 2004 and 2007 were included in the study. All appropriate patients were offered the choice of PR at either King's College Hospital (hospital) or at one of six community programmes in Lambeth and Southwark (community). Those with a baseline MRC dyspnoea score of 5 were preferentially allocated to hospital and were therefore excluded from the current study. Primary outcomes were defined as changes in incremental shuttle walk distance (ISWD) and breathlessness (as measured by the

Abstract P52 Table

	Community	Hospital	p Value
Mean (SD) ISWD change	65 (81)	55 (71)	0.33
Mean (SD) CRQ-D change	0.71 (1.2)	0.43 (1.16)	0.002

CRQ-D, chronic respiratory disease dyspnoea domain; ISWD, incremental shuttle walk distance.

chronic respiratory disease dyspnoea domain; CRQ-D) pre and post-PR. Secondary outcomes were take-up rates (the percentage of appropriate patients who started a PR programme) and completion rates (the percentage of patients starting PR who completed a minimum of eight sessions).
Results: Take-up rates were similar between community and hospital (67% vs 62%, respectively), as were completion rates (83% vs 77%). In total, 630 patients completed PR (community n = 505; hospital n = 125). Both community and hospital PR led to improvements in ISWD and CRQ-D (see table).
Conclusions: Supervised community PR programmes result in clinically significant improvements in exercise capacity and breathlessness.

Cystic fibrosis: clinical aspects

P53 MECHANISMS OF GLUCOSE INTOLERANCE IN CYSTIC FIBROSIS

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Introduction: The pathogenesis of cystic fibrosis-related diabetes (CFRD), a poor prognostic factor in cystic fibrosis (CF), is poorly understood. To look at this further we studied the role of insulin secretion and resistance in adult CF patients and correlated glycaemic parameters with clinical status.
Methods: A standard 2-h oral glucose tolerance test was performed in 60 stable adult CF patients not known to have CFRD. Blood samples for plasma glucose and insulin were collected before and at 30, 60, 90 and 120 minutes after glucose ingestion. Insulin secretion and sensitivity were determined by homeostatic model assessment (HOMA 2), Stumvoll and oral glucose insulin sensitivity (OGIS) indices.
Results: 42 (70%) had a normal glucose tolerance (NGT), 10 (17%) impaired glucose tolerance (IGT) and eight (13%) diabetes mellitus (CFRD). Fasting plasma glucose and insulin levels were similar among the CF subgroups. Beta cell function (HOMA 2: CFRD 50% + 14 vs NGT 67% + 20; $p<0.05$) and first phase insulin secretion were reduced in CFRD (250 + 116 vs NGT 509 + 292; $p = 0.004$). First phase insulin secretion was inversely correlated with 1 and 2-h glucose levels ($r = -0.74$, $p<0.001$ and $r = -0.34$, $p<0.05$, respectively). The time to reach peak insulin was delayed in both IGT and CFRD (99 and 101 minutes; both $p<0.01$ vs NGT 75). There was no difference in insulin sensitivity among the three groups (HOMA 2: NGT 280 + 130, IGT 250 + 107, CFRD 339 + 160; $p = 0.42$; Stumvoll: NGT 0.128 + 0.017, IGT 0.126 + 0.016, CFRD 0.129 + 0.012; $p = 0.76$; OGIS: NGT 515 + 68, IGT 472 + 62, CFRD 472 + 52; $p = 0.12$). Although there was no difference in body mass index, there was a trend towards poorer lung function (FEV_1: CFRD 54 + 13% vs NGT 65 + 24%; $p = 0.43$) and increased hospital admissions in the diabetic group (CFRD 3 vs NGT 1 per patient per year; $p<0.05$).
Conclusion: Glucose intolerance in CF is characterised by qualitative and quantitative defects in insulin secretion and not insulin resistance and is associated with increased hospital admissions for pulmonary exacerbations.

P54 HOW COST EFFECTIVE IS REGULAR ORAL GLUCOSE TOLERANCE TEST IN ADULT PATIENTS WITH CYSTIC FIBROSIS?

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Introduction: As patients with cystic fibrosis (CF) have increased survival, the prevalence of cystic fibrosis-related diabetes (CFRD) has risen. The onset of CFRD is associated with reduced survival and therefore early diagnosis is paramount. Current UK CF trust guidelines recommend annual oral glucose tolerance tests (OGTT) in all adult CF patients. However, the outcome follows World Health Organisation (WHO) criteria, which may not be appropriate, as CFRD is a different disease entity from insulin-dependent and non-insulin-dependent diabetes mellitus.

At Royal Brompton Hospital, a selective approach to OGTT for adult CF patients has been used following work by Yungin 1999. The decision for OGTT is based on one or more of the following: random blood glucose ⩾11.1 mmol/l; glycosylated haemoglobin ⩾6.1%; clinical symptoms (polydipsia, polyuria, nocturia, unexplained weight loss >5%, unexplained pulmonary decline >10%). The cost of an OGTT is £25, but this does not include nursing time, a bed, or the patient's time and the need to be starved and have two blood tests.
Aim: To review the results of OGTT and determine a cost benefit.
Methods: All patients who had an OGTT from 2003 until 2007, inclusive, were identified. Fasting and 2-h blood glucose results were used to determine outcome, as per WHO criteria.
Results: A total of 207 OGTT was performed. Four were incomplete and three were done elsewhere. From the 200 OGTT available, 63 (31.5%) had a diabetic profile, 42 (21%) had an impaired profile and 95 (47.5%) had a normal profile. Of these 200, six had three OGTT and 30 had two OGTT. Of those with repeat OGTT, 55.6% showed no change, 27.8% showed deterioration to either impaired or diabetic profile and 16.6% showed an improvement to either normal or impaired diabetic profile.
Conclusion: Despite this approach, the development of CFRD remains unpredictable and further work is needed to improve the sensitivity of diagnostic tests. By using a selective process for OGTT, the cost of this test was £5000 over 5 years. If annual OGTT were to be performed on all our patients, the cost would be approximately £75 000 over 5 years.

P55 REPEAT MEASUREMENTS OF BREATH GLUCOSE AND BREATH TO BLOOD GLUCOSE RATIO IN ADULT PATIENTS WITH CYSTIC FIBROSIS

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Introduction: Glucose concentrations in normal human lung secretions are ~12.5 times lower than blood glucose concentrations (Baker *et al*, *J Appl Physiol* 2007;**102**:1969–75). In adult patients with cystic fibrosis (CF), lung luminal glucose concentrations are elevated 4–8 times, with lung glucose concentrations being 2–4 times lower than blood. Elevated glucose concentrations in lung secretions could therefore be a marker for or contribute to the pathogenesis of CF lung disease. We therefore determined the effect of repeated measurement on lung glucose concentrations.
Methods: Adult CF outpatients (>18 years) with stable disease, defined as >6 weeks without pulmonary exacerbations, extra/change in antibiotics or steroids and without glucose intolerance or diabetes were recruited. All participants gave written informed consent and the study was approved by Wandsworth Research Ethics Committee. Participants were nil by mouth for 2 h, then underwent capillary blood glucose measurement and 10-minute exhaled breath condensate collection three times over the next 60 minutes. Condensate samples were lyophilised, resuspended and glucose concentration measured by high performance anion exchange chromatography. Dilution correction was performed using total cation concentration calculated from sample conductivity to obtain breath glucose, an estimate of glucose concentration of lung secretions.
Results: Three repeat samples were available for 17 patients (eight female, mean age 29 years (range 20–46)). Breath glucose was: