Supplementary material

Extended Methods

Home-based pulmonary rehabilitation

Those in the home-based group attended one introductory session at the hospital. During this session participants were introduced to the SPACE for COPD program by a trainee health psychologist or physiotherapist with clinical experience in COPD and PR and competency in motivational interviewing (LA, KM, VJ-W). This individualized induction to the programme lasted approximately 1 hour and incorporated a discussion regarding the participant's readiness to start the programme and explored immediate education needs. Participants were informed that the aim of the programme was to increase their health and fitness and to improve their ability to manage their condition. Self-efficacy was supported by goal setting and problem solving encouraged. During this session a discussion also took place on suitable walking routs from their home.

The SPACE for COPD Manual

The manual is divided into four stages and participants were advised how to progress through the various educational topics (detailed below), with goal-setting text, case studies for peer modelling, and activities to encourage problem solving and support behaviour change. Throughout the stages there are also 'Top Tip' boxes to summaries key messages. Other useful sections in the manual are also highlighted where cross reference may be useful. The manual appendix contains information

that was not considered necessarily relevant to all participants; for example, information on smoking cessation and oxygen therapy.

The exercise programme progresses as they moved through the stages of the manual, and incorporates a modest resistance-training program in stage 3. The home exercise programme advised bouts of exercise most days of the week and the strength-training program three times a week. Individualised exercise prescription is described below. Participants were advised to keep a record of their progress in a walking diary within the manual.

Content of the SPACE for COPD manual

Stage 1
What's happened to your lungs?
How to get fitter
Setting your goals
Managing your stress
Your emotions
Controlling your breathing
Your medication
Stage 2
How to stay fit
Avoiding and managing days when you feel unwell
Saving your energy
The right foods when you feel unwell
Clearing your chest
Stage 3
How to get stronger
Managing your stress
Healthy eating
Travelling and your lung disease
Stage 4
Your hobbies and staying fit
Your relationships
Dealing with setbacks
Sex and your lungs
Breathe easy
Appendix
Setting your walking speed
Help for carers
Advice about oxygen
Smoking: advice on giving up
Information about your medication
Action Plan

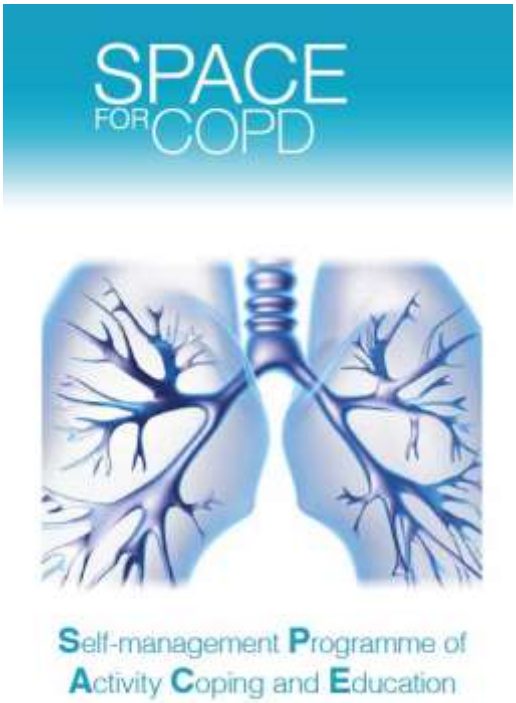

Figure S1. Front cover of the SPACE FOR COPD manual

Each stage of the manual includes tasks to complete, such as exercise diaries, goal setting and problem solving to enhance engagement in the programme.

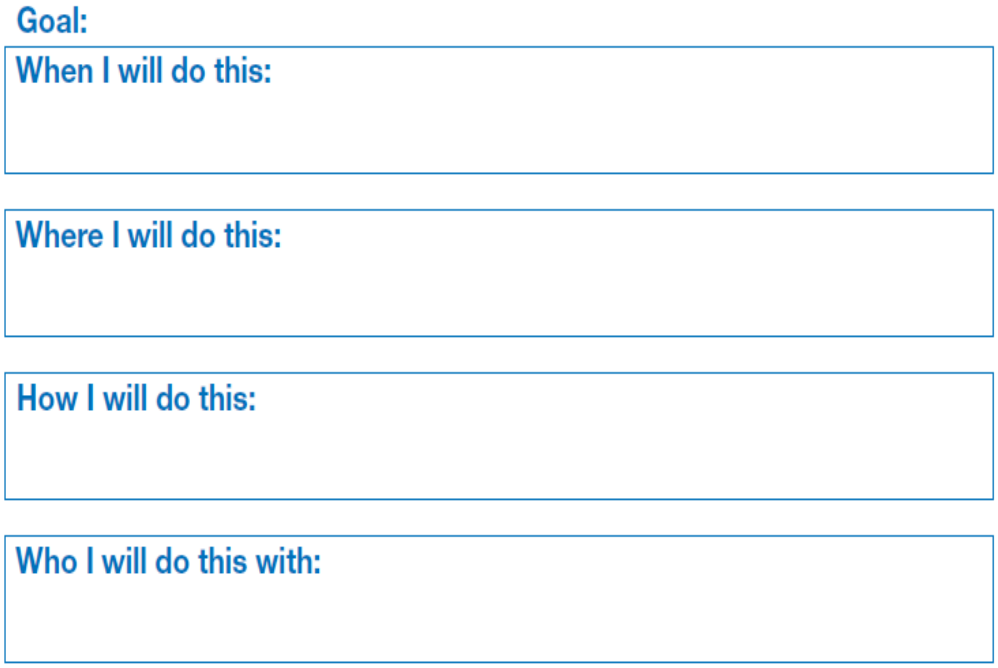

Figure S2 Example goal setting task in the SPACE for COPD manual

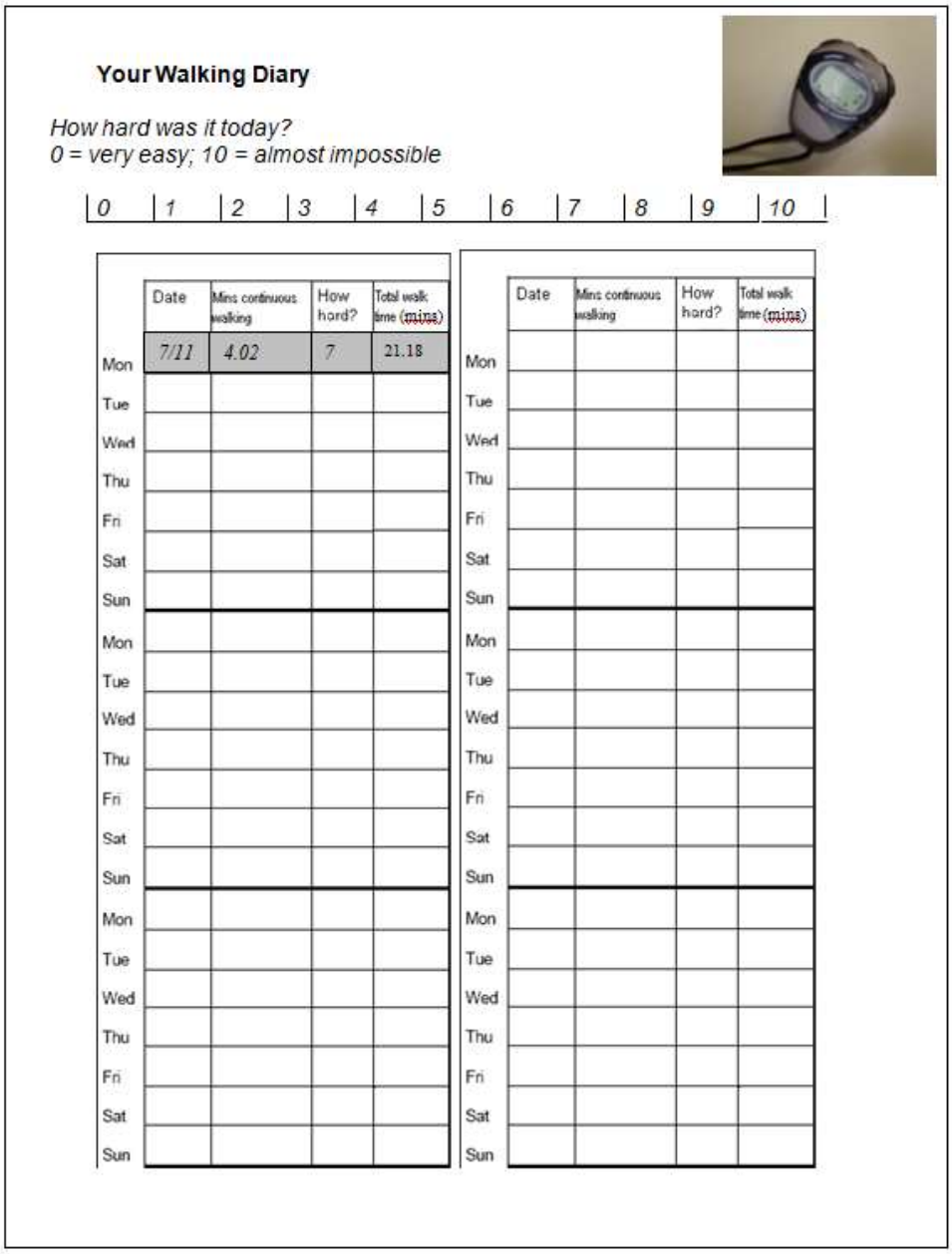

Figure S3 The SPACE for COPD walking diary

Telephone calls

Each patient was further supported by two motivational telephone calls made and documented by the same individual delivering the intervention (LA, KM and VJ-W) at weeks 2 and 4. The calls involved asking how the participant was progressing with their exercise, in regards to frequency and duration of walks. Encouragement was

given for participants to continue with their programme. Further discussion was allowed depending on the participant's needs. The telephone calls were of approximately 10 minutes duration and aimed to support the participant through their exercise program and their self-efficacy in self-managing their COPD. Participants also had a contact telephone number for the research team and were able to ring the team if necessary.

Centre-based pulmonary rehabilitation

Participants allocated to this group were enrolled into the conventional centre-based pulmonary rehabilitation (PR) programme. This programme consisted of 14, twice weekly, two hour sessions involving exercise and education. During the first session participants were introduced to the structure of PR and given a walking diary to record their daily walks. Each session the diary was reviewed by the PR team and targets discussed. During the first hour the participants completed a group warm up and then their individually prescribed exercise. During one of the supervised sessions per week participants completed some resistance exercise.

During the second hour, participants completed an education session with an appropriate member of the healthcare team. Topics covered were those matched in the SPACE for COPD manual such as 'What's happening in your lungs?', 'how to get fitter' and 'eating the right foods when feeling unwell'.

Exercise Prescription – both home and centre-based interventions

Aerobic training

Regardless of which intervention participants were assigned to, the walking programmes were prescribed in the same way. Each participant was advised that the aim of PR was for them to work towards achieving a daily 30 minute walk. Participants had an individually prescribed walking programme. Walking speed was prescribed at 85% of predicted VO_2 peak from the ISWT. The initial walking duration was informed by the length of time the participants completed the endurance shuttle walk test. Patients were provided with a daily walking diary to record walking times and Borg breathlessness scores. Instructions were given about walking at the correct speed (intensity) and guidance given about increasing walking time. For those in the centre-based group walking speeds and times are checked weekly and time targets set for the following week. All participants were advised to purchase a stopwatch to monitor their home walking.

For those only able to complete a few minutes of walking at a time, they were guided to complete several prescribed walks per day. All walks were recorded in a walking diary. Participants were demonstrated the required walking speed and given tips on remembering how to keep to the speed required in their first session (introductory hospital based session for the home-based group).

Resistance training

Resistance exercise was completed once per week within the supervised centre-based sessions and patients were also encouraged to complete their programme twice at home (a conversion table was given to them as to how much liquid is needed in a milk bottle for their prescribed weight; i.e. 2 pints = 1.2kg). Those in the home-based group were prescribed a suitable resistance programme during the introductory session and advised to complete it three times per week. The programme consists of upper and lower body resistance training of the major muscle groups. Resistance exercises included biceps curls, sit-to-stands, pull ups and step-ups. Each patient's resistance was individually prescribed and they were encouraged to complete three sets of eight repetitions. Participants recorded their progress over the seven weeks as well as their Borg breathlessness scores. Advice was given to increase the resistance once their Borg scores became easier (lower).

Results

There was no evidence of substantive differences in baseline characteristics of those that did or did not complete the seven week assessments (table S1).

Table S1 Baseline Characteristics of completers and non-completers of the seven week assessment.

	Completers n=178 *(unless otherwise stated)*	***Non completers n=110*** *(unless otherwise stated)*	***p value***
Age years	67 (9)	68 (8)	0.73
Male:Female, n (%)	118:60 (66:34)	70:40 (64:36)	0.65
BMI m/kg^2	27 (6)	28 (6)	0.26
FEV_1 litres	1.25 (0.56)	1.28 (0.54), 92	0.66
FEV_1 per cent predicted	48.02 (18.79), 169	48.92 (16.28), 92	0.69
FVC litres	2.72 (0.91), 169	2.67 (0.80), 92	0.66
MRC n (%)			0.35
2	33 (18)	16 (15)	
3	71 (40)	38 (34)	
4	51 (29)	35 (32)	
5	23 (13)	21 (19)	
Per cent SpO_2 rest	94.31 (2.80)	94.10 (3.48)	0.62
Smoking status, n (%)			0.33
Current smoker			
Never smoked	42 (23)	28 (26)	
Ex smoker	12 (7)	3 (3)	
	124 (70)	78 (71	
Pack years, n (%)	46 (33), 175	47 (31), 96	0.77
CRQ-SR, n			
Dyspnoea	2.49 (0.87), 175	2.53 (1.01), 91	0.78
Fatigue	3.49 (1.12), 175	3.19 (1.30), 91	0.06
Emotion	4.47 (1.21), 175	4.25 (1.27), 91	0.19
Mastery	4.49 (1.34), 175	4.37 (1.39), 91	0.53

HADS n (%)			
Anxiety			0.70
0-7	91 (53)	48 (51)	
8-10	47 (27)	25 (27)	
11-14	26 (15)	14 (15)	
15-21	8 (5)	7 (7)	
Depression			0.33
0-7	126 (73)	61 (65)	
8-10	26 (15)	20 (21)	
11-14	17 (10)	10 (11)	
15-21	3 (2)	3 (3)	
PRAISE, n	44.70 (7.16), 164	43.90 (8.03), 88	0.41
ISWT m	262 (148), 178	240 (151), 106	0.21
ESWT sec	210 (177), 178	196 (137), 105	0.51

Data are presented as mean (± SD) or number (%). BMI: body mass index; FEV_1: forced expiratory volume in 1 s; FVC: forced vital capacity; MRC: Medical Research Council; SpO_2: oxygen saturation; CRQ-SR: Chronic Respiratory Questionnaire – Self Report; HADS: Hospital Anxiety and Depression Scale; PRAISE: Pulmonary Rehabilitation Adapted Index of Self-Efficacy; ISWT: Incremental Shuttle Walk Test; ESWT: Endurance Shuttle Walk Test.

We undertook analysis to determine the likely effect of missing data using multiple imputation models at seven weeks and six months. Data suggests that regardless of there being no between group difference it is inconclusive as to the non-inferiority of

the home-based trial regarding CRQ-SR dyspnoea. This data supports the findings of the complete case analysis.

Table S2. Between group difference in primary and secondary outcomes at 7 weeks post-randomisation follow up – imputed analysis

	Between group difference (home-centre)* Mean difference (95% CI) P-value	**Inference regarding non-inferiority**
CRQ-SR dyspnoea		
mITT	-0.23 (-0.67 to 0.20) 0.28	Inconclusive
PP	-0.35 (-0.78 to 0.07) 0.10	Inconclusive
CRQ-SR fatigue		
mITT	-0.34 (-0.83 to 0.15) 0.16	Inconclusive
PP	-0.37 (-0.75 to 0.01) 0.06	Inconclusive
CRQ-SR emotion		
mITT	-0.39 (-0.82 to 0.03) 0.07	Inconclusive
PP	-0.48 (-0.82 to -0.14) 0.006	Inconclusive
CRQ-SR mastery		
mITT	-0.27 (-0.72 to 0.18) 0.23	Inconclusive
PP	-0.33 (-0.68 to 0.01) 0.06	Inconclusive
HADS anxiety		
mITT	0.45 (-0.71 to 1.61) 0.44	Inconclusive
PP	0.59 (-0.41 to 1.60) 0.25	Inconclusive
HADS depression		
mITT	0.88 (-0.30 to 2.06) 0.14	Inconclusive

PP	1.00 (0.10 to 1.91) 0.03	Inconclusive
Praise		
mITT	-2.58 (-4.87 to -0.30) 0.03	No non-inferiority margin
PP	-2.44 (-4.90 to 0.02) 0.05	No non-inferiority margin
ISWT distance (m)		
m ITT	-29.96 (-82.34 to 22.42) 0.25	Inconclusive
PP	-13.69 (-41.93 to 14.55) 0.34	Non-inferiority
ESWT time (sec)		
mITT	-135.12 (-276.42 to 6.17) 0.06-	Inconclusive
PP	128.51 (-268.82 to 11.79) 0.07	Inconclusive

ITT: intention to treat – all patients according to random allocation with outcome data; PP: Per protocol – patients according to random allocation with outcome data and attending final outcome assessment; N: number patients; CRQ-SR: Chronic Respiratory Questionnaire Self Report; HADS: Hospital Anxiety and Depression Scale; ISWT: Incremental shuttle walk test; ESWT: Endurance Shuttle Walk Test

*Adjusted for baseline score

Table S3. Between group difference in primary and secondary outcomes at 6 months post-randomisation follow up – imputed analysis

	Between group difference (home-centre)* Mean difference (95% CI) P-value	**Inference regarding non-inferiority**
CRQ-SR dyspnoea		
mITT	-0.34 (-0.73 to 0.06) 0.09	Inconclusive
PP	-0.39 (-0.79 to 0.002) 0.05	Inconclusive

CRQ-SR fatigue		
mITT	-0.10 (-0.48 to 0.29) 0.62	Non-inferior
PP	-0.16 (-0.58 to 0.26) 0.45	Inconclusive
CRQ-SR emotion		
mITT	-0.17 (-0.59 to 0.26) 0.43	Inconclusive
PP	-0.31 (-0.67 to 0.06) 0.10	Inconclusive
CRQ-SR mastery		
mITT	-0.16 (0.68 to 0.36) 0.53	Inconclusive
PP	-0.30 (-0.74 to 0.13) 0.17	Inconclusive
HADS anxiety		
mITT	-0.30 (-1.91 to 1.31) 0.70	Inconclusive
PP	0.08 (-1.07 to 1.23) 0.89	Non-inferior
HADS depression		
m ITT	-0.83 (-1.17 to 1.00) 0.88	Non-inferior
PP	0.07 (-0.99 to 1.13) 0.89	Non-inferior
PRAISE		
mITT	-1.10 (-4.34 to 2.14) 0.49	No non-inferiority margin
PP	-1.06 (-3.97 to 1.19) 0.47	No non-inferiority margin
ISWT distance, metres		
mITT	-18.58 (-108.15 to 70.99) 0.66	Inconclusive
PP	-19.38 (61.3 to 22.5) 0.36	Inconclusive
ESWT time, seconds		
mITT	-67.83 (-207.72 to 72.06) 0.34	Inconclusive

PP	-69.58 (-212.25 to 73.09)	0.34	Inconclusive

mITT: intention to treat – all patients according to random allocation with outcome data; PP: Per protocol – patients according to random allocation with outcome data and attending final outcome assessment; N: number patients; CRQ-SR: Chronic Respiratory Questionnaire Self Report; HADS: Hospital Anxiety and Depression Scale; ISWT: Incremental shuttle walk test; ESWT: Endurance Shuttle Walk Test

*Adjusted for baseline score

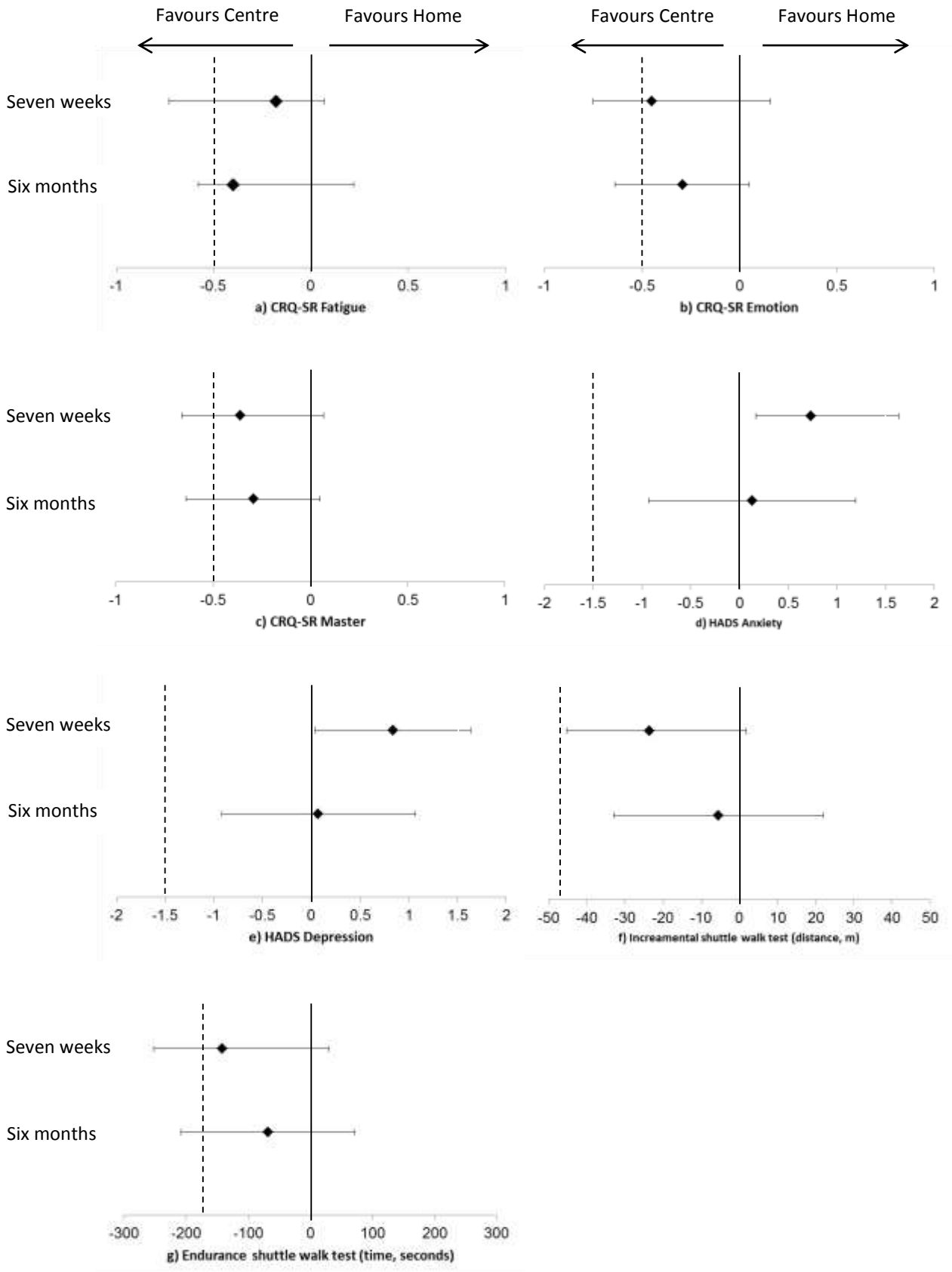

Figure S4 Between group change (home-centre) in a) Chronic Respiratory Questionnaire self-report (CRQ-SR) fatigue; b) CRQ-RS emotion; c) CRQ-SR mastery; d) Hospital Anxiety And Depression Scale (HADS) anxiety; e) HADS depression; f)

Incremental shuttle walk test; g) Endurance shuttle walk test. Data are mean and 95% CI. The area between the dotted lines represents the non-inferiority margin.

Table S4 Mean (SD) Baseline, seven week and six month data and change in scores from baseline to six months for centre-based and home-based groups

Outcome		*Home-Based mean (SD; n=75)*	*Centre-based mean (SD; n=70)*	Between-group difference mean (95%CI)
	Baseline	2.58 (0.93)	2.42 (0.91)	0.16 (-0.05 to 0.41)
CRQ-S Dyspnoea score	7 weeks	3.11 (1.23)	3.38 (1.18)	-0.27 (-0.62 to 0.15)
	6 months	2.80 (1.13)	3.08 (1.25)	-0.28 (-0.69 to 0.13)
	Change	0.22 (1.24)	0.66 (1.20)	-0.44 (-0.87 to -0.03)
	Baseline	3.42 (1.19)	3.36 (1.20)	0.06 (-0.24 to 0.35)
CRQ-SR fatigue score	7 weeks	3.71 (1.22)	4.09 (1.49)	-0.38 (-0.83 to 0.01)
	6 months	3.44 (1.40)	3.47 (1.31)	-0.03 (-0.53 to 0.39)
	Change	**0.02 (1.28)**	**0.11 (1.27)**	**-0.09 (-0.68 to 0.19)**

	Baseline	4.41 (1.24)	4.37 (1.24)	0.04 (-0.30 to 0.32)
CRQ-SR emotion score	7 weeks	4.56 (1.20)	4.92 (1.03)	-0.36 (-0.71 to -0.01)
	6 months	4.28 (1.32)	4.51 (1.23)	-0.23 (-0.59 to 0.28)
	Change	**-0.13 (0.23)**	**0.14 (1.02)**	**-0.27 (-0.71 to 0.15)**
	Baseline	4.50 (1.31)	4.36 (1.30)	0.14 (-0.22 to 0.46)
	7 weeks	4.78 (1.31)	4.94 (1.19)	-0.16 (-0.58 to 0.20)
CRQ-SR mastery score	6 months	4.54 (1.33)	4.61 (1.27)	-0.07 (-0.55 to 0.44)
	Change	**0.04 (1.34)**	**0.25 (1.18)**	**-0.21 (-0.86 to 0.03)**
	Baseline	7.39 (4.00)	7.91 (3.97)	-0.52 (-1.40 to 0.54)
HADS Anxiety	7 weeks	7.14 (4.07)	6.80 (3.64)	0.34 (-0.79 to 1.60)
	6 months	7.31 (4.31)	7.96 (4.13)	-0.65 (-2.06 to 0.76)
	Change	**-0.08 (3.31)**	**0.05 (3.18)**	**-0.13 (-0.77 to 1.43)**
	Baseline	6.11 (3.59)	6.67 (3.32)	-0.56 (-1.36 to 0.31)

HADS Depression	7 weeks	5.96 (3.57)	5.55 (3.13)	0.41 (-0.46 to 1.63)
	6 months	6.26 (3.64)	6.52 (3.58)	-0.26 (-1.45 to 0.94)
	Change	**0.15 (3.12)**	**-0.15 (3.06)**	**0.30 (-0.79 to 1.31)**
PRAISE	Baseline	44.83 (7.44)	44.81 (7.00)	0.02 (-1.77 to 1.95)
	7 weeks	44.69 (8.66)	47.24 (8.09)	-2.55 (-4.86 to 0.13)
	6 months	43.21 (8.79)	44.11 (9.06)	-0.9 (-3.86 to 2.05)
	Change	**-1.62 (8.14)**	**-0.7 (9.73)**	**-0.92 (-4.35 to 1.82)**
ISWT, metres	Baseline	260.24 (147.91)	268.61 (149.89)	-8.37 (-37.99 to 32.03)
	7 weeks	277.86 (145.59)	310.13 (156.46)	-32.27 (-74.45 to 17.75)
	6 months	248.14 (151.86)	270.00 (150.94)	-21.86 (-183.90 to 111.04)
	Change	**-12.1 (70.30)**	**1.39 (86.47)**	**-16.49 (-31.26 to 24.96)**
ESWT, seconds	Baseline	231.42 (231.00)	189.14 (96.25)	42.28 (-26.26 to 50.36)
	7 weeks	444.33 (393.09)	534.85	-90.52

			(395.38)	(-226.20 to 18.34)
	6 months	408.27 (420.09)	444.70	-36.43
			(414.89)	(-183.90 to 111.19)
	Change	**176.85 (400.91)**	**255.56**	**-78.71**
			(386.88)	**(-214.83 to 63.27)**

N: number patients; CRQ-SR: Chronic Respiratory Questionnaire Self Report; HADS: Hospital Anxiety and Depression Scale; ISWT: Incremental shuttle walk test; ESWT: Endurance Shuttle Walk Test

Table S5 Adverse Events

	Home n=14	Centre n=9
Died	2	1
Hospital admission due to COPD exacerbation	8	3
Hospital admission due to non-respiratory reason	4	2
Became unwell during Centre rehabilitation (no hospital admission)		2
Admitted to hospital, reason unknown		1

COPD: chronic obstructive pulmonary disease