Home-based rehabilitation for chronic obstructive pulmonary disease using minimal resources: a randomised, controlled equivalence trial.

Extended methods

Home-based pulmonary rehabilitation program

The first session was a home visit from an experienced respiratory physiotherapist. During this visit the physiotherapist worked with the participant to establish exercise goals, write a formal exercise prescription, provide education in use of a home diary and assess inhaler technique. The physiotherapist also supervised the first exercise session,

Participants were informed at the start of the program that the aim of the exercise program was to improve their strength and fitness. The overall goal was for participants to achieve at least thirty minutes of aerobic training on most days of the week, using a modality accessible to the participant, which was usually walking. The initial walking speed was set at 80% of the speed walked during the 6-minute walk test that had been performed during the baseline assessment, expressed as a distance to be walked during a given time. Participants recorded the distance walked using a pedometer (Omron Walking Style Pro). During this initial visit the physiotherapist accompanied the participant on their initial walk (weather permitting for those who had chosen to walk outside the home). This allowed planning of an appropriate route around the local neighbourhood consistent with the patient's abilities (eg ability to walk up hills) and education in the use of the pedometer.

Resistance training included functional activities and equipment that is readily available in the home environment, including sit to stand from a dining chair, step ups on an internal or external step, and water bottles or bags of rice for upper limb weights. At the home visit the physiotherapist worked with the participant to choose up to four exercises suitable for them

from those listed in the Better Living with COPD guide,[1] taking into consideration their comorbidities and home environment. Both upper and lower limb exercises were included, unless precluded by orthopaedic problems.

The physiotherapist worked with the participant to establish their exercise goals for the first week of the program, and to complete their diary for the first time. Participants were encouraged to set goals for both endurance exercise (duration and frequency of walking) and resistance exercise (frequency, number of repetitions and sets). In the home diary the participants would record when, where and how often they would do their exercise; what might get in the way of their plans this week; and what they could do to overcome any perceived barriers. Participants also rated their confidence in achieving their exercise goals on a Likert scale. All participants were encouraged to documented their unsupervised exercise sessions in their diary, including duration and distance walked, and the number and type of resistance exercises performed. The participant could then discuss these with the physiotherapist during subsequent weekly telephone calls. The diary included a telephone number by which the participant could contact the physiotherapist between sessions if required, to answer questions related to the program. Such telephone calls occurred infrequently and mostly related to queries about the pedometer.

During the initial home visit the physiotherapist also assessed safety of the home environment; whether the participant would benefit from a gait aid to assist with walking; whether any other referrals were needed (eg orthopaedic physiotherapy for those with significant pain interfering with training); and assessed inhaler technique as this could not be done over the telephone

The home visit was followed by seven once-weekly structured telephone calls from a physiotherapist, using a motivational interviewing approach.[2] During the telephone calls

the participants discussed their exercise program and exercise goals, and had the option to discuss other health goals.

A typical telephone call began with a brief discussion of what had happened during the exercise program over the past week. Consistent with the principles of motivational interviewing, the physiotherapist might then ask the participant why they might want to increase their exercise program (desire); how they might do this if they decided to (ability); what would be the most important benefits to them from doing more exercise (reasons); and how important it is for them to do more exercise at this time (need). The physiotherapist would then encourage the participant to move towards commitment and action, with specific goal setting for the following week. During each telephone call the participants documented their goals in their diaries in the same manner as they had done during the initial home visit.

The discussion then moved on to other health goals. In their diaries, participants were provided with a menu of topics relevant to COPD self-care and encouraged to select a topic they felt was of relevance to them for discussion with the physiotherapist each week, providing opportunity for self-management education and goal setting. Management of acute exacerbations and ongoing participation in exercise were discussed at least once during the program with all participants. The process of discussion and goal setting was similar to that used for the exercise goals, and documented in the diary in a similar fashion. The Better Living with COPD patient guide[1] was used to provide supporting educational material for these discussions.

Physical activity measurement:

Objective physical activity assessment was undertaken using the SenseWear armband (SWA; BodyMedia, Pittsburgh, USA; professional software version 7·0) in a subgroup of consecutive participants when additional funding became available. Measures were taken prior to commencement of pulmonary rehabilitation, immediately following completion of pulmonary rehabilitation and 12 months later.

The SWA was positioned on the participant's left upper arm according to manufacturer instructions. Participants were instructed to wear the SWA for one week from day of assessment, only removing it for bathing or water-based activities.

The first and last days of data were excluded from analysis upon data retrieval. A day of data (midnight to 23:59) was included for analysis if there were at least 10 hours of data within the 24 hour period. A minimum of four valid days of data were required per participant at each assessment time point, inclusive of at least one weekend day.

The proprietary algorithm provides a range of variables for each minute of wear time, including energy expenditure and number of steps. The intensity of physical activity is described according to metabolic equivalents (1 MET = 1 kcal/kg/hour). Each minute of wear time was allocated to a category of physical activity on the basis of MET classification (sedentary $\leq$ 1.5 METs[3] moderate and vigorous $\geq$ 3 METs[4]).

Bouts of time spent sedentary and in moderate and vigorous physical activity (MVPA) between 7:00 and 19:00 were also determined from the program output. A bout was defined as a minimum of 10 continuous minutes of time spent in the specified level of physical activity.[4]

Calculation of program costs

Data for resource usage and unit costs were collected prospectively and included staffing, transport, equipment, materials and consumables. All equipment was priced at the time of commencement of the study (2012). Pay rates for staff were calculated using the *Victorian Public Health Sector (Health Professionals, Health and Allied Services, Mangers and Administrative Officers) Multiple Enterprise Agreement 2011-2015* salary and on-costs. Costs related to the provision of the home based intervention included training of physiotherapists to provide the weekly phone calls and payment to the physiotherapist who provided the initial session during a home visit (inclusive of salary, running costs and logistics). Where additional time was required outside of the telephone calls (eg referrals to other health professionals) this was included in the costing. Direct observation was used to apportion staff time to individual participants in centre-based rehabilitation classes, where two or more health professionals supervised a group of 12 – 18 participants at a time. The costs for provision of educational lectures to the centre-based group were included, at one hour per lecture at the rate appropriate to their discipline. An allowance of 22% of direct costs for the overheads and facility usage was determined by hospital policy (where total cost = 82% direct costs + 18% indirect costs). Costs were calculated in Australian dollars and converted to United Kingdom pounds for the purposes of comparison using the exchange rate at 1st January 2015.

Results

The proportion of participants with anxiety and depression at each time point is in Figures S1 and S2. There were no significant differences between groups at any time point.

The per protocol analysis for exercise capacity, symptoms and quality of life variables is in Table S1.

Those participants who completed the pulmonary rehabilitation program, regardless of group, had a longer time to first hospitalization than those who were not able to complete the rehabilitation program (Figure S3).

References

1. Better Living with Chronic Obstructive Pulmonary Disease – A Patient Guide: The State of Queensland (Queensland Health) and Australian Lung Foundation; 2008. http://www.lungfoundation.com.au/lung-information/patient-educational-material/better-living-with-copd-a-patient-guide. Accessed 22/11/2012.
2. Rollnick S, Miller WR, Butler CC. *Motivational Interviewing in Health Care. Helping Patients Change Behavior*. New York: Guildford Press, 2008.
3. Sedentary Behaviour Research Network. Letter to the editor: standardized use of the terms 'sedentary' and 'sedentary behaviours'. *Appl Physiol Nutr Metab* 2012;**37:**540–2
4. Haskell WL, Lee IM, Pate RR et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc* 2007; **39**:1423–34

Table S1. Per Protocol analysis for clinical outcomes

	Within group differences from baseline (95 % CI)				Between group differences	
	Home (n=73)		Centre (n=42)		Home – Centre (95% CI)	
	End rehabilitation	1 year	End rehabilitation	1 year	End rehabilitation	1 year
6MWD, meters	28·32	-7·90	29·30	21·01	-0·98	-28·92
	(14·21 to 42·44)	(-23·31 to 7·50)	(11·07 to 47·54)	(1·22 to 40·81)	(-24·06 to 22·11)	(-54·00 to -3·83)†
CRQ dyspnoea	4·34	1·92	3·40	2·45	0·95	-0·53
	(2·97 to 5·72)	(0·45 to 3·40)	(1·61 to 5·19)	(0·47 to 4·43)	(-1·32 to 3·21)*	(-3·00 to 1·94)†
CRQ fatigue	1·86	0·58	1·78	1·68	0·08	-1·10
	(0·83 to 2·89)	(-0·51 to 1·68)	(0·43 to 3·12)	(0·21 to 3·15)	(-1·62 to 1·78)	(-2·93 to 0·74)†
CRQ emotional	2·86	2·88	3·83	3·41	-0·97	-0·53
	(1·25 to 4·47)	(1·19 to 4·58)	(1·74 to 5·91)	(1·14 to 5·67)	(-3·60 to 1·67)†	(-3·35 to 2·30)
CRQ mastery	2·43	2·04	2·97	3·26	-0·54	-1·23
	(1·43 to 3·42)	(0·97 to 3·11)	(1·68 to 4·26)	(1·83 to 4·70)	(-2·17 to 1·09)†	(-3·02 to 0·57)†

PRAISE	1·21	1·70	1·70	4·04	-0·49	-2·34
	(-0·56 to 2·98)	(-0·25 to 3·65)	(-0·63 to 3·03)	(1·43 to 6·65)	(-3·43 to 2·46)	(-5·61 to 0·94)
MMRC	-0·08	0·27	-0·13	0·45	0·05	-0·19
	(-0·32 to 0·16)	(0·02 to 0·52)	(-0·44 to 0·19)	(0·11 to 0·80)	(-0·35 to 0·44)	(-0·61 to 0·24)

Data are mean and 95 % confidence intervals (CI) adjusted for baseline values. 6MWD – 6-minute walk distance; CRQ – Chronic Respiratory Questionnaire; PRAISE – Pulmonary Rehabilitation Adapted Index of Self Efficacy; MMRC – modified Medical Research Council scale. No significant difference between groups for any outcome. * Confidence interval exceeds the upper equivalence limit of the minimal important difference and cannot exclude superiority; † confidence interval exceeds the lower equivalence limit and cannot exclude inferiority.

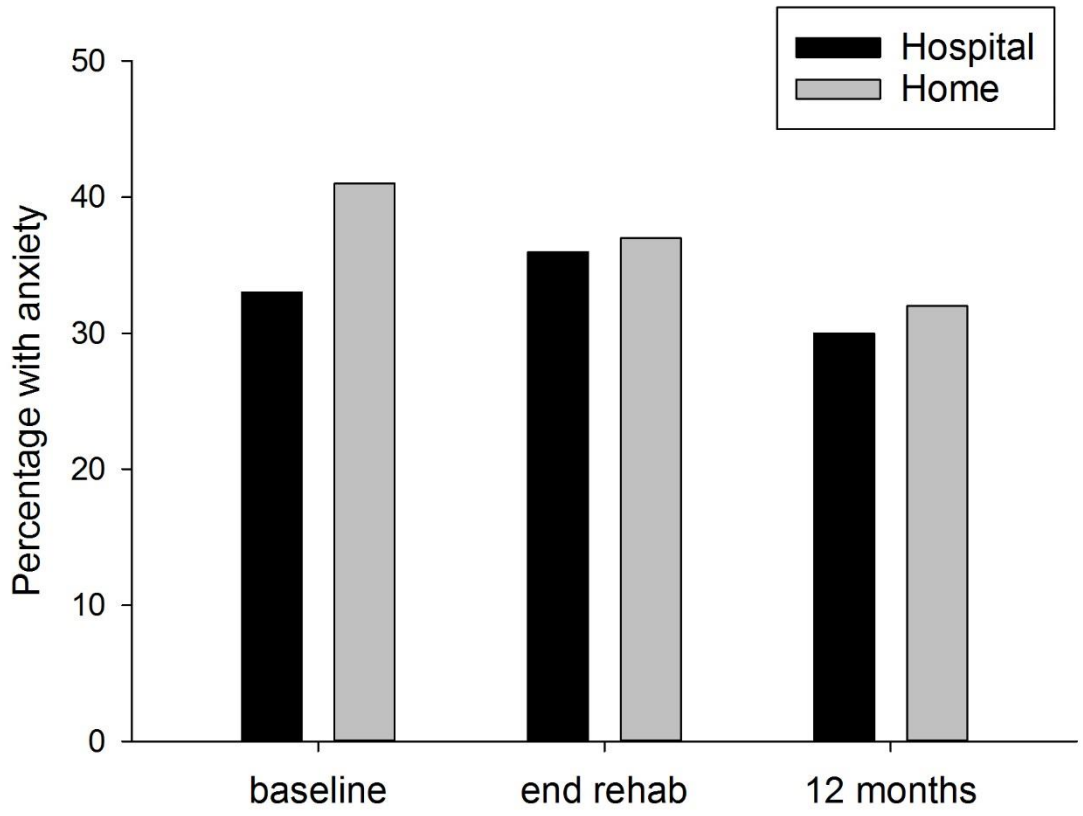


Figure S1. Percentage of participants with anxiety. Data represent participants classified as a 'case' or 'borderline case' at each time point.

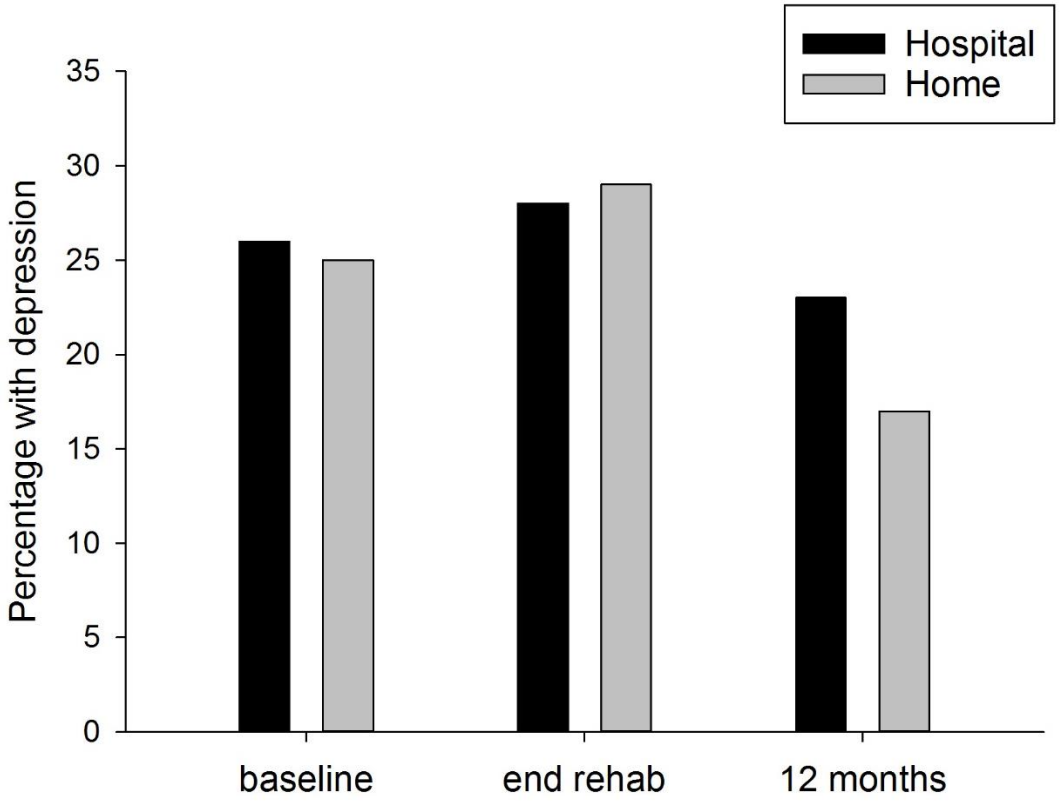
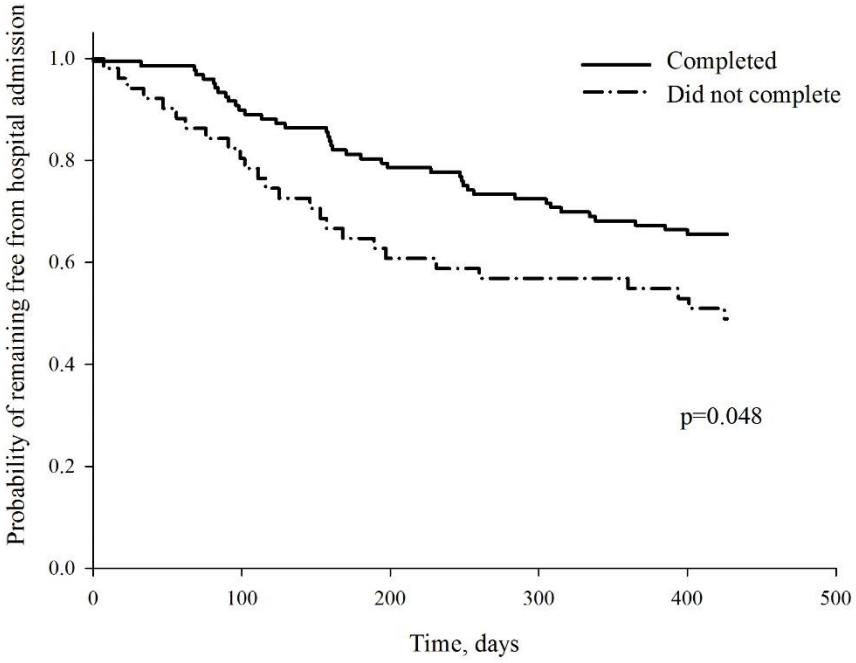


Figure S2. Percentage of participants with depression. Data represent participants classified as a 'case' or 'borderline case' at each time point.

(a)



(b)

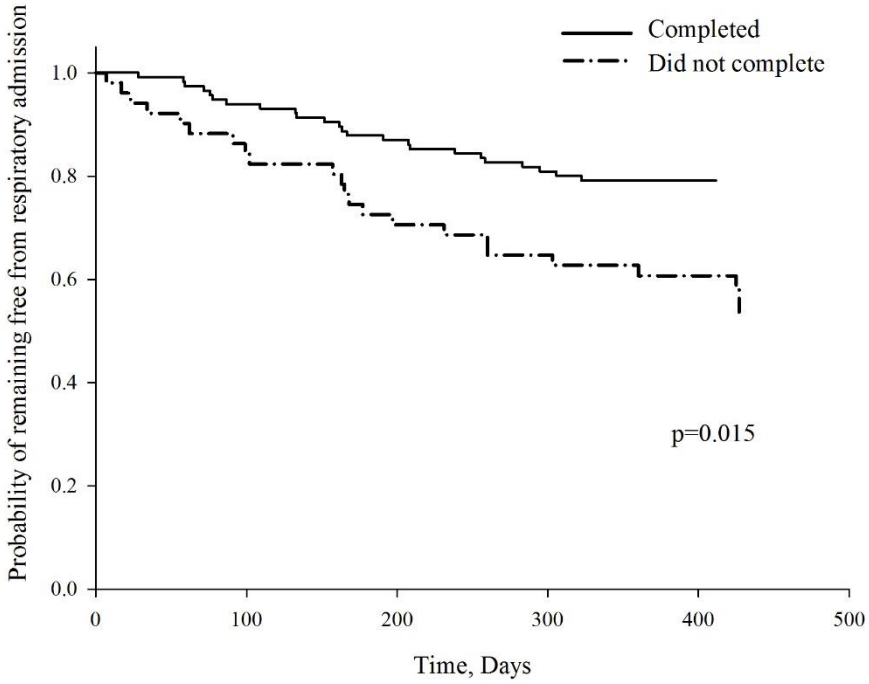


Figure S3. Time to first hospitalisation in those who did or did not complete the program (regardless of group allocation) for (a) all hospital admissions and (b) respiratory admissions. p value is from Cox proportional hazards model.