An economic evaluation of a self-management programme of activity, coping and education for patients with chronic obstructive pulmonary disease

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Abstract

The aim was to undertake a cost-utility analysis of a self-management programme of activity, coping and education (SPACE) for chronic obstructive pulmonary disease (COPD). The analysis was conducted alongside a six-month randomized controlled trial in 30 primary care settings. The economic analysis used data from 184 patients with confirmed diagnosis of COPD, forced expiratory volume in one second/forced vital capacity ratio <0.7 and with grade 2–5 on the Medical Research Council dyspnoea scale. Participants received either a self-management programme consisting of an education manual (SPACE for COPD) and consultation or usual care. Six-month costs were estimated from the National Health Service and Personal Social Services perspective and quality-adjusted life years (QALYs) were calculated based on patient responses at baseline and six months.

The mean difference in costs between usual care and SPACE FOR COPD programme was −£27.18 (95% confidence interval (CI); −£122.59 to £68.25) while mean difference in QALYs was −0.10 (95% CI; −0.17 to −0.02). The results suggest that the intervention is more costly and more effective than usual care. The probability of the intervention being cost-effective was 97% at a threshold of £20,000/QALY gained. We conclude that the SPACE FOR COPD programme is cost-effective compared to usual care.

Keywords

COPD, cost-effectiveness analysis, cost-utility analysis, RCT, self-management, education

Introduction

Chronic obstructive pulmonary disease (COPD) is a major cause of disability and mortality with the death of more than 3 million people in 2012, which is equal to 6% of all deaths globally that year.[1] As well as being recognized to contribute to the substantive deterioration of health-related quality of life (HRQoL) for many patients,[2] COPD places a heavy burden on the healthcare system, patients and society overall.[3–5]

Non-pharmacological-based treatments such as self-management interventions are acknowledged as important strategies to support patients with long-term conditions[6] such as COPD.[7] Although there is no one definition of self-management, the broad approach is to teach individuals the skills needed to cope with the disease, ability to recognize and respond to symptoms proactively and adopt a healthy lifestyle as well as manage social interactions.[8] The clinical effectiveness of self-management educational programmes has already been established for a range

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of chronic illnesses including COPD.[9–12] The most recent Cochrane systematic literature review on self-management showed that it improved HRQoL in patients with COPD compared with usual care.[2] They also showed a reduction in all-cause and COPD-related hospital admissions in those participating in the self-management interventions. The authors of this review, however, claim that they were unable to come to any definitive conclusions due to the heterogeneity of the studies, in terms of both the study populations, follow-up times, outcome measured, methodology used and the different specification of the 'self-management intervention'[2].

To date only a few studies have attempted to evaluate the cost-effectiveness of self-management programmes for people with COPD. Some studies reported only the programme costs.[9,13,14] The evidence suggests that self-management programmes are cost-effective in improving patient outcomes and reducing cost.[10,15,16] These studies have taken different methodological approaches and differ on the primary outcome considered.[17]

A randomized controlled trial was carried out to determine the short-term (baseline to 6 weeks) and medium-term (6 weeks to 6 months) effectiveness of a Self-management Programme of Activity, Coping and Education (SPACE) for COPD (SPACE FOR COPD) on patient outcomes, compared with usual care alone. Full clinical results of this trial are reported elsewhere.[18] In brief, at 6 weeks, there were significant differences between groups in Chronic Respiratory Questionnaire-Self-Reported (CRQ-SR) dyspnoea, fatigue and emotion scores, exercise performance, anxiety and disease knowledge. However, there was no between-group difference in change of the primary outcome measure (CRQ-SR dyspnoea) at 6 months. However, exercise performance, anxiety and self-reported smoking status were significantly different between groups, in favour of the intervention.

The aim of this study was therefore to undertake a cost-utility analysis to examine the cost-effectiveness of SPACE FOR COPD versus usual care at 6 months.

Methods

Study design

This was a single-centre, investigator-blinded, randomized controlled trial conducted with 6 months follow-up, which took place between December 2009 and April 2012. One hundred and eighty four participants were randomized to either SPACE FOR COPD (*n* = 89) or to usual care (*n* = 95). Practices screened patient registers to identify eligible candidates. To be included, participants were required to: (1) have a diagnosis of COPD confirmed by spirometry, with a forced expiratory volume in one second/forced vital capacity ratio <0.7; (2) be grade 2–5 on the Medical Research Council dyspnoea scale[19]; and (3) have been clinically stable for 4 weeks. Individuals were excluded if they; (1) were unable to undertake an exercise regime due to neurological, musculoskeletal or cognitive co-morbidities; (2) unable to read English to the reading age of an 8-year-old; and (3) had completed pulmonary rehabilitation within the previous 12 months.

SPACE for COPD

Participants randomized to SPACE FOR COPD were introduced to the programme by a physiotherapist during a 30–45 minute consultation using principles of Motivational Interviewing. This comprehensive programme has been described elsewhere[18,20] and is structured around the SPACE FOR COPD manual. Briefly, the manual contains educational material on a wealth of topics and a home exercise programme. Acquisition of skills is promoted through goal-setting strategies, coping planning and case studies. The manual advises on training progression and includes an action plan for exacerbation management.[20]

Participants' needs were discussed and goal-setting strategies were introduced at initial consultation. It was anticipated that participants would work through the manual in approximately 6 weeks; participants received two telephone contacts at 2 and 4 weeks into the programme from the physiotherapist, with the aim of reinforcing skills and providing encouragement to progress. There was no further contact between the physiotherapist and participant after the telephone contact at 4 weeks.

Usual care

All study participants continued to receive usual care for their COPD management. Within primary care, all participants were managed under a general practitioner (GP) and practice team. No participants received pulmonary rehabilitation during the study period.

Health outcomes

Participants were asked to describe their HRQoL at baseline, 6 weeks and 6 months post-randomization

using the EuroQol EQ-5D-3 L instrument (the Netherlands).[21] The EQ-5D is the generic, multi-attribute, preference-based measure preferred by National Institute for Health and Care Excellence (NICE)[22] for broader cost-effectiveness comparative purposes. The EQ-5D consists of two principal measurement components. The first is a descriptive system, which defines HRQoL in five dimensions: 'mobility', 'self-care', 'usual activities', 'pain/discomfort' and 'anxiety/depression'. A total of 243 health states are generated by the EQ-5D descriptive system. For the purposes of this study, the York A1 tariff was applied to each set of responses to the descriptive system to generate an EQ-5D utility score.[23] Resulting utility scores range from scores −0.59 to 1.0, with '0' representing death and '1' representing full health. Utility values <0 indicate health states worse than death. The second measurement component of the EQ-5D, the vertical visual analogue scale (VAS) ranging from 100 (best imaginable health state) to 0 (worst imaginable health state), was also included.

Collection and valuation of resource-use cost data

Data on the resource items and services used for the intervention and the control arm were collected over the 6-month time horizon. Data on consumable use (SPACE FOR COPD manual), introduction to SPACE FOR COPD and telephone contact duration were recorded prospectively in research/study records. Healthcare data were obtained through three primary sources. First, the hospital records were investigated to capture all resources relating to the participants' use of health and social care services over the 6-month study period. Second, GP records were also analysed to capture the use of primary healthcare and social care services. Thirdly, patients were asked at their follow-up research appointment to detail any healthcare contacts. The following data were captured: the dates, duration and reasons for healthcare contacts (classified as respiratory or non-respiratory related), the healthcare professional involved, mode of delivery (i.e. clinic, home visit or telephone contact) for all appointments, investigations, admissions, emergency department visits and referrals. Information was obtained from these three data sources (hospital, GP and patient) and triangulated to give the most likely, overall healthcare resource use. Medication use was obtained from prescription and medication records from GP sources. Type, dose and frequency of medications prescribed

were recorded (including oxygen therapy) and classified as respiratory or non-respiratory medications.

The unit cost for resources used for the implementation of SPACE FOR COPD was mainly obtained from the SPACE FOR COPD study records, apart from the unit costs of physiotherapists' time obtained from the Personal Social Services Research Unit (PSSRU) 'Unit costs of health and social care 2013–' cost compendium.[24] Unit costs for hospital and community-based health and social care services were derived from National Health Service (NHS) Reference costs[25] and the PSSRU[24] for the economic evaluation. The medication collected included respiratory antibiotics and steroids. The drug prescription costs were obtained from the British National Formulary.[26]

Economic Analysis

The incremental cost-effectiveness of SPACE FOR COPD compared with usual care is based on EQ-5D data, as this is the utility measure currently recommended by NICE for the evaluation of cost-effectiveness of interventions used or services delivered in the public and non-public sectors.[22] The study was conducted from a NHS and Personal Social Services perspective including COPD-related and all-cause healthcare costs.

Our analysis used a regression approach to better reflect the nature of the data.[27] The distribution of costs are highly skewed, so that ordinary least square (OLS) assumptions of normality might not be appropriate; hence a Generalized Linear Model was fitted for costs using a Gamma distribution and identity link function. Quality-adjusted life years (QALYs) were estimated using an OLS regression with baseline utility (EQ-5D) as a covariate to adjust for differences between groups. This method of adjusting for baseline utility differences is more efficient than estimation of QALYs using the 'change from baseline' method. Results were based on 1000 bootstrap samples, which was sufficient to provide stable estimates of costs and effects.[28]

Results were presented as incremental cost-effectiveness ratio (ICER) statistics, 'the cost per QALY'. This is the estimated difference in mean costs between the SPACE FOR COPD and usual care arms (the incremental cost), divided by the difference in mean QALYs between the two arms (incremental effect). The ICERs can be compared against the benchmark thresholds for cost-effectiveness in the NHS context of £20,000 to £30,000 per QALY gained, as applied by NICE.[29] If the ICER is below

Table 1. Mean utilities derived from the EQ-5D, and the associated mean QALYs.[a]

| | Number of patients | | Mean quantity (SE) | | |
	Usual care	SPACE	Usual care	SPACE	Mean treatment difference (95% CI)
Baseline	90	87	0.63 (0.03)	0.70 (0.02)	−0.07 (−0.14 to 0.00)
6 months	81	69	0.62 (0.03)	0.71 (0.03)	−0.08 (−0.16 to −0.01)
Change 0–6 months	78	68	0.00 (0.02)	−0.01 (0.02)	0.00 (−0.06 to 0.06)
QALYs	78	68	0.61 (0.03)	0.71 (0.03)	−0.10 (−0.17 to −0.02)

QALY: quality-adjusted life year; CI: confidence interval; SPACE: self-management programme of activity, coping and education.
[a]QALYs, estimated by the area-under-the-curve for individual patients.

Table 2. Mean utilities derived from the VAS scores and the associated mean QALYs.[a]

| | Number of patients | | Mean quantity (SE) | | |
	Usual care	SPACE	Usual care	SPACE	Mean treatment difference (95% CI)
Baseline	88	82	64.3 (1.71)	66.9 (1.87)	−2.20 (−7.19 to 2.80)
6 months	81	68	65.0 (2.02)	66.2 (2.26)	−1.16 (−7.14 to 4.82)
Change 0-6 months	76	65	0.18 (1.96)	−2.68 (1.82)	2.86 (−2.49 to 8.22)
QALYs	76	65	64.58 (1.75)	67.6 (1.98)	−3.05 (−8.25 to 2.14)

QALY: quality-adjusted life year; VAS: visual analogue scale; SPACE: self-management programme of activity, coping and education; CI: confidence interval.
[a]QALYs, estimated by the area-under-the-curve for individual patients.

£20,000 per QALY, this suggests that the intervention is a cost-effective alternative to usual care, above £30,000 per QALY this suggests that the intervention is not cost-effective and in between these figures, the result is indeterminate. We also present the results using Incremental Net Benefit (INB) statistics, calculated by multiplying the incremental effects by an assumed monetary value of a QALY (the 'cost-effectiveness threshold') and subtracting the incremental cost. We calculate INB statistics based on the two cost per QALY thresholds of £20,000 and £30,000 per QALY. A positive INB suggests that the intervention is cost-effective compared with usual care at the defined threshold.

Uncertainty over the cost-effectiveness of the intervention is reflected in an estimated probability that the INB is positive. If this figure is greater than 0.5, it indicates that the intervention is more likely to be cost-effective than not.

Results

Complete economic data regarding costs and QALYS over the 6-month study period were available for all patients. Mean EQ-5D utility scores for SPACE FOR COPD and usual care at baseline and 6 months and the mean QALYs gained are presented in Table 1.

Estimated by the simple area-under-the-curve method, mean QALYs attained over the trial period based on EQ-5D utility measure were slightly lower and statistically significant for the usual care group than for SPACE FOR COPD group: −0.10 (−0.17 to −0.02). For comparison with the utility measure, we also show results based on the EQ-5D VAS (−3.05 (−8.25 to 2.14)), which provides us with a value for the participant's self-rated health at the time of survey completion on a scale of 0–100 (Table 2).

Information about the use of NHS services was obtained by GP and hospital records at 6 months. Reported estimates of healthcare use including prescription and diagnostic tests over 0–6 months are given in Table 3. These resource quantities were multiplied by the relevant unit costs (Table 4) to provide estimates of the mean costs per patient from 0 to 6 months (Table 5). Differences between the groups in the costs of healthcare use over these periods were modest, with wide confidence intervals (CIs). A summary of all included costs over the trial period is given in Table 5. This shows a difference, though non-significant, between the groups. The mean cost for the SPACE FOR COPD group was £181.39 compared with £160.65 for the usual care group: a difference of £20.74 (−£51.77 to £10.29). Overall, taking account of costs for the intervention, for prescribed

Table 3. Health care utilization over the study period.

Type of care	Number of patients		Mean quantity (SE)		Mean treatment difference (95% CI)
	Usual care	SPACE	Usual care	SPACE	
GP, surgery visit	90	85	0.96 (0.15)	0.76 (0.13)	0.19 (−0.20 to 0.58)
GP, home visit	90	85	0.08 (0.04)	0.01 (0.01)	0.07 (−0.02 to 0.15)
GP, phone	90	85	0.21 (0.06)	0.26 (0.09)	−0.05 (−0.26 to 0.16)
Community physiotherapist, hour	90	85	0.06 (0.02)	0.08 (0.03)	−0.03 (−0.10 to 0.05)
Social worker, hour	90	85	0.01 (0.01)	0 (0)	0.01 (−0.01 to 0.03)
District nurse, hour	89	85	0.63 (0.09)	0.53 (0.08)	0.10 (−0.15 to 0.35)
District nurse, phone	90	85	0.06 (0.03)	0.02 (0.02)	0.03 (−0.03 to 0.10)
District nurse, home visit	90	84	0.37 (0.34)	0.01 (0.01)	0.35 (−0.35 to 1.06)
Clinical decision clinic	95	86	0.04 (0.02)	0.02 (0.02)	0.02 (−0.03 to 0.07)
Inpatient stay, episode	95	86	0.01 (0.01)	0.01 (0.01)	0 (−0.03 to 0.03)
Respiratory clinic, visit	95	86	0.08 (0.03)	0.22 (0.07)	−0.14 (−0.29 to 0.01)
Hospital nurse	95	86	0 (0)	0.02 (0.02)	−0.02 (−0.05 to 0.01)
Emergency department, visit	95	86	0.01 (0.01)	0.03 (0.02)	−0.02 (−0.07 to 0.02)
Physiotherapist department, visit	95	86	0.01 (0.01)	0.02 (0.02)	−0.01 (−0.05 to 0.02)
X-rays, test	95	86	0.17 (0.05)	0.20 (0.06)	−0.03 (−0.18 to 0.12)
CT scan, test	95	86	0.01 (0.01)	0.10 (0.04)	−0.09 (−0.17 to 0.01)
Blood tests, test	94	86	1.71 (0.40)	2.10 (0.40)	−0.39 (−1.50 to 0.72)
Spirometry test, test	95	86	0.07 (0.03)	0.10 (0.03)	−0.03 (−0.11 to 0.05)
Lung function test, test	95	86	0.02 (0.01)	0.05 (0.02)	−0.03 (−0.08 to 0.030
Sputum test, test	95	86	0.11 (0.05)	0.20 (0.08)	−0.09 (−0.28 to 0.09)
Electrocardiogram monitoring, test	95	86	0.09 (0.03)	0.15 (0.05)	−0.06 (−0.17 to 0.05)
Urine test, test	95	86	0.35 (0.08)	0.28 (0.06)	0.07 (−0.13 to 0.26)

SPACE: self-management programme of activity, coping and education; CI: confidence interval; GP: general practitioner.

medications and for other NHS services, the estimated between-group difference in costs is £27.18 (−£122.59 to £68.25), indicating reduced cost in favour of the usual care group.

The results of the incremental cost-effectiveness analysis of the SPACE FOR COPD group compared with usual care are presented in Table 6. The estimated mean healthcare cost with the intervention was approximately £30 higher than the mean cost under usual care, but there was a wide CI around this estimate (−£80.19 to £134.54). The estimated difference in mean QALYs accrued over the 6-month period was approximately 0.10 greater in the intervention group than in the usual care group, with a CI of 0.02–0.17. These results suggest that the SPACE FOR COPD costs around £280.00 more per additional QALY gained compared with the usual care control.

Uncertainty surrounding the estimated costs and effects is represented on the cost-effectiveness plane (Figure 1). The joint density of incremental costs and effects straddles both east quadrants of the cost-effectiveness plane, with the majority of the points lying in the north-east quadrant. This indicates that there is some degree of uncertainty surrounding both the presence and the magnitude of cost-savings and effectiveness. This uncertainty is also shown in the cost-effectiveness acceptability curve (CEAC) in Figure 2. The CEAC illustrates the probability of SPACE FOR COPD being more cost-effective than usual care at different thresholds of decision makers' willingness to pay for a QALY. There is a 97% chance that the intervention is cost-effective at a threshold of £20,000 per QALY and 99% chance at a threshold of £30,000.

Discussion

The aim of this study was to perform an economic evaluation of a SAFE in patients with COPD. The intervention showed to have a statistically significant benefit to patients' health gain (0.10 QALYs), compared to usual care. Also, it showed that there was no statistically significant difference in cost for SPACE FOR COPD compared to usual care. Analysis of the costs and effects of the self-management programme over the 6-month trial period indicates that this is likely to be a cost-effective use of NHS resources. At £280.39 per QALY gained, the estimated ICER is well within NICES's cost-effective thresholds of £20,000.

Table 4. Unit costs of healthcare resources used.[a]

Healthcare resource	Unit cost	Details	Source of unit cost
Community care			PSSRU
GP surgery consultation	45.00	Per session	PSSRU
GP home visit	292.00	Per home visit	PSSRU
GP phone call	27.00	Per hour phone call	PSSRU
Physiotherapist	34.00	Per hour of consultation	PSSRU
Social worker	57.00	Per hour of consultation	PSSRU
District nurse surgery consultation	48.00	Per hour of consultation	PSSRU
District nurse home visit	70.00	Per hour of home visit	PSSRU
District nurse phone call	58.00	Per hour phone call	PSSRU
Hospital Services			
Clinical decision unit	40.00	Per session	Ref Cost
Inpatient	478.00	Per inpatient day	Ref Cost
Respiratory clinic	154.00	Per session	Ref Cost
Nurse	75.00	Per session	Ref Cost
Emergency Department	117.00	Per session	Ref Cost
Physiotherapy	42.00	Per session	Ref Cost
X-rays	5.00	Per test	assumption
CT scan	92.00	Per test	Ref Cost
Blood tests	3.00	Per test	Ref Cost
Spirometry tests	167.00	Per test	Ref Cost
Lung function test	167.00	Per test	Ref Cost
Sputum test	7.00	Per test	Ref Cost
ECGs	53.00	Per test	Ref Cost
Urine test	4.00	Per test	Ref Cost

PSSRU: Personal Social Service Research Unit; NHS: National Health Service; GP: general practitioner.

[a]Ref Cost: Department of Health, NHS reference costs.[25] PSSRU, Unit costs of Health and Social Care 2012–2013.[24]

The results of this study indicate that the self-management programme slightly increased the use of respiratory clinic visits, emergency department visit and community physiotherapist visits, but reduced, on average, the use of district nurse visits and GP visits. Our results differ from previous findings,[15] which demonstrated that a pharmacy-led education and self-management programme reduced hospital days by 60%, emergency visits by 48% and unscheduled GP visits by 48% while another study of a comprehensive intervention[9] reported 42% reduction in hospital days, 35% reduction in accident and emergency visits and 59% reduction in unscheduled GP visits. This difference may be due to the fact that as patients are better at self-managing their condition, they may actually use healthcare resources more because they identify when there is a problem so want help/advice to overcome it, that is, they may be better able to identify an exacerbation, so will seek to take their exacerbation medication quicker than someone who isn't able to identify this. Also, if they are aware of the reasons for taking their medication/inhalers, then they may be more likely to actually take them as prescribed, which may increase medication costs, and so on. The study by Bourbeau et al.[9] differed from this one because their intervention was far more intense than SPACE FOR COPD and also they recruited patients with advanced COPD and at least one previous hospitalisation, whereas, we recruited from primary care where our participants' number of hospital visits was actually rather low and the patient population was relatively mild compared to the more traditional secondary care population in other studies[13] that recruited in secondary care and post exacerbation reported much higher number of hospital visits. Perhaps this indicates that there are differences between the patient populations in these studies that could significantly impact on healthcare resource use. Furthermore, in different healthcare systems what constitutes 'usual care' may be quite different, so what people are 'used to' or expect from care may also affect their use of resources.

In contrast with previous studies that were unable to document any benefit in terms of QALYs between treatment groups,[13,16] we did find significant differences on HRQoL and QALYs, so we can conclude that SPACE FOR COPD has a beneficial effect on patient well-being. Furthermore, our results are in line with other secondary clinical outcomes that have showed a significant change in favour of the SPACE FOR COPD intervention at 6 weeks (i.e. CRQ-SR-dyspnoea dimension) and 6 months (i.e. CRQ-SR-emotional dimension).[18]

To date there are only four studies, we are aware of, that analysed the cost-effectiveness of self-management in patients with COPD.[10,13,15,30] Gallefoss's study[10] concluded that patient education reduced costs and improved outcomes. Similarly, the cost-effectiveness analysis conducted by Effing et al.[30] showed that a self-treatment strategy was cost saving and resulted in lower probabilities for hospital admissions and healthcare contacts. Also,

Table 5. Mean NHS costs (£) of healthcare resource use over the 6-month study period.

Type of care	Number of patients		Mean cost (SE)		Mean treatment difference (95% CI)
	Usual care	SPACE	Usual care	SPACE	
Intervention (therapy deliver, consumables and sessions attended	95	89	160.65 (108.69)	181.39 (104.37)	−20.74 (−51.77 to 10.29)
NHS services					
GP, surgery visit	90	85	43 (6.59)	34.41 (5.87)	8.59 (30.10 to 47.57)
GP, home visit	90	85	22.71 (11.51)	3.44 (3.43)	19.28 (−5.02 to 43.58)
GP, phone	90	85	5.7 (1.62)	6.99 (2.40)	−1.29 (−6.95 to 4.37)
Community Physiotherapist, hour	90	85	1.89 (0.83)	2.8 (1.02)	−0.91 (−3.49 to 1.67)
Social worker, hour	90	85	0.63 (0.63)	0 (0)	0.63 (−0.65 to 1.92)
District nurse, hour	89	85	30.20 (4.43)	25.41 (3.99)	4.79 (−7.01 to 16.59)
District nurse, phone	90	85	3.22 (1.68)	1.36 (0.96)	1.86 (−2.02 to 5.73)
District nurse, home visit	90	84	25.67 (24.12)	0.83 (0.83)	24.83 (−24.48 to 74.15)
Clinical Decision Clinic	95	86	1.68 (0.83)	0.93 (0.65)	0.75 (−1.35 to 2.87)
Inpatient stay, episode	95	86	5.03 (5.03)	5.56 (5.56)	−0.53 (−15.28 to 14.23)
Respiratory clinic, visit	95	86	12.97 (4.98)	34.02 (10.92)	−21.05 (−44.02 to 1.91)
Hospital nurse	95	86	0 (0)	1.74 (1.23)	−1.74 (−4.05 to 0.56)
Emergency department, visit	95	86	1.23 (1.23)	4.08 (2.33)	−2.85 (−7.94 to 2.22)
Physiotherapist department, visit	95	86	0.44 (0.44)	0.98 (0.69)	−0.53 (−2.12 to 1.05)
X-rays, test	95	86	0.84 (0.24)	0.99 (0.30)	−0.15 (−0.90 to 0.61)
CT scan, test	95	86	0.97 (0.97)	9.63 (3.74)	−8.66 (−15.96 to −1.37)
Blood tests, test	94	86	5.14 (1.19)	6.31 (1.18)	−1.18 (−4.50 to 2.15)
Spirometry test, test	95	86	12.31 (4.50)	17.48 (5.54)	−5.17 (−19.15 to 8.81)
Lung function test, test	95	86	3.51 (2.48)	7.77 (3.81)	−4.25 (−13.10 to 4.56)
Sputum test, test	95	86	0.74 (0.32)	1.39 (0.59)	−0.65 (−1.94 to 0.64)
Electrocardiogram monitoring, test	95	86	5.02 (1.79)	8.01 (2.40)	−2.99 (−8.83 to 2.85)
Urine test, test	95	86	1.39 (0.31)	1.12 (0.24)	0.27 (−0.51 to 1.05)
All NHS services	88	84	178.24 (33.6)	166.42 (25.21)	11.82 (−71.69 to 95.33)
Prescriptions					
Respiratory	95	89	59.95 (5.26)	77.07 (9.05)	−17.11 (−37.45 to 3.22)
Antibiotics	95	89	1.42 (0.22)	1.14 (0.31)	0.27 (−0.48 to 1.02)
Steroids	90	85	0.91 (0.19)	1.07 (0.39)	−0.16 (−0.99 to 0.68)
All prescriptions	90	85	62.28 (5.34)	79.28 (9.25)	−17.00 (−37.74 to 3.74)
Total cost	88	84	409.54 (351.72)	436.72 (275.72)	−27.18 (−122.59 to 68.25)

NHS: National Health Service; SPACE: self-management programme of activity, coping and education; CI: confidence interval; GP: general practitioner.

more recently Kdour et al.[15] proved that a pharmacist-led self-management education programme was cost saving and improved HRQoL (0.065 QALYs gain). On the other hand, Monninkhof's study[13] showed that a self-management programme costs twice as much as usual care without providing any measurable beneficial effects. The latter may partly be explained by the fact that they have used a far more expensive intervention in a relative short-time horizon that might have not allowed patients' benefits to become well pronounced.

Comparison of the studies by Gallefoss[10] and Effing[30] with our study is difficult because they have used other outcome measured rather than QALYs, thus preventing comparisons across these different programmes of care.[22] Our study differs from the above since SPACE FOR COPD is the first brief, light-touch self-management intervention to show a beneficial effect in terms of symptom burden, exercise performance, anxiety[18] and HRQoL (QALYs), with limited use of healthcare professional support.
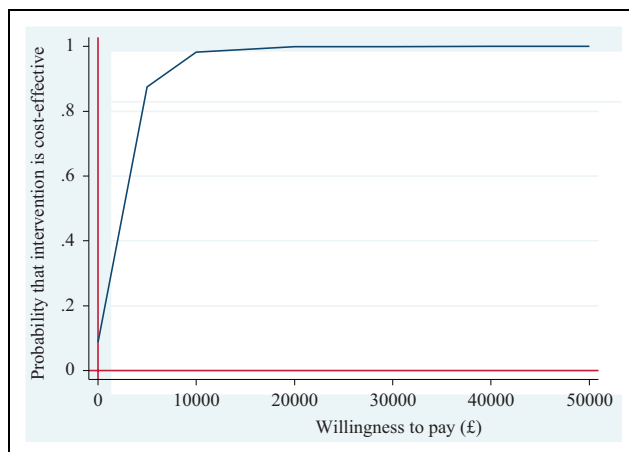
Table 6. Cost effectiveness results.

	GLM regression		
	Mean treatment difference	95% CI	p Value
Total NHS cost (£)	27.18	(−80.19 to 134.54)	0.620
QALYs	0.097	(0.02 to 0.17)	0.012
ICER (£ per QALY)	280.39	(−12,581 to 13,142.04)	0.966
NMB (£) 20K	1879.92		
30K	2845.9		
40K	3811.9		

GLM: generalized linear model; CI: confidence interval; NHS: National Health Service; QALY: quality-adjusted life year; ICER: incremental cost effectiveness ratio; NMB: net monetary benefit.
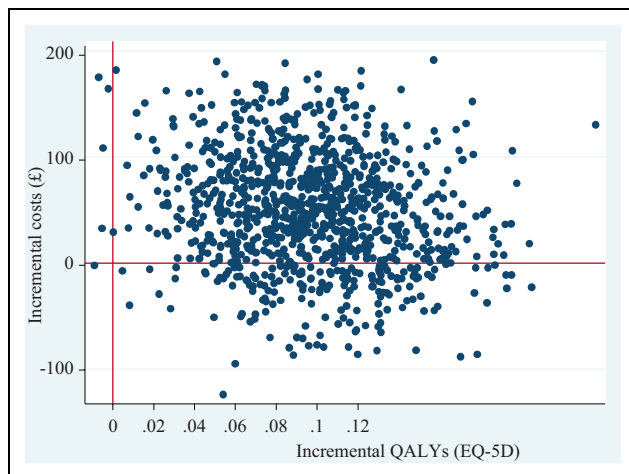
Figure 1. Cost effectiveness plane, bootstrap samples using GLM. GLM: generalized linear model.

Figure 2. Cost effectiveness acceptability curve.

Conclusion

Combining our cost-effectiveness results presented here, with the clinical analysis published elsewhere,[18] we conclude that SPACE FOR COPD has resulted in significant clinical improvements (exercise performance, disease knowledge and anxiety) and a significant HRQoL gain (in terms of QALYs) during a 6-month period compared to usual care, at a cost increase of £27.18 per patient. Furthermore, SPACE FOR COPD is likely to be cost-effective for the NHS over 6 months at the £20, 000 threshold.

Declaration of Conflicting Interests

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