



UNIVERSITY OF
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Active Steps Evaluation: Full Report

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“Talking really helped me mentally. Having regular conversations about my activity encouraged me to do more, but also to be realistic with my goals. If I failed, I didn’t give up and managed to get back on track slowly again. Encouraged me to continue. I will be continuing my activity and want to access pulmonary rehabilitation.”

Active Steps service user

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Background and rationale of Active Steps



Background

Although anyone can be inactive, we know that levels of inactivity rise in populations with a long-term health condition.¹ People diagnosed with chronic lung conditions such as Chronic Obstructive Pulmonary Disease (COPD), asthma, bronchiectasis and pulmonary fibrosis are known to report lower levels of daily physical activity when compared with healthy counterparts of a similar age.²⁻¹⁵ Many lead a largely inactive lifestyle with few meeting the recommended physical activity guidelines.^{3,16}

In people with chronic lung conditions, increased physical activity is associated with improved symptoms, physical function and quality of life whereas inactivity is associated with adverse clinical outcomes, including increased hospitalisation and all-cause mortality.¹⁷⁻²⁵ As such, the importance of physical activity in management of a chronic lung condition is well recognised.

Structured physical activity programmes, such as pulmonary rehabilitation, a face-to-face 6-8 week intervention involving education and exercise, are one of the key treatments for chronic lung conditions in the NHS.²⁶ The key benefits include clinically important improvements in exercise capacity, quality of life and symptoms such as shortness of breath.²⁶⁻³² However, across the UK there are barriers preventing people with a lung condition attending these programmes including accessibility, under-referral and long waiting times.³⁰ We also know that completion of short-term programmes of pulmonary rehabilitation do not always translate to changes in long-term daily physical activity for people with lung conditions.³²⁻³³

More strategies are needed to increase physical activity across a wider range of settings for people with lung conditions including when structured physical activity programmes cannot be accessed or before starting such programmes. Remote coaching interventions delivered through internet and telephone have shown potential to support behaviour change and promote physical activity in people with lung conditions³⁴⁻³⁷ but they are not readily available in the UK.

The British Lung Foundation (BLF) received funding from Sport England and the National Lottery to develop, deliver and test this approach through a new remote health coaching behaviour change service called Active Steps. An outline of the overall project is depicted as a logic model in Figure 1.

In addition to Active Steps, Sport England awarded funding to a wider collection of projects run by other individual charities from the Richmond Group of Charities under a programme known as 'Movement for All'. Some of the outcome measures used in the evaluation of Active Steps were chosen to support the overarching evaluation of the 'Movement For All' programme. It is also worth

noting that outcomes in the Active Steps project were reported according to the requirements of Sport England projects and domains used across the Movement for All programme (e.g. physical wellbeing, mental wellbeing, individual development).

Rationale and service development

Improving the quality of life of people living with lung conditions is one of the key strategic priorities of the BLF. This relates to two strategic outcomes, firstly to give information and knowledge to people with lung conditions and secondly, to improve health behaviours including physical activity.

To meet these priorities, the BLF provide a range of support to increase activity levels of people living with lung conditions including health information and specific projects. The BLF produce a *Keep active* booklet, which includes information on benefits of activity, how to stay safe, different ways of being active and how to get started. They also produce practical resources for those ready to be active, such as the *Stay active, stay well* activity DVD and exercise handbook. They also have a network of Breathe Easy support groups across the country, many of which provide opportunities to be active.

Projects in the past have included BLF Active (specialist exercise classes run by Level 4 trained exercise instructors) and localised activities for Tai Chi, Walking for Lung Health, and Singing for Lung Health. Many of these groups still exist, however BLF's focus is to develop a broader approach that provides greater reach and access to support people with a lung condition to be active.

The shift in approach from localised set up of physical activity opportunities to behaviour change support started with a Sport England funded project called *Keep Active, Keep Well*, a 12-week group behaviour change programme delivered indirectly through local Clinical Commissioning Groups and public health teams. The Active Steps project was developed to expand the reach of the BLF beyond existing face-to-face services and to develop one of their key existing assets, the helpline, which supports 20,000 callers annually.

The majority of calls to the BLF helpline are on a one-off basis. Prior to Active Steps, the helpline did not have the capacity to offer additional ongoing support. Evidence suggests that telephone health coaching to support behaviour change is acceptable and feasible to people with COPD, but this had not been tested in a helpline setting until this opportunity arose with the launch of Active Steps.

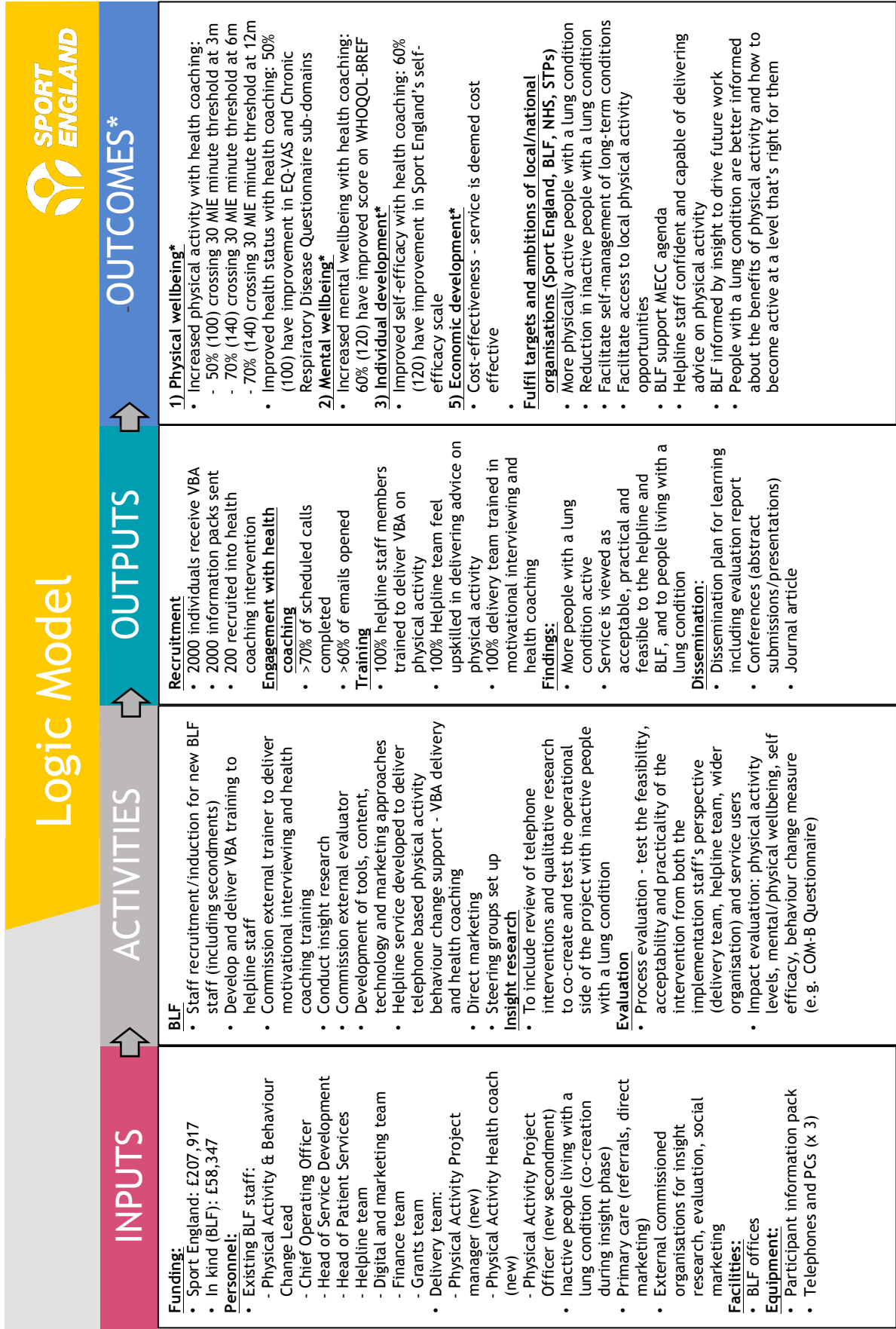


Figure 1. Logic Model for Active Steps project. *Outcomes reported according to requirements of Sport England projects.

Active Steps service



Aim of Active Steps service

To support inactive people living with a lung condition to become and stay active over 12 months.

Objectives of Active Steps service

- Train existing BLF helpline staff in very brief advice for physical activity
- Recruit specialist delivery team and train in motivational interviewing and delivery model
- Deliver very brief advice to people with lung conditions when they raise concerns that could be alleviated by being active and signpost into service
- Recruit inactive people with lung conditions to a newly developed health coaching service
- Provide support to these individuals over 12 months using motivational interviewing to help them to become and stay active

Active Steps Delivery

The Active Steps service was delivered by a new specialist delivery team in the BLF. The service was funded for delivery from January 2019 to October 2020. During this time, inactive individuals (completing less than 30 minutes of moderate to vigorous intensity physical activity per week) were recruited into the service either via the helpline, or self-referral (enquiry via BLF website).

The service consisted of 1:1 telephone health coaching through motivational interviewing over 12 months. This support was person-centred, considering individual needs and therefore frequency and intensity of the intervention varied.

The overarching delivery model of the Active Steps service is shown in Figure 2.

The Behaviour Change Wheel³⁸ was used as an intervention development framework, which resulted in the final design of the Active Steps service, delivered remotely through the BLF Helpline.

The full detail of the intervention development of Active Steps was reported in a peer-reviewed article.³⁹ All service users received 1:1 telephone health coaching, regular email newsletters and an information pack including: a *Keep active* booklet, Active Steps plan (including behaviour change tasks, activity diary and wall chart), *Stay active, stay well* activity DVD and a letter to give to their GP. Participants could also receive a pedometer. A summary of the components of Active Service including which component of the COM-B model of behaviour (the hub of the behaviour change wheel) was being targeted is displayed in Table 1.

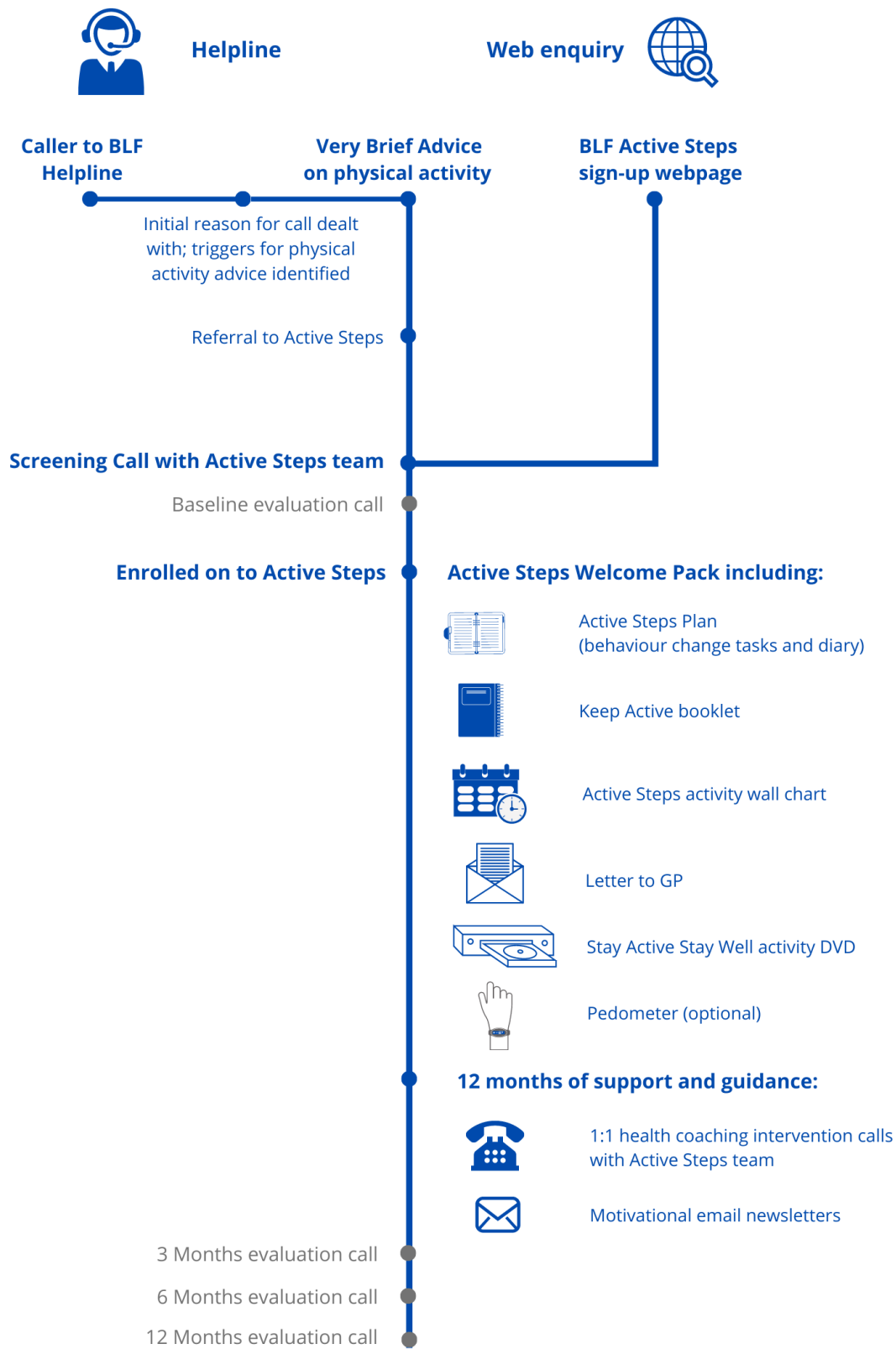


Figure 2: Active Steps Delivery model.

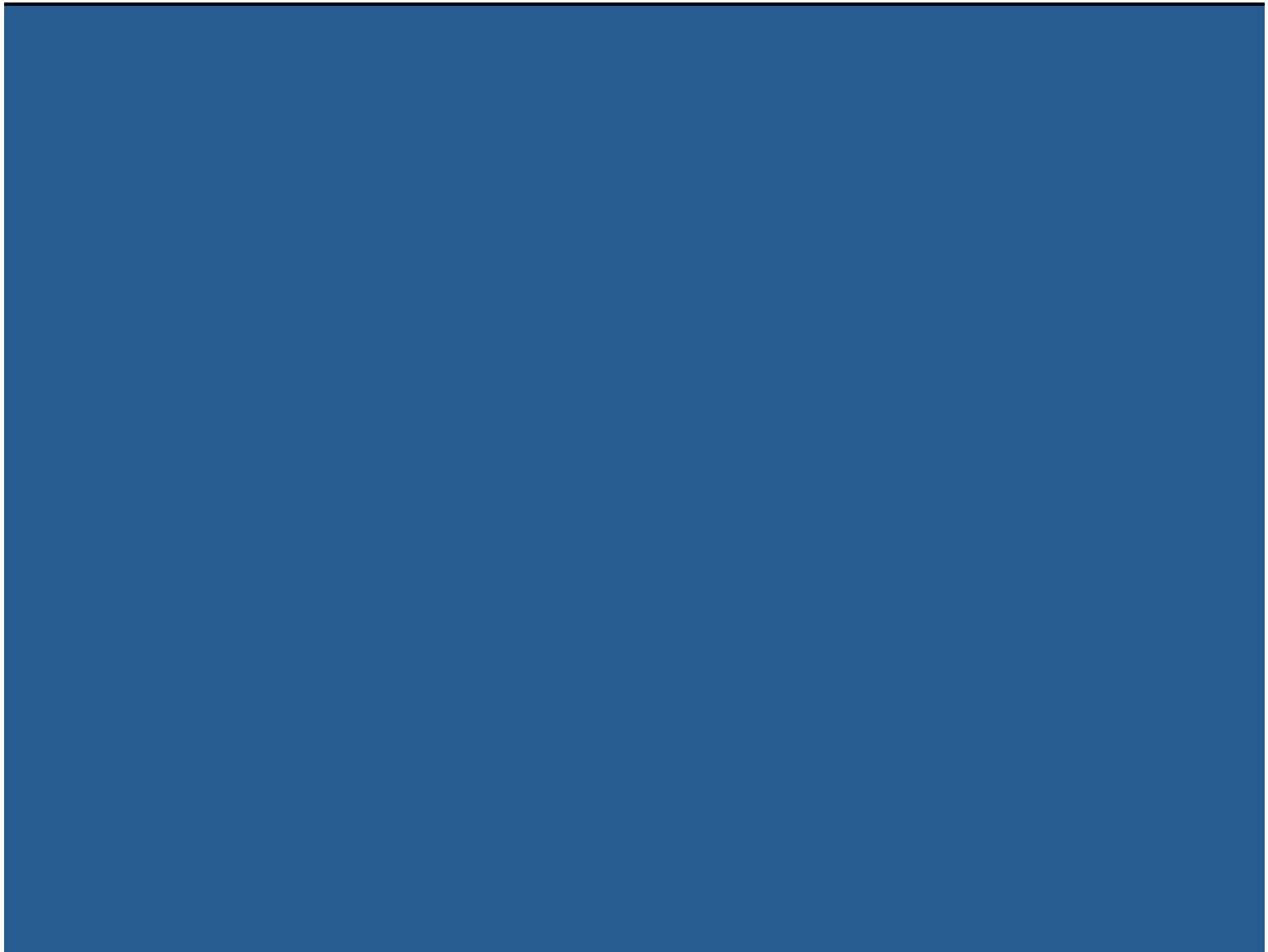
Table 1. Outline of the final design of the components of Active Service, guided by the Behaviour Change Wheel.

COM-B component	Barriers or facilitators to physical activity	Active Steps service components		
		Phone support	Welcome information pack (sent to all service users at baseline)	Email newsletters (sent to all participants at month 1, 2, 3, 6, 9, 12)
Psychological capability	Lack of knowledge of the importance of physical activity, including knowledge of family members	Provide information about the health benefits of physical activity and how it may alleviate symptoms of their condition	Written health information about health consequences and social/environmental benefits - references to encourage participants to share this information with their friends and family	Month 1 themed around the benefits of being active
		Encourage participants to speak to their family/peers about the importance of being active with their condition	Includes exercise video which has educational information from a clinician and a patient	
		Promote use of BLF's existing patient forum (Health Unlocked) to share experiences		
		Help participants to find activities that they enjoy	Includes guidance on getting started	Month 1 and 2 include references and tips on how to get started
		Support participants to set short-, medium- and long-term goals for physical activity and outcomes important to them. Identify rewards and positive achievements	Includes guidance for goal setting Includes task on tracking progress which includes goal setting	Month 6 themed around goal setting and tracking progress
		Encourage participants to make plans to be physically active at a particular time on certain days of the week	Includes activity diary for goal setting, action planning, self-monitoring, self-reward and goal review. Also prompts assessment of feelings after being active.	
		Support participants to identify specific personal triggers for physical inactivity and develop strategies to address these	Includes problem solving task for overcoming barriers	
	Review the patient's goals with the patient and how behaviour corresponds to agreed goals. Consider modifying goal accordingly	Includes task to consider advantages and disadvantages of becoming active		
Physical opportunity	Access to resources equipment and opportunities	Use motivational interviewing to help individual to decide what activities might be best for participants to try	Includes suggestions for resources, national physical activity opportunities, activities of daily living, pulmonary rehabilitation and other activities	Month 9 themed around different ways to be active
		Help participants to find activities in their local community or ways to be active at home	Includes task about identifying different activities to try and space to record information	
		Give practical information on local physical activity opportunities and transport links. This may include access to specialist services for individuals who require professional support	Includes task to reduce sedentary time	
		Suggest mobile applications or activity websites	Includes exercise video which provides resource to do exercise at home Provide pedometers to those interested in walking or step-based goals (optional)	

Table 1 (continued). Outline of the final design of the components of Active Service, guided by the Behaviour Change Wheel.

COM-B component	Barriers or facilitators to physical activity	Active Steps service components		
		Phone support with a health coach for 12 months	Welcome information pack (sent to all service users at baseline)	Email newsletters (sent to all participants at month 1, 2, 3, 6, 9, 12)
Social opportunity	<p>No one to be physically active with</p> <p>Lack of encouragement</p>	<p>Provide encouragement and social support</p> <p>Encourage participants to be active with friends and family</p> <p>Welcome family members on calls if requested</p> <p>Create personalised plans to be active which include family and friends</p> <p>Encourage participants who are motivated by the social side of physical activity to find groups to be active with</p> <p>Promote use of BLF's existing patient forum (Health Unlocked) as a source of social support and sharing experiences</p> <p>Promote use of BLF's existing patient forum (Health Unlocked) as a source of sharing positive achievements</p> <p>Support the individual to restructure their social environment to encourage physical activity and to identify environmental/social stimuli to be active and use these to encourage physical activity.</p>	<p>Includes resources to support participants to be active, e.g. activity diary and A3 activity wall chart and prompts to be active with others</p> <p>Includes exercise video which shows people with lung conditions being active and a case study from an individual with a lung condition</p> <p>Includes exercise to identify difficult situations, sources of social support and social cues that will facilitate physical activity</p>	<p>All include references to being active with family and friends</p> <p>Month 3 includes case studies to reinforce facilitators and reduce barriers</p> <p>Includes top tips to encourage environmental restructuring, e.g. placing trainers by the front door</p>
Reflective motivation	<p>Psychological distress of living with a lung conditions including fear, embarrassment, frustration and disappointment</p> <p>Perception of low importance of physical activity</p>	<p>Increase knowledge of what activities will suit participants and what they may enjoy whilst encouraging them to commence at a level that is right for them and gradually increase over time</p> <p>Reframe negative cognitions related to being active and create more positive beliefs about physical activity.</p> <p>Provide participants with information/evaluative feedback based on their self-monitoring</p> <p>Provide encouragement</p> <p>Increase self-efficacy to be active through motivational interviewing</p> <p>Help participants to develop a positive perception of being active. Reframe negative past experiences</p> <p>Inform the patient of how their patient reported outcome measures have changed since baseline at follow-up intervals</p>	<p>Includes health information on the importance of physical activity</p> <p>Includes a task on how might life be different by becoming active and identifying advantages and disadvantages of change</p> <p>Provide pedometer to those interested in step-based goals (optional) and encourage use alongside monitoring in activity chart/diary</p> <p>Includes health information on the importance of physical activity</p>	<p>Month 1 themed around the benefits of being active</p> <p>Month 2 themed around managing breathlessness and associated emotions</p> <p>Case studies included in each newsletter to aim to change perceptions of being active with a lung condition</p>
Automatic motivation	Physical activity becoming a habit	<p>Support participants to establish a daily routine and to make plans to be active at particular time on defined days of the week, so that these form habits over time</p> <p>Encourage the patient to record their weekly physical activity</p>	<p>A3 activity wall chart and activity diary to record activity and encourage habit creation</p> <p>Provide pedometers (or signpost to step counting apps to use on their phone) to those who are interested in step-based goals (optional)</p> <p>Includes exercise videos</p>	Month 12 themed around habit creation

Approach and methods of evaluation



Procedures

The BLF collected all impact data for Active Steps service users over the telephone. Following consent, data were collected from Active Steps service users on a battery of outcome measures uploaded to web-based questionnaire software (Qualtrics, Utah, United States) at baseline, 3, 6 and 12 months (see Appendix 1). The evaluation calls for participants were conducted by a member of the Active Steps team who had not been involved in delivering intervention calls to them. Upon completion of the web-based questionnaires, data were submitted directly to the evaluation team at the University of Lincoln. In September 2019, data collection procedures were expanded to include the option of participants being emailed a link to the web-based questionnaires to self-complete, if BLF were unable to schedule a telephone follow-up.

Comparator

Independent control group: In order to account for changes over time (independent of Active Steps) in the primary outcome (Short Active Lives Survey) and a secondary outcome (EQ-VAS) that also contributed to the economic evaluation, the evaluation team recruited a control group (n= 80). The eligibility criteria for this group were designed to be as broad as possible and replicate those seeking support from Active Steps. An outline of the methods for the follow-up of this independent control group is publicly registered <https://clinicaltrials.gov/ct2/show/NCT04080583> and had received Health Research Authority and NHS Westminster Research Ethics Committee approval. The independent control group was recruited through the following recruitment routes:

- Mailshot to eligible participants (adults with a chronic lung condition) from Lincolnshire East Clinical Commissioning Group (CCG), Lincolnshire West CCG, South Lincolnshire CCG, and Countywide Respiratory Services of Lincolnshire Community Health Services NHS Trust
- Opportunistic participant identification by nurses, GPs, or respiratory physiotherapists at the above participant identification sites
- Previous research participants on a study, (<https://clinicaltrials.gov/ct2/show/NCT03660644>) conducted by the evaluation team, who were happy to be contacted for future research
- Patient support groups in Lincolnshire (e.g. Breathe Easy).

Outcomes

Primary

- Physical activity levels using the Short Active Lives Survey: number of participants completing 30 minutes or more of moderate to vigorous physical activity per week at 12 months.

Secondary

- Physical activity: Short Active Lives Survey: number of participants completing 30 minutes or more of moderate to vigorous physical activity per week at 3 or 6 months; total number of minutes of physical activity per week at 3, 6 and 12 months.
- Health Status/Physical wellbeing: EQ-5D-5L (Descriptive System and EQ-VAS);⁴⁰ Short Form Chronic Respiratory Disease Questionnaire (CRQ)⁴¹ at 3, 6 and 12 months.
- Mental wellbeing: 1-item measure from WHOQOL-BREF questionnaire (used across all Movement for All projects) at 3, 6 or 12 months.

Sample size

Anticipating a loss of 20% of participants to follow-up over a period of 12 months, it was estimated that 73 participants in Active Steps and Control groups would provide a sufficient sample size (at 90% power, 5% significance) to detect 10% increase in the number of Active Steps service users completing 30 minutes or more of moderate to vigorous physical activity per week at 12 months.

Impact data analysis

All analyses were performed using SPSS v27 (IBM Armonk, New York). In line with project aims, the primary approach for evaluation of impact was a “per protocol” efficacy analysis. This referred to the analysis of only those patients who strictly adhered to the project (protocol) including receipt of the intervention for 12 months and/or provided data at the follow-ups i.e., among those who completed the treatment and/or study as planned.

The primary analysis focused on the change in the primary outcome (number of patients reporting at least 30 min of moderate to vigorous physical activity per week) within the Active Steps users and between groups (i.e. Active Steps versus Control) from baseline to 12 months.

Changes at 3 and 6 months in self-reported physical activity were also evaluated to explore shorter-term effects. Analyses of the secondary outcomes (EQ-VAS, total minutes of subjective physical activity, CRQ) looked at the average change in outcomes, from baseline to each of the data collection points (3, 6 and 12 months).

The primary outcome was assessed using binary logistic regression. Given the study design we first identified potential confounders for the outcome of physical activity. A directed acyclic graph (DAG)⁴² was constructed (Appendix 2) to identify the minimal sufficient set of potential confounders for adjusting the effect of Active Steps on physical activity. Based on prior literature (e.g.^{43,44}), baseline differences in demographic or clinical factors between groups in the study and inspection

of the DAG, we identified age, gender, breathlessness severity, diagnosis of diabetes, heart condition or mental health condition and social deprivation as potential confounders of the effect of Active Steps on physical activity. Binary regression models with and without adjustment for these potential confounders were used to estimate the effect (interpreted as an odds ratio) of Active Steps on the number reporting to be physically active at 12 months. This approach was also taken to determine the impact of Active Steps on the number of participants completing 30 minutes or more of moderate to vigorous physical activity per week at 3 or 6 months

The aforementioned approach of “per protocol analysis” is likely to show an exaggerated effect of Active Steps (or rather a “best case” scenario), hence we had plans to consider an intention to treat analysis of physical activity at 12 months, which may better reflect the service as business as usual, exploring “effectiveness” rather than “efficacy”. This would involve the inclusion of all who provided baseline data to the study regardless of whether they adhered to the intervention. This approach was limited by lack of Active Steps service users providing data at 12 months. In an attempt to support the intention to treat analysis, BLF sent a letter to all service users prior to the follow-up at 12 months to encourage completion. This was only partly successful in engaging service users who had withdrawn from the service to come forward to provide data at 12 months. The analysis with the additional small number of participants (service withdrawals) who did provide data at 12 months was performed. However, due to the level of missing data in Active Steps service users, a full application of intention to treat analysis was not possible and the imputation of data was deemed unwise.

The effect of Active Steps in changes from baseline at 3, 6 or 12 months in the secondary outcomes of total minutes of physical activity and self-perceived health (EQ-VAS) were assessed using logistic regression with or without adjustment for the potential confounders in accordance with the primary outcome. The potential confounders for the outcome of self-perceived health (EQ-VAS) were considered similar to that of physical activity (see DAG in Appendix 2). Analysis of the effect of Active Steps on self-perceived health (EQ-VAS) was performed with or without adjustment for the potential confounders.

Descriptive statistics of the EQ5D profile of Active Steps and Control at all follow-up were performed in accordance with published methods and reporting of EQ5D data⁴⁵ Briefly, this involved: descriptive (cross-sectional) summary of health by dimension and level in study groups at baseline; descriptive summary of changes in health from baseline to 3, 6 and 12 months by dimension and level in study groups; descriptive summary of changes in health from baseline to 3, 6 and 12 months in study groups using profile data called the Paretian Classification of Health Change.

Long-term changes from (Baseline to 12 months) in CRQ domain scores and the one-item measure from WHOQOL-BREF questionnaire (available in Active Steps group only) were assessed using paired t-tests. The short to medium changes (from baseline to 3 and 6 months) in CRQ domain scores (available in Active Steps only) were assessed using one way repeated measures analysis of variance followed by post-hoc paired t-tests.

ii) Process evaluation

Throughout the delivery phase of Active Steps, a process evaluation on the feasibility, acceptability and practicability of the service to both service users and the BLF was conducted.

The process evaluation was undertaken in line with the Medical Research Council guidelines for complex interventions.⁴⁵ In January 2020, an interim report was produced to BLF with descriptive data relating to aspects of service engagement, recruitment and delivery. Recommendations were provided so that they could be acted upon in the second year of the project. The current report provides more detailed understanding of how and why Active Steps was successful, or not, by considering if the intervention components were delivered as intended (the recruitment processes and the quantity and quality of what was delivered); exploring how the service users interacted and adhered with the intervention and if, and how, participation triggered behaviour change.

Implementation

The quality and quantity of intervention delivery, and the extent to which the intervention reached the target audience was assessed using the following quantitative data:

Reach

- Consent: Number of inactive individuals willing to accept the offer of joining Active Steps
- Recruitment: Number of inactive adults who joined the service each month
- Service engagement: Number of adults who engaged with Active Steps via the different recruitment routes and regions of England

Dose

- Total number of calls per service user
- Average duration of calls

Fidelity

- Number of successful screening and intervention calls.

To further evaluate fidelity to the intervention, a member of the evaluation team listened to a random sample (5%) of audiotaped telephone calls between the Active Steps team and service users. Checklists were used to assess fidelity to planned intervention including adherence to motivational interviewing principles and behaviour counselling techniques. Conversations were coded according to the Motivational Interviewing Treatment Integrity (MITI) coding sheet,^{46,47} and Behaviour Change Counselling Index (BECCI).⁴⁸

The MITI is comprised of two components: global scores and the behaviour counts. The global scores capture the coder's overall judgment about the four dimensions: Cultivating Change Talk, Softening Sustain Talk, Partnership, and Empathy on a 1-5 Likert scale. Each recording was given a Technical Global score based on the average rating for the components Cultivating Change Talk and Softening Sustain Talk. A Relational Global score was derived from the average ratings to the components Partnership and Empathy.

The behaviour counts component of the MITI are intended to capture specific practitioner behaviours that are relevant to good practice of Motivational Interviewing. Based on the counts of interviewer behaviours that were tallied during the calls, the percentage of Complex Reflections (of all Reflections) and the ratio of Reflections to Questions were computed for each recording. Based on expert opinion, the manual for MITI 4.2.1 reports thresholds for Fair (Technical Global =3, Relational Global =4, % Complex Reflection = 40% and Reflections:Questions = 1:1) and Good (Technical Global = 4, Relational Global = 5, % of Complex Reflections = 50% and Reflections:Questions = 2:1) Motivational Interviewing practice.

For BECCI, a practitioner score was calculated for each recording as the average rating of all completed questionnaire items rated on a Likert scale of 1-4 (0=Not at all, 1=Minimally, 2=To some extent, 3=A good deal, and 4=A great extent). An indicator of health coach talk time was also reported for each call (More than 50% of the time; About 50% of the time; Less than 50% of the time).

Qualitative methods were also used to better understand facilitators and barriers to implementation and gain key insight into how the health coaching intervention might be scaled-up or transferable after the project. The following subgroups were interviewed: those who received very brief advice by the BLF Helpline but declined the offer to join Active Steps Service or those who initially accepted but later withdrew from Active Steps (see topic guide in Appendix 3). Interview participants were purposefully sampled to ensure maximum variation in sociodemographic variables and disease characteristics. Interviews took place between the evaluation team and patients via telephone.

These interviews were supplemented by semi-structured interviews with 10 BLF staff who were involved in project delivery (see topic guide in Appendix 3). Staff interviews were conducted at multiple timepoints to capture changes in implementation (e.g. staff practice) and contextual factors (e.g. season, location) over time.

Mechanisms of impact

Exploring the mechanisms through which Active Steps brought about any change in physical activity was crucial for understanding both how impact on service users occurred and how these effects might be replicated in the future or transferred to other long-term conditions.

At 3 months, 6 months and 12 months, service users were asked to report on the types of physical activity performed during the follow-up period.

Domains or sources of potential behaviour change (i.e. physical activity) that were targets of the Active Steps service (Table 1, page 12 and 13) were assessed in service users at baseline, 3 months, 6 months and 12 months. The following measures were used:

- Sport England's self-efficacy one-item measure from Sport England's question bank
- Bespoke COM-B Questionnaire for assessing individual's capability, opportunity and motivation

These quantitative data were again supplemented by qualitative methods to further understand the pathways of impact of Active Steps and/or to identify unexpected mechanisms. A subgroup of 10 Active Steps service users (who complied with the intervention calls) was invited to take part in a semi-structured interview (see topic guide in Appendix 3).

Interview participants were purposefully sampled to ensure maximum variation in sociodemographic variables, disease characteristics and level of engagement with support. Interviews took place between the evaluation team and service users via telephone.

Process data analysis

Quantitative measures of fidelity, dose and reach were treated as exploratory and were reported descriptively (means, proportions). The change from baseline to 12 months in service users for the Sport England's self-efficacy measure and the COM-B questionnaire components were assessed using a paired t test. The change in those components from baseline to 3 months and 6 months were assessed using one-way repeated measures analysis of variance followed by post-hoc paired t-tests. The odds of an improvement in self-efficacy or COM-B components increasing the number of Active Steps service users being physically active at 3 months, 6 months and 12 months was explored using unadjusted binary logistic regression.

Audio recordings of all patient and staff interviews were transcribed verbatim. Anonymised transcripts were analysed thematically using inductive coding via NVivo software. A member of the evaluation team coded and analysed all transcripts and a subset (10%) of transcripts were coded independently by another member of the team to ensure rigour and consistency in coding. Identified themes were discussed between the evaluation steering group to enhance credibility (so the results made sense) and transparency (how we reached conclusions) of the analytic process. Qualitative data were analysed iteratively so that themes that emerged in early interviews were explored in later interviews.

iii) Economic evaluation

For the evaluation, economic data were sourced from the two groups of the concurrent cohort study: Active Steps and the independent standard care control group. Incremental analysis was employed to compare, in 2018-19 prices, Active Steps to standard care for adults with chronic lung conditions from the perspective of NHS and personal social services.

For deterministic assessments, the incremental cost-effectiveness ratio (ICER) was estimated as the ratio of the difference in total per person cost to the difference in quality adjusted life year (QALY) per person. Accounting for uncertainty, a nonparametric bootstrap (1000 replications) was performed, from which the cost-effectiveness acceptability curve (CEAC) was estimated for probabilistic assessments.

The main evaluation aimed to utilise the data from as many Active Steps and Control participants as was possible. A focussed subgroup of relevance was adults who considered themselves functionally disabled by breathlessness and awaiting pulmonary rehabilitation, indicated by MRC Dyspnoea grade 3 or higher.

Data

Two instruments were used to collect data from Active Steps service users' participants for the economic evaluation: the EuroQoL® EQ-5D-5L and a bespoke block of questions designed to elicit those NHS resources used to manage their chronic lung condition (see Q55-Q70 of Appendix 1). The same instruments were used in the independent control. Active Steps and Control had scheduled follow-ups at 3, 6 and 12 months beyond baseline for the purpose of gathering data. In neither group was a longer-term post-intervention follow-up scheduled.

There were a number of follow-up protocol variations resulting in missing data and mistimed follow-ups, largely due to disruptions brought about by the COVID-19 pandemic. Both variations impacted

cost calculations and QALY. For it created periods of gap and overlap in participant records, arising because self-reported use of health resource were subject to fixed recall periods of lengths up to 3 months prior to baseline, 1st and 2nd follow-ups, and up to 6 months prior to the 3rd follow-up. An illustrative example of timelines is given in Figure 3 showing that despite the timing of the three follow-ups lasting a period more than a year beyond baseline, the period of cost recall for this participant is a fraction of one year due to gap and overlap.

In a period of gap, usage of health resources was missing and so we removed this period when calculating costed recall years. When an overlap was created an imputation was used in order to mitigate the problem of double-counting of costs, this is because dates on which health resources were used were not part of the data collection: the participant's cost of the current follow-up period was reduced by the cost in the prior period uniformly apportioned for the duration of the overlap.

Finally, one participant from the Control group was recorded with total costs exceeding £50,000 in a follow-up period due to a severe exacerbation of COPD that resulted in 14 days of overnight stay in hospital ward and 32 days in intensive care during winter 2020. Their baseline demographics were similar to those of the other participants in the evaluation (white female of 65 years, index of multiple deprivation decile 2, diagnosis of COPD and asthma along with 4 other comorbidities, not an oxygen user, MRC breathlessness score of 4), but baseline health-related utility score -0.116 and EQ-VAS score of 25 were amongst the lowest. Their cost data were designated a study outlier and analyses were adjusted by presenting results with and without their data included.

Resource use

NHS resources used by participants included GP visits and prescription medicines, hospitalisations, outpatient visits, ED attendances, and interactions with other health care professionals such as dieticians, and hospice care. Unit costs, expressed in 2018-19 prices, were attached to these using information from Personal Social Services Research Unit (PSSRU)⁴⁹ and online NHS sources.^{50,51} Any prior period costings were inflated to 2018-19 prices using the NHS Cost Inflation Index.⁵⁰ The schedule of unit costs is given in Appendix 4.

The cost of Active Steps (£153) was derived from the BLF staff cost of phone calls to all service users, supply of pedometers, participant welcome pack, postage and staff training. Full-time staff costs were not included because it was assumed existing employees of BLF would administer the service in the future or include NHS nurses trained by BLF staff.

Additional information on unit cost was sought for participant oxygen usage and in the first instance, the main companies supplying oxygen to NHS contracts were approached to get a better idea on the annual costs of masks, tubes, cylinders and the gas itself. This proved unhelpful; however, a brief literature search revealed a peer-reviewed precedent⁵² and their estimate of cost in 2012-13 prices was inflated to 2018-19 prices.

EQ-5D

A health-related utility score was assigned to EQ-5D-5L responses using the NICE-recommended crosswalk algorithm.⁵³ If death was reported, a score of zero was imputed from the halfway point of the follow-up period in which the participant died. Provided baseline score and at least one follow-up score were available, participant contributions to total QALY were constructed using area under the curve (AUC). Life years of involvement by participant was set to the length of time from baseline until the date on which the last observed EQ-5D response was taken. End point corrections to QALY were imputed if the scheduled 3rd follow-up was held more than 12 months beyond baseline.

Deviation to original evaluation protocol

- **Active Steps Service:** The Active Steps service was launched at the end of January 2019, with an original recruitment target of 200 service users by October 2019. By October 2019, the British Lung Foundation Active Steps had enrolled 125 service users. The recruitment period was extended until 31 March 2020 with a further 41 service users enrolled. As the funding period for the Active Steps service ended in October 2020, participants who were enrolled into the service during the extended recruitment window only provided data for the follow-up at 3 and 6 months of the evaluation. Therefore the evaluation at 12 months was only based on a pool of 125 Active Steps service users.
- **Impact of COVID-19:** The evaluation intended to measure changes in device measured moderate to vigorous physical activity (via an accelerometer ActiGraph wGT3X-BT) as a secondary outcome at the 12 months follow-up in a subset of Active Steps service users and all control group participants. Due to the COVID-19 pandemic, collection of this secondary outcome was not completed. The significant delays in delivery and return of post in England that were met during this period and a large proportion of participants being clinically extremely vulnerable people to COVID-19 (and hence a need to shield) this data collection was not feasible. Baseline data on self-reported (Short Active Lives Survey) and accelerometer derived (ActiGraph wGT3X-BT) physical activity in all control participants is presented in Appendix 5. These data were analysed in order to determine the agreement between the two approaches in measuring physical activity in adults with lung conditions.

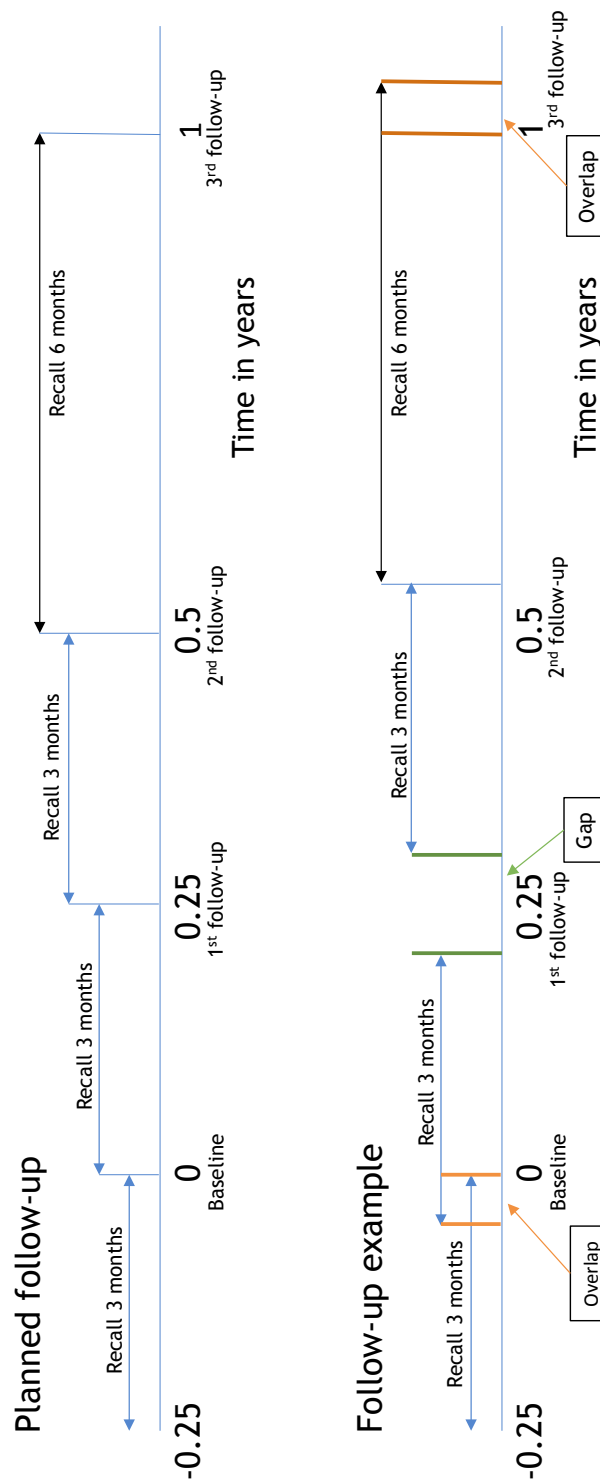
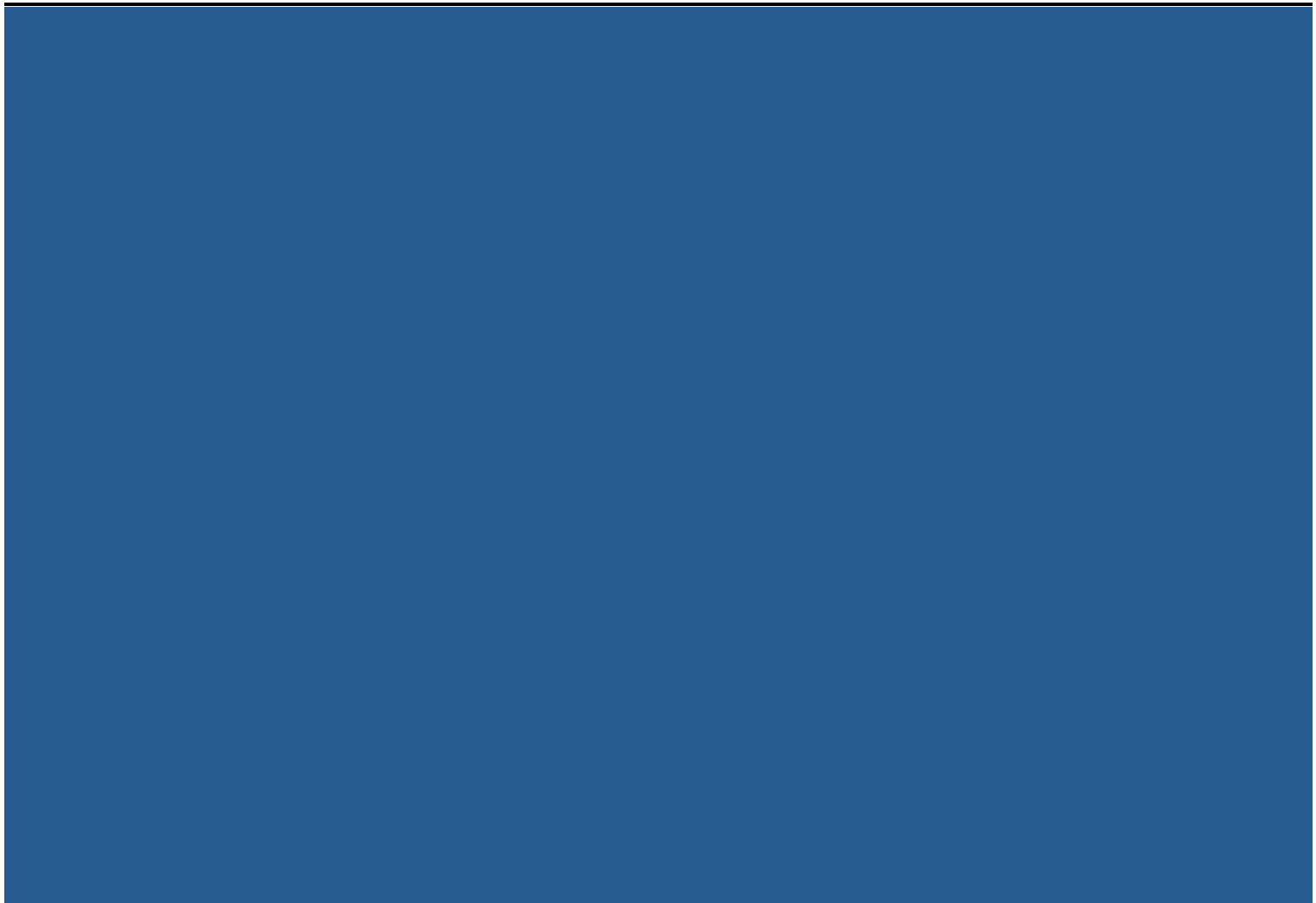


Figure 3. Example of a participant follow-up for economic data against planned protocol. Typical observed timeline causing overlap and gap: 1st follow-up earlier than scheduled, 2nd and 3rd follow-ups later than scheduled.

Results: Impact evaluation



Key points

- Active Steps increased the number of adults physically active:
 - at 12 months but this effect was only statistically significant when unadjusted for potential confounders
 - at 3 months and 6 months, which was statistically significant when unadjusted and adjusted for potential confounders.
- Active Steps improved self-perceived health:
 - at 12 months, which was only statistically significant when unadjusted for potential confounders
 - at 3 months, which was statistically significant when unadjusted and adjusted for potential confounders.
- Active Steps service users' reported statistically significant and clinically meaningful improvements in dyspnoea, fatigue, emotional function, and mastery at all follow-ups (except for mastery at 6 months).
- Active Steps services users reported statistically significant improvements in quality of life at 3 months, 6 months and 12 months.



Participants

Baseline data were collected on 166 Active Steps service users and a concurrent control group of 80 participants for the evaluation. Service users who provided baseline data by October 2019 were included in the evaluation of impact at 12 months (n= 124), whereas impact on outcomes at 3 and 6 months included all service users. The baseline characteristics are provided in Table 2.

Compared to the Control group, Active Steps group had a statistically significant:

- greater proportion of females when considering service users recruited up to October 2019 (p=0.004) and March 2020 (p=0.01)
- older age, with the average difference being 6.6 (95% confidence intervals (CI), 3.3-9.8) and 5.6 (95% CI, 2.6-8.5) years for those recruited up to October 2019 (p<0.001) and March 2020 (p<0.001) respectively.
- greater proportion of people reporting a mental health condition when considering service users recruited up to October 2019 (p=0.037) and March 2020 (p=0.034).
- lower proportion reporting a heart condition when considering service users recruited up to October 2019 (p=0.016) and March 2020 (p=0.004).
- lower proportion reporting a diagnosis of diabetes when considering service users recruited up to October 2019 (p=0.008) and March 2020 (p=0.035).

Table 2: Baseline characteristics of Active Steps service users and Control

	Active Steps [recruited up to October 2019]	Active Steps [recruited up to March 2020]	Control
Gender, n (%)			
Female	92 (74)	118 (71)	43 (54)
Male	32 (26)	48 (29)	37(46)
Age, mean± SD	64 ± 12	65 ± 11	70 ± 10
Ethnicity, n (%)			
White	118 (95)	157 (95)	78 (98)
Asian or Asian British	2 (2)	3 (2)	1 (1)
Black or Black British	2 (2)	3 (2)	1 (1)
Mixed	2 (2)	2 (1)	0 (0)
Index of Multiple Deprivation Decile, n (%)			
1 (most deprived)	8 (7)	14 (8)	11(14)
2	12 (10)	17 (10)	8 (10)
3	14 (11)	15 (9)	10 (13)
4	19 (15)	21(13)	7 (9)
5	7 (6)	15 (9)	4 (5)
6	9 (7)	12 (7)	11 (14)
7	12 (10)	18 (11)	10 (13)
8	15 (12)	18 (11)	4 (5)
9	16 (14)	20 (12)	10 (13)
10 (least deprived)	5 (4)	9 (6)	5 (6)
Lung Condition, n (%)			
COPD	79 (64)	111 (67)	60 (75)
Asthma	26 (21)	39 (24)	25 (31)
Bronchiectasis	22 (18)	24 (15)	12(15)
Interstitial lung disease	16 (13)	22(14)	6 (8)
Lung cancer	1 (1)	1 (1)	1 (1)
Other	4 (3)	6 (4)	1 (1)
MRC Dyspnoea Scale, mean± SD	3 ± 1	3 ± 1	3 ± 1
Oxygen Use, n (%)			
None	107 (86)	143 (86)	74 (93)
Long-term oxygen	9 (7)	12 (7)	4 (5)
Ambulatory oxygen	8 (7)	11 (7)	2 (3)
Comorbidities, n (%)			
Arthritis or ongoing back/ joints problem	50 (40)	69(41)	38 (48)
Other long-term condition or disability	45 (36)	61 (37)	20 (25)
Mental health condition	40 (32)	53 (32)	15 (19)
High blood pressure	29 (23)	46 (28)	31(39)
Heart condition	21 (17)	26 (16)	26(33)
Diabetes	11 (9)	19 (11)	18(23)
Cancer diagnosis/treatment (last 5 years)	8 (7)	10 (6)	6 (8)
Kidney or liver disease	7 (6)	10 (6)	6 (8)
Blindness or partial sight	3 (2)	5 (3)	7 (9)
Neurological condition	3 (2)	6 (4)	1 (1)
Learning disability	2 (2)	2 (1)	1 (1)
Stroke which affects your day-to-day life	2 (2)	4 (2)	2 (3)
Dementia	1 (1)	1 (1)	2 (3)

Completeness of follow-up

Of those Active Steps Service users who provided baseline data by October 2019, 55% were followed up for the primary outcome at 12 months. This included 9 service users who had withdrawn from the service. Of the 68 who provided the primary outcome (Short Active Lives Survey), 19 chose not to provide data for the secondary outcomes. For the follow-ups at 3 and 6 months, 51% of all Active Steps service users (n=166, recruited up to March 2020) provided data. The completeness of follow-up for the Control group was 93%, 88% and 60% at 3 months, 6 months and 12 months respectively. For the Control group (see details elsewhere for Active Steps, Figure 6), three participants died during the 12 months. The other Control participants were lost to follow-up. The completeness of follow-up of Active Steps service users and the Control group is presented in Figure 4.

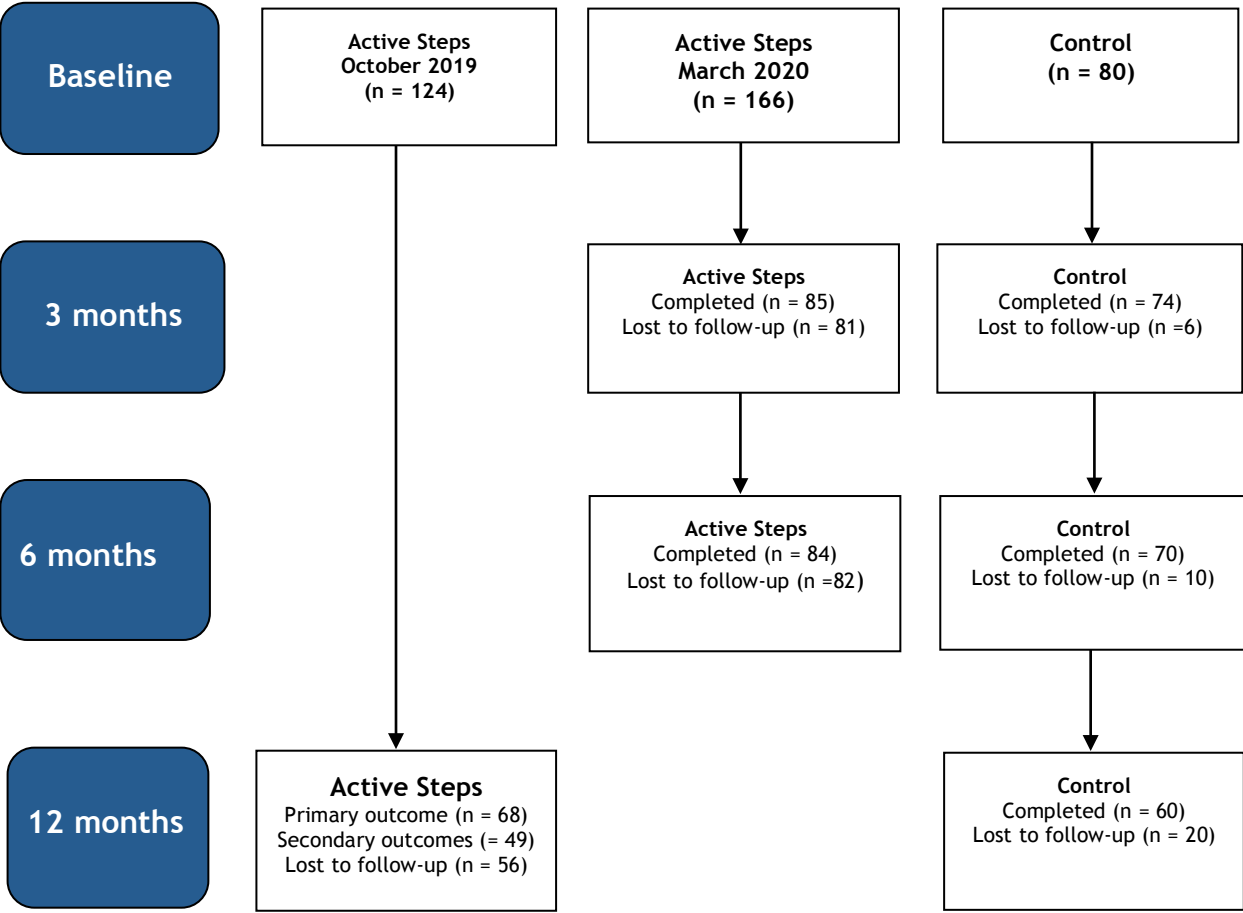


Figure 4. Completeness of follow up of Active Steps service users and control participants during evaluation.

Primary Outcome

Number completing 30 minutes or more of moderate-vigorous physical activity at 12 months

Based on a per protocol analysis, Active Steps increased the number of adults physically active at 12 months but this effect was only statistically significant in the unadjusted model (Unadjusted OR[95% CI]: 2.8[1.3-6.1], $p = 0.011$; Adjusted OR: 2.2[0.9-5.4], $p = 0.097$) (Table 3). The analysis was repeated with an additional 9 service users who withdrew from Active Steps but provided the primary outcome at 12 months. This had minimal impact on the point estimate of effect of Active Steps and the pattern between unadjusted and adjusted estimates (Unadjusted OR[95% CI]: 2.4 [1.1-5.3], $p = 0.023$; Adjusted OR: 2.1[0.9-5.3], $p = 0.105$).

Subgroup analysis within the Active Steps service users, showed that participants who received intervention calls for 6 months or more were more likely to be physically active at 12 months (≥ 6 months: 54% vs < 6 months: 26%, $p = 0.021$).

Secondary Outcomes

Number completing 30 minutes or more of moderate-vigorous physical activity at 3 or 6 months

Active Steps increased the number of adults physically active at 3 months, which was statistically significant when unadjusted and adjusted for potential confounders (Unadjusted OR[95% CI]: 8.3 95% CI, 3.7-18.8, $p < 0.001$; Adjusted OR: 9.1 [3.6-22.5], $p < 0.001$) (Table 3). Active Steps also increased the number of adults physically active at 6 months, which was statistically significant when unadjusted and adjusted for potential confounders (Unadjusted OR: 13.6 95% CI, 5.3 - 34.7, $p < 0.001$; Adjusted OR: 17.3 [5.8-51.4], $p < 0.001$) (Table 3).

Total minutes of moderate-vigorous intensity physical activity per week at 3, 6 or 12 months

Active Steps increased the total minutes of moderate to vigorous physical activity per week at 12 months but this effect was only statistically significant in the unadjusted model (Unadjusted Mean difference(MD)[95% CI]: 52[2-102], $p = 0.041$; Adjusted MD: 48[-9-105], $p = 0.096$) (Table 4). Active Steps increased the total minutes of moderate to vigorous physical activity per week at 3 months (Table 4), which was statistically significant in the unadjusted and adjusted models (Unadjusted MD: 49[14-83], $p = 0.005$; Adjusted MD: 50[13-86], $p = 0.008$). Active Steps increased the total minutes of moderate to vigorous physical activity per week at 6 months, which was statistically significant in the unadjusted and adjusted model (Unadjusted MD: 65[27-103], $p = 0.001$; Adjusted MD: 50[13-86], $p = 0.008$) (Table 4).

Table 3. Number completing 30 minutes or more of moderate intensity physical activity per week in Active Steps and Control groups at each follow-up of the evaluation.

3 months				
	Active n (%)	Inactive n (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Active Steps (n=85)	46 (54)	39 (46)		
Control (n=74)	9 (12)	65 (88)	8.3 (3.7 - 18.8)	9.1 (3.7 - 22.5)
6 months				
	Active n (%)	Inactive n (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Active Steps (n= 84)	47 (56)	37 (44)		
Control (n = 70)	6 (9)	64 (91)	13.5 (5.3 - 35.0)	17.3 (5.8 - 51.4)
12 months				
	Active n (%)	Inactive n (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Active Steps (n= 59)	27 (46)	32 (54)		
Control (n = 60)	14 (23)	46 (77)	2.8 (1.3 - 6.1)	2.2 (0.9 - 5.4)

Table 4. Change in absolute values of moderate to vigorous physical activity (minutes per week) at each follow-up in Active Steps and Control group. Change at 3 months: Active Steps n =85, Control n = 74; Change at 6 months n =84, Control n = 70; Change at 12 months: Active Steps n = 59, Control n = 60). Data shown as mean (95% confidence intervals).

	Active Steps	Control
Change at 3 months, mean (95% CI)		
Moderate to vigorous physical activity (minutes per week)	75 (50 - 100)	26 (4- 48)
Change at 6 months, mean (95% CI)		
Moderate to vigorous physical activity (minutes per week)	100 (69 - 132)	25 (-3 - 55)
Change at 12 months, mean (95% CI)		
Moderate to vigorous physical activity (minutes per week)	91 (45 - 137)	34 (13 - 56)

EQ-5D-5L

EQ-VAS

12 months:

Active Steps improved self-perceived health at 12 months, but this effect was only statistically significant in the unadjusted model (Unadjusted MD: 13 [3-23], $p=0.011$; Adjusted MD: 7 [-5-18], $p=0.272$) (Table 5).

3 and 6 months:

Active Steps improved self-perceived health at 3 months, which was statistically significant when unadjusted and adjusted for potential confounders (Unadjusted MD: 10 [2 - 17], $p = 0.011$; Adjusted MD: 9 [1-17], $p=0.026$) (Table 5). The effect of Active Steps on self-perceived health at 6 months was not statistically significant when unadjusted or adjusted for potential confounders (Unadjusted MD: 5 [-2-12], $p=0.164$; Adjusted MD: 6 [2-14], $p=0.026$) (Table 6).

EQ-5D descriptive system

The main objective of the EQ-5D-5L data was to contribute health profiles for the cost-effectiveness analysis (see Results: Economic evaluation). Descriptive summaries of responses to the EQ-5D by dimension and level as well as changes in health over time for Active Steps and the Control group are presented in Table, 6, 7 and 8. At baseline, a greater number of Active Steps service users reported some problems across all dimensions of the EQ-5D (Table 6). Exploration of changes in responses between groups at 3, 6 and 12 months suggested Active Steps mostly improved the mobility of service users (Table 7). Whilst the proportion of Active Steps service users reporting any problems was greater than the Control group throughout the evaluation; in those who reported any problems, a greater proportion of Active Steps improved in their overall Health State according to the Paretian Classification of Health Change at 3, 6 and 12 months (Table 8).

Table 5. Changes in EQ-VAS at each follow-up in Active Steps and Control group. Change at 3 months: Active Steps $n=85$, Control $n=74$; Change at 6 months $n=84$, Control $n=70$; Change at 12 months: Active Steps $n=49$, Control $n=60$. Data shown as mean (95% confidence intervals).

	Active Steps			Control		
	Change at 3 months ($n = 85$)	Change at 6 months ($n = 84$)	Change at 12 months ($n = 49$)	Change at 3 months ($n = 74$)	Change at 6 months ($n = 70$)	Change at 12 months ($n = 60$)
EQ-VAS	11.3 (6.2-16.2)	11.2 (6.9-15.5)	15.2 (7.3-23.1)	1.7 (-3.7-7.2)	6.2 (0.3-12.1)	2.0 (-4.7-8.6)

Table 6: Responses to the EQ-5D-5L for the Active Steps and Control group at baseline. Data shown as n (% of group).

Dimension/Level	Active Steps [recruited up to October 2019]	Active Steps [recruited up to March 2020]	Control
Mobility			
1	23 (19)	32 (19)	24 (30)
2	32 (26)	39 (24)	12 (15)
3	50 (40)	67 (40)	26 (33)
4	19 (15)	27 (16)	16 (20)
5	0 (0)	1 (1)	0 (0)
Total ^a	124 (100)	166 (100)	78 (100)
Number reporting some problems ^b	101 (81)	134 (81)	54 (70)
Self Care			
1	48 (39)	63 (38)	43 (54)
2	39 (32)	48 (29)	13 (16)
3	29 (23)	43 (26)	16 (20)
4	7 (6)	10 (6)	5 (6)
5	1 (1)	2 (1)	1 (1)
Total ^a	124 (100)	166 (100)	78 (100)
Number reporting some problems ^b	76 (61)	103 (62)	35 (46)
Usual Activities			
1	5 (4)	9 (5)	24 (30)
2	35 (28)	45 (27)	22 (28)
3	44 (36)	59 (36)	19 (24)
4	27 (22)	33 (20)	12 (15)
5	13 (11)	20 (12)	1 (1)
Total ^a	124 (100)	166 (100)	78 (100)
Number reporting some problems ^b	119 (96)	157 (95)	54 (70)
Pain/Discomfort			
1	22 (18)	27 (16)	24 (30)
2	40 (32)	52 (31)	15 (18)
3	45 (36)	58 (35)	23 (29)
4	16 (13)	28 (17)	14 (18)
5	1 (1)	1 (1)	2 (3)
Total ^a	124 (100)	166 (100)	78 (100)
Number reporting some problems ^b	102 (82)	139 (84)	54 (70)
Anxiety/Depression			
1	29 (23)	34 (21)	37 (46)
2	44 (36)	56 (34)	17 (21)
3	31 (25)	48 (29)	18 (23)
4	14 (11)	18 (11)	5 (6)
5	6 (5)	10 (6)	1 (1)
Total ^a	124 (100)	166 (100)	78 (100)
Number reporting some problems ^b	98 (77)	132 (79)	41 (54)

^aTotal number in group who provided responses, there were two participants who were recruited who did not provide data at baseline in the control group.

^bSome problems = Level 2 + 3 + 4 + 5

Table 7: Descriptive statistics of responses to each of the EQ-5D-5L dimensions in the Active Steps and Control group at 3 months, 6 months and 12 months. Change at 3 months: Active Steps n=85, Control n=75; Change at 6 months: Active Steps n=84, Control n=70; Change at 12 months: Active Steps n=49, Control n=60). Data shown as n (% of group).

Dimension/Level	Active Steps			Control		
	3 months	6 months	12 months	3 months	6 months	12 months
Mobility						
1 (no problems)	16 (19)	25 (30)	18 (37)	23 (31)	28 (40)	21 (35)
2	29 (34)	16 (19)	10 (20)	10 (13)	11 (16)	11 (18)
3	25 (29)	23 (27)	15 (31)	24 (32)	18 (26)	15 (25)
4	15 (18)	20 (24)	6 (12)	18 (24)	13 (19)	13 (22)
5 (unable to)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total number reporting ^a	85 (100)	84 (100)	49 (100)	75 (100)	70 (100)	60 (100)
Number reporting some problems ^b	69 (81)	59 (70)	31 (63)	52 (69)	42 (60)	39 (65)
Self Care						
1 (no problems)	44 (52)	45 (54)	32 (65)	43 (57)	46 (66)	48 (68)
2	21 (25)	16 (19)	11 (22)	12 (16)	10 (16)	12 (20)
3	17 (20)	19 (23)	5 (10)	17 (23)	9 (20)	5 (8)
4	3 (3)	4 (5)	1 (1)	3 (4)	1 (6)	1 (2)
5 (unable to)	0 (0)	0 (0)	0 (0)	0 (0)	4 (1)	1 (2)
Total number reporting ^a	85 (100)	84 (100)	49 (100)	75 (100)	70 (100)	60 (100)
Number reporting some problems ^b	41 (48)	39 (46)	17 (35)	32 (43)	24 (34)	19 (32)
Usual Activities						
1 (no problems)	20 (24)	19 (23)	14 (29)	29 (39)	34 (49)	30 (50)
2	29 (34)	27 (32)	16 (33)	12 (16)	8 (11)	7 (12)
3	27(32)	25 (30)	12 (25)	19 (25)	16 (23)	12 (20)
4	6 (7)	6 (7)	2 (4)	11 (15)	7 (10)	5 (8)
5 (unable to)	3 (4)	7 (8)	5 (10)	4 (5)	5 (7)	6 (10)
Total number reporting ^a	85 (100)	84 (100)	49 (100)	75 (100)	70 (100)	60 (100)
Number reporting some problems ^b	65 (76)	65 (77)	35 (71)	46 (61)	36 (51)	30 (50)
Pain/Discomfort						
1 (no pain)	25 (29)	20 (24)	12 (25)	18 (24)	25 (36)	16 (27)
2	26 (31)	21 (25)	19 (39)	21 (28)	8 (11)	12 (20)
3	23 (27)	35 (42)	11 (22)	24(32)	26 (37)	21 (35)
4	7 (8)	7 (8)	5 (10)	10 (13)	9 (13)	9 (15)
5 (extreme pain)	4 (5)	1 (1)	2 (4)	2 (3)	2 (3)	2 (3)
Total number reporting ^a	85 (100)	84 (100)	49 (100)	75 (100)	70 (100)	60 (100)
Number reporting some problems ^b	60 (71)	102 (76)	37 (76)	57 (76)	45 (64)	44 (73)
Anxiety/Depression						
1 (not anxious or depressed)	28 (33)	26 (31)	20 (41)	39 (52)	39 (56)	36 (60)
2	25 (29)	27 (32)	13 (27)	15 (20)	12 (17)	6 (10)
3	21 (25)	21 (25)	13 (27)	9 (12)	13 (19)	13 (22)
4	8 (9)	3 (4)	1 (2)	10 (13)	5 (7)	4 (7)
5 (extremely anxious or depressed)	3 (3)	7 (8)	2 (4)	2 (6)	1 (1)	1 (2)
Total number reporting ^a	85 (100)	84 (100)	49 (100)	75 (100)	70 (100)	60 (100)
Number reporting some problems ^b	57 (67)	58 (69)	29 (59)	36 (48)	31 (44)	24 (40)

^aTotal number in group who provided responses, two participants who were recruited for the control group did not provide data at baseline

^bSome problems = Level 2 + 3 + 4 +5

Table 8. Changes in Health State according to the Pareian Classification of Health Change (PCHC), taking account of those with no problems as measured by EQ-5D. Change at 3 months: Active Steps n=85, Control n= 74; Change at 6 months: Active Steps n=84, Control n=70; Change at 12 months: Active Steps n=49, Control n=60).

	Active Steps	Control
3 months		
<i>Number with problems (% of those with problems)</i>		
No change	1 (1)	2 (3)
Improve	32 (39)	20 (31)
Worsen	16 (20)	18 (28)
Mixed change	33 (40)	25 (39)
Total with problems	82 (96)	65 (87)
No problems	3 (4)	10 (13)
6 months		
<i>Number with problems (% of those with problems)</i>		
No change	3 (4)	6 (10)
Improve	29 (35)	16 (28)
Worsen	14 (17)	16 (28)
Mixed change	36 (44)	20 (35)
Total with problems	82 (98)	58 (83)
No problems	2 (2)	12 (17)
12 months		
<i>Number with problems (% of those with problems)</i>		
No change	0 (0)	2 (3)
Improve	19 (41)	13 (26)
Worsen	11 (24)	15 (30)
Mixed change	16 (35)	21 (42)
Total with problems	46 (94)	50 (83)
No problems	3 (6)	10 (17)

No change = Same score at follow-up and baseline; Improved = Follow-up has at least one dimension better than baseline and no worse on any other dimension; Worsen = Follow-up is at least one dimension worse than baseline and is no better in any other dimension; Mixed = Follow-up score is better in at least one dimension, but worse in at least one other.

Chronic Respiratory Disease Questionnaire (CRQ) and World Health Organisation Quality of Life questionnaire (WHOQOL-BREF)

Changes over 12 months

At 12 months, the average changes from baseline in each of the domains of the CRQ were statistically significant and of a magnitude considered to be clinically meaningful. Average ratings improved (Mean (95%CI)) by 0.5 (0.2-1.0, p=0.008), 0.6 (0.2-1.0, p=0.005), 0.8 (0.4-1.2, p<0.001) and 0.5 (0.1-1.0, p=0.026) for dyspnoea, fatigue, emotional function and mastery domains respectively.

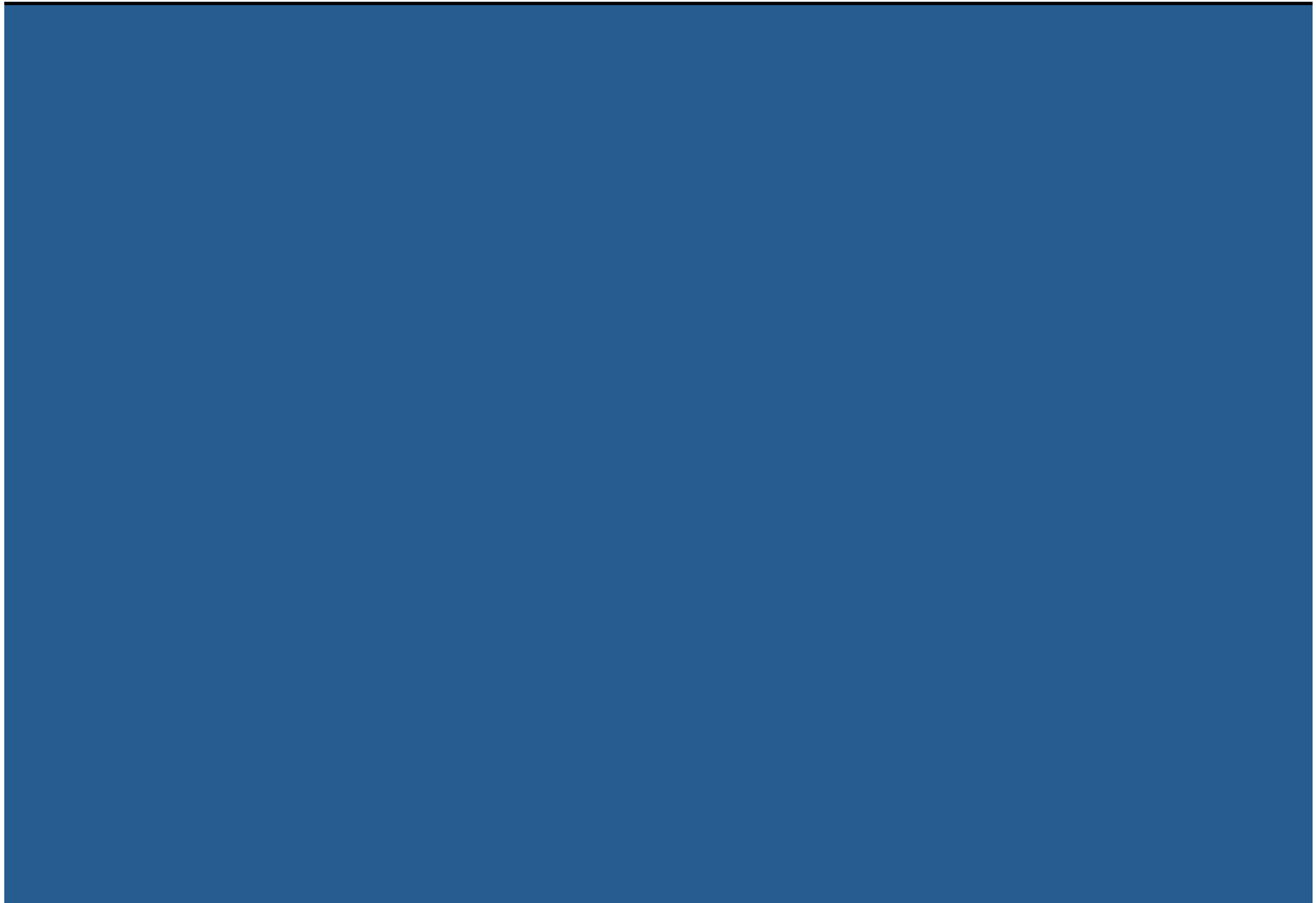
Across all projects of the Movement for All programme (page 6), a one-item question from the WHO quality of life survey was being used as a measure of mental wellbeing. The average change from baseline to 12 months in service users was statistically significant (0.35, 0.01-0.69, p=0.045).

Changes at 3 and 6 months

There was a main effect of time (i.e. statistically significant differences in the time from baseline to 6 months) for dyspnoea ($p < 0.001$), fatigue ($p < 0.001$), emotional function ($p < 0.001$) and mastery ($p = 0.006$) domains of the CRQ and the one-item question from the WHO quality of life survey ($p = 0.01$). Post hoc paired t-tests (with Bonferroni correction) revealed average change from baseline:

- to both 3 months (0.5, 0.1-0.8, $p = 0.014$) and 6 months (0.8, 0.3-1.2, $p < 0.001$) in dyspnoea were statistically significant and clinically meaningful.
- to both 3 months (0.6, 0.2-0.9, $p = 0.002$) and 6 months (0.6, 0.3-1.0, $p < 0.001$) in fatigue were statistically significant and clinically meaningful.
- to both 3 months (0.7, 0.2-1.2, $p = 0.005$) and 6 months (0.9, 0.6-1.3, $p < 0.001$) in emotional function were statistically significant and clinically meaningful.
- was statistically significant and clinically meaningful at 3 months (0.6, 0.1-1.0, $p = 0.007$) but not at 6 months (0.4, 0.1-1.9, $p = 0.147$) in mastery.
- to both 3 (0.34, 0.08-0.60, $p = 0.005$) and 6 months (0.41, 0.11-0.7, $p = 0.003$) in quality of life were statistically significant.

Results: Process evaluation



Key Points

- Over the service delivery period, the Active Steps team:
 - received 1417 enquiries, with 61% first making contact via the BLF website
 - screened 534 people, with 30% deemed eligible and consenting to join the service
 - enrolled 166 service users, with an average of 12 joining per month
 - delivered 888 intervention calls, with an average of 6 calls per service user
 - delivered behaviour change counseling between ‘a good deal’ and ‘a great extent’ during intervention calls.
- Active Steps service users were significantly more likely to be physically active at:
 - 12 months with improved self-efficacy or reflective motivation (plans to be active)
 - 3 months with improved self-efficacy or physical capability
- Key themes from Interviews with service users and BLF staff revealed:
 - Facilitators to physical activity including social support, encouragement and goals
 - Barriers to physical activity including health status or limited confidence and routine
 - Facilitators to implementation including staff training and scheduling of intervention calls
 - Barriers to implementation including helpline referral process and staff workload
 - Improvements to procedures including advertisement, staffing and screening for service
 - Improvements to service welcome pack and psychological support for service users
 - Active Steps fits within wider health services such as pulmonary rehabilitation.



Reach

Over the service delivery period, the Active Steps service pathway (Figure 2) engaged with 1417 individuals (Figure 5), with 61% (n = 864) of these first making contact via a website enquiry.

The BLF set a target of delivering very brief advice to 2000 individuals via the helpline team during the project. Referral of individuals to Active Steps via the helpline, and hence delivery of very brief advice was lower than anticipated at 553 individuals (28% of the original target). The main triggers identified in helpline calls that led to delivery of very brief advice by helpline staff were 'everyday activities' (n=258, 47%) and 'breathlessness' (n=162, 29%). The remaining triggers included 'fitness' (n=53, 10%), 'frequent exacerbations' (n=23, 0.04%), 'multiple conditions' (n=11, 0.02%), 'loss of strength' (n=10, 0.02%), 'lung function' (n=6, 0.01%) and 'social isolation' (n=2, 0.003%). The reasons for the remaining 28 deliveries were not recorded. Following delivery of very brief advice, 56% (n=145) accepted referral to a screening call for Active Steps.

A total of 1422 screening calls for Active Steps were attempted following website enquiry or helpline referral, of which 55% (n=781) were successful. The other 45% (n=641) of individuals did not answer their phone to complete the screening call or were busy at the time of the screening call. The average time taken to successfully complete screening was 27.5 (± 20) minutes.

Of the 534 individuals who were successfully screened for the Active Steps service (some of which required more than one call), 30% (n=166) were eligible for the service and consented for the evaluation. Others screened included those who were already active (30%, n=162) and were inactive but not interested (4%, n=22).

Of the 166 who joined Active Steps, 18% (n= 30) and 82% (n=136) first contacted BLF via the helpline and website respectively. A map to report the location of all Active Steps service users in England is presented in Figure 5. An average of 12 (± 9) people joined the service each month but this ranged from 3 to 38.



Figure 5. Map of Active Steps participation across England

Intervention Fidelity

On average it took 16 (\pm 9) days for the first intervention call to take place following enrolment on to the service. Throughout the service delivery period, a total of 999 calls were attempted, with 883 (88%) of these successful. For Active Steps service users, the adopted schedule of intervention calls with their health coaches differed to the anticipated phasing of calls (fortnightly calls during first 3 months, monthly calls from month 4-6 and then bimonthly calls thereafter). Although the average duration of time from enrolment to intervention calls 1 and 2 were 17 (\pm 12) and 19 (\pm 19) days respectively, after this point the average duration of days between intervention calls was typically 30-40 days.

The Technical and Relational Global scores of MITI for the random sample ($n=44$) of recordings were 4.1 (\pm 0.6) and 4.2 (\pm 0.7) respectively. The average proportion of Complex Reflections in the recorded calls was 46% and the typical ratio of Reflections to Questions was 1:1. The mean BECCI practitioner score for these recordings was 3.5 (\pm 0.3), indicating that the Active Steps team were delivering behaviour change counselling between 'a good deal' and 'a great extent'. The Active Steps team spoke for about 50%, or less than 50% of the call, for all calls.

A comparison of scores for Technical Global, Relational Global and BECCI practitioner score revealed no statistically significant differences ($p<0.05$) between the two health coaches of the Active Steps team involved in delivery of calls.

Intervention Dose

The number of intervention calls received per service user ranged from 1 to 22 over 12 months with an average across all current service users of 6 (\pm 4) calls each. For these intervention calls, the average duration of each intervention call per participant was 31 minutes (\pm 7). Of the 166 service users who joined Active Steps, 26% ($n=43$) lost contact with the service or withdrew from the service. The timing of these and the reasons for withdrawals are displayed in Figure 6. The most common were health or personal reasons but some did withdraw because they felt motivated to be active.

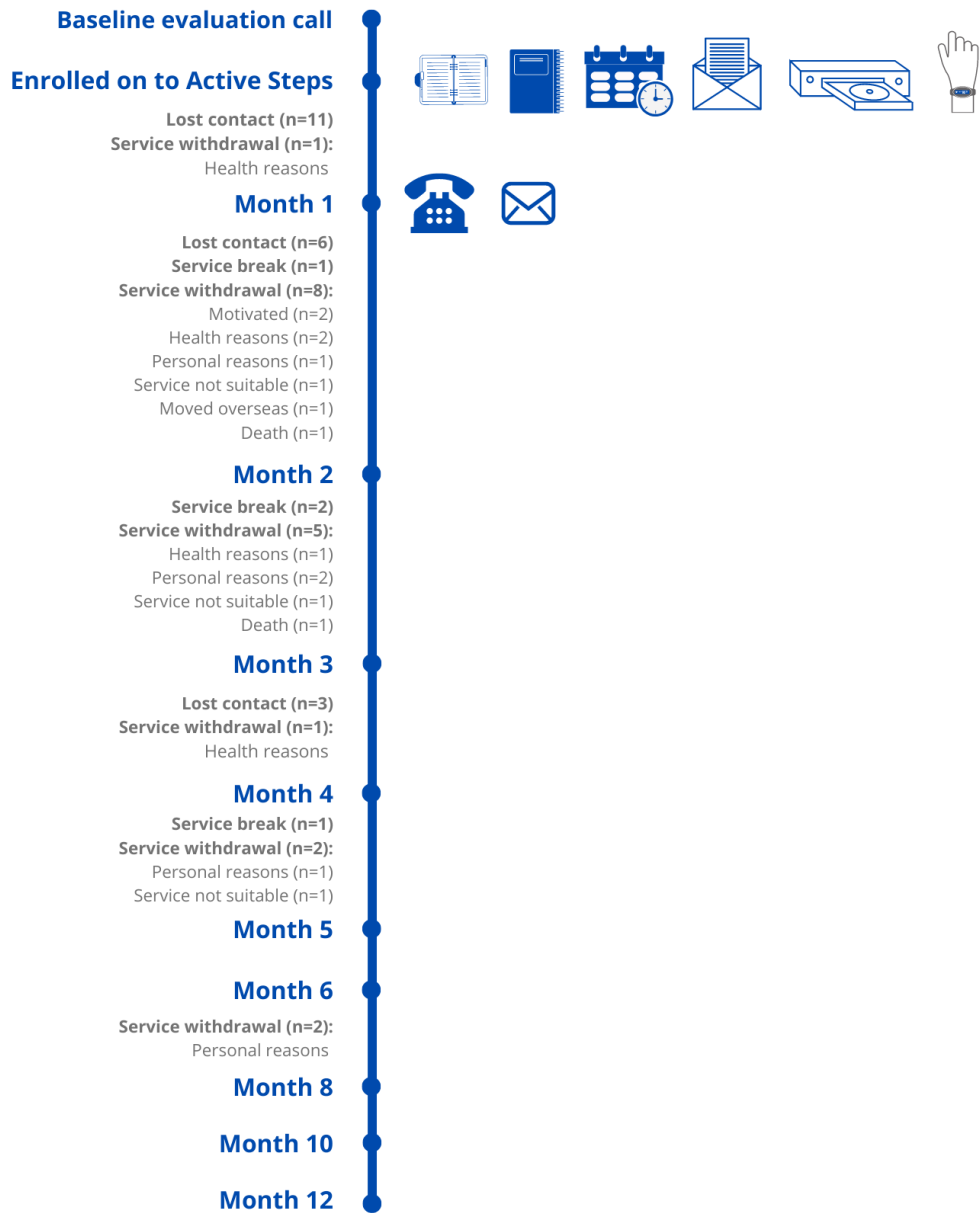


Figure 6. Service user attrition in Active Steps

Mechanisms of impact

Type of physical activity

The level of participation in a range of physical activities in service users at 3 months, 6 months and 12 months is provided in Table 9. The most common activities across all follow-ups were home activity, walking, self-care and conditioning. At all follow-ups, more than 1 in 5 service users were accessing pulmonary rehabilitation.

Self-efficacy (Sport England's self-efficacy one-item measure) and Capability, Opportunity and Motivation (COM-B) questionnaire

Long-term changes (over 12 months)

A secondary objective of Active Steps delivery plan was to increase self-efficacy in at least 60% of the participants at 12 months. Sport England's self-efficacy one-item measure is referred to as an individual development outcome in Sport England funded projects. At 12 months, 50% of the participants have increased their self-efficacy. The average change from baseline to 12 months in service users was statistically significant (0.6, 0.2-1.0, $p=0.002$).

The behavioural model, COM-B, outlines that behaviour change occurs from an interaction of 'capability' to perform the behaviour and 'opportunity' and 'motivation' to carry out the behaviour. Each of these components are further split as physical capability, psychological capability, social opportunity, physical opportunity, reflective motivation and automatic motivation. Active Steps was developed with specific intervention functions and behaviour change techniques to target a change in physical activity via modification of these components.³⁹

The average changes from baseline to 12 months in service users were statistically significant for physical capability (0.6, 0.2-1.0, $p=0.006$) psychological capability (0.8, 0.4-1.2, $p=0.001$) social opportunity (0.4, 0.02-0.7, $p=0.034$) reflective motivation (making plans to be active) (0.8, 0.5-1.1, $p<0.001$) and automatic motivation (1.1, 0.6-1.5, $p<0.001$) (Table 10). The average changes from baseline to 12 months in physical opportunity (both time and opportunities to be active), and reflective motivation (important to be active) were not statistically significant ($p>0.05$) (Table 10).

These measures of self-efficacy and COM-B components were further explored to assess their association with the number of Active Steps services users completing 30 minutes or more of moderate to vigorous physical activity at 12 months. Service users who achieved a 1 point or more improvement in self-efficacy (OR 7.3, 2.0-26.1, $p=0.002$) or reflective motivation (making plans to be active) (OR 6.3, 1.8-21.6, $p=0.004$) were significantly more likely to be physically active at 12 months than those with no improvement in those components (Table 12).

Short-term changes: 3 and 6 months

There was a main effect of time for self-efficacy ($p=0.001$), physical capability ($p=0.012$), psychological capability ($p=0.004$), social opportunity ($p=0.007$), reflective motivation (plans to be active ($p<0.001$) and automatic motivation ($p<0.0001$)). There was no main effect of time (i.e. Active Steps) on changes from baseline to 3 or 6 months in physical opportunity (both physical opportunities and time to be active) or reflective motivation (importance to be active ($p > 0.05$)). Post hoc paired t-tests (with Bonferroni correction) revealed the average changes from baseline (Table 11) were statistically significant at:

- both 3 months (0.5, 0.1-0.9, $p=0.009$) and 6 months (0.5, 0.2-0.9, $p=0.003$) in self-efficacy.
- both 3 months (0.4, 0.001-0.9, $p=0.049$) and 6 months (0.5, 0.1-1.0, $p< 0.015$) in social opportunity
- both 3 months (0.7, 0.3-1.1, $p< 0.001$) and 6 months (0.6, 0.2-1.0, $p<0.001$) reflective motivation (plans to be active).
- both 3 months (1.2, 0.7-1.6, $p< 0.001$) and 6 months (1.4, 1.0-1.8, $p <0.001$) in automatic motivation.
- 3 months (0.5, 0.04-0.9, $p=0.026$) but not 6 months (0.4, 0.2-0.8, $p=0.066$) in physical capability
- 6 months (0.6, 0.1-1.1, $p<0.001$) but not at 3 months (0.5, -0.001-0.9, $p=0.05$) in psychological capability

The measures of self-efficacy and COM-B components were further explored to assess their association with the number of Active Steps services users completing 30 minutes or more of moderate to vigorous physical activity at 3 or 6 months. Service users who achieved a 1 point or more improvement in self-efficacy (OR 7.3, 2.0-26.1, $p=0.002$) or physical capability (OR 6.3, 1.8-21.6, $p=0.004$) were significantly more likely to be physically active at 3 months than those with no improvement in those components (Table 12). At 6 months, the only measure, which was a significant predictor of completing 30 minutes or more of moderate to vigorous physical activity at 12 months, was self-efficacy (OR 7.3, 2.0-26.1, $p=0.002$) (Table 12).

Table 9. Service users' involvement in physical activities classified according to the adult compendium of physical activities or relevant management of lung conditions (e.g. NHS programmes)

Type of PA	3 months (n =86)	6 months (n = 82)	12 months (n=67)
Home activity (e.g. cleaning, vacuuming, laundry)	74 (86)	70 (85)	60 (90)
Walking	65 (76)	64 (78)	54 (81)
Self Care (e.g. showering, dressing)	61 (71)	64 (78)	58 (87)
Conditioning (e.g. video exercises, resistance training)	44 (51)	38 (46)	29 (43)
Home repair (e.g. washing car, carpentry)	20 (23)	19 (23)	22 (33)
NHS programmes (e.g., Pulmonary Rehabilitation)	18 (21)	20 (24)	15 (22)
Lawn and garden	34 (21)	29 (35)	37 (55)
Cycling	11 (13)	9 (11)	8 (12)
Dancing	11 (13)	9 (11)	9 (13)
Water Sports (e.g. swimming)	8 (9)	6 (7)	6 (9)
Sports (e.g. bowling, golf)	7 (8)	9 (11)	4 (6)
Running	1 (1)	1 (1)	1 (2)
Singing	1 (1)	0 (0)	1 (2)

Table 10. Changes in measures of self-efficacy, capability, opportunity and motivation in Active Steps service users over 12 months.

Domain/Component		Baseline Mean (95% CI)	12 months Mean (95% CI)
Sport England self-efficacy one item measure (n=48)	To what extent do you agree with the statement 'I can achieve most of the goals I set myself'?	2.9 (2.5 -3.3)	3.5 (3.2 -3.82)
COM-B questionnaire (n=49)			
Physical capability	I am physically capable of being active	2.7 (2.2 - 3.1)	3.3 (2.9- 3.6)
Psychological capability	I know how to overcome the barriers which stop me from being active	3.1 (2.7 - 3.5)	3.9 (3.6- 4.2)
Physical opportunity	There are opportunities for me to be active either at home or near to where I live	4.2 (3.9-4.5)	4.0 (3.7-4.3)
	I have enough time to be active	4.4 (4.1-4.6)	4.5 (4.2-4.7)
Social opportunity	My friends and family support me to be active	3.7 (3.3-4.1)	4.1 (3.7-4.3)
Reflective motivation	I believe it is important for me to be active	4.9 (4.8-5.0)	4.9 (4.8-5.0)
	I make plans to be active	3.6 (3.2-4.0)	4.4 (4.2-4.7)
Automatic motivation	Being active is part of my daily routine	3.0 (2.6-3.4)	4.1 (3.7-4.4)

Table 11. Changes in measures of self-efficacy, capability, opportunity and motivation in Active Steps service users at 3 and 6 months.

Domain/Component		Change at 3 months Mean (95% CI)	Change at 6 months Mean (95% CI)
Sport England self-efficacy one item measure (n=63) To what extent do you agree with the statement 'I can achieve most of the goals I set myself'?		0.5 (0.1-0.9)	0.5 (0.2-0.9)
COM-B questionnaire (n=66)			
Physical capability	I am physically capable of being active	0.5 (0.04-0.87)	0.4 (-0.02-0.78)
Psychological capability	I know how to overcome the barriers which stop me from being active	0.5 (0.0 -0.90)	0.6 (0.1-1.1)
Physical opportunity	There are opportunities for me to be active either at home or near to where I live	0.06 (-0.34 - 0.47)	0.12 (-0.20-0.45)
	I have enough time to be active	0.09 (-0.18-0.36)	0.22 (-0.09-0.52)
Social opportunity	My friends and family support me to be active	0.4 (0.01-0.8)	0.5 (-0.1-1.0)
Reflective motivation	I believe it is important for me to be active	0.0 (-0.1-0.1)	0.0 (-0.1-0.1)
	I make plans to be active	0.7 (0.3-1.1)	0.6 (0.24-0.95)
Automatic motivation	Being active is part of my daily routine	1.2 (0.7-1.6)	1.4 (1.0-1.8)

Table 12. Associations of a 1 point or more improvement in self-efficacy or COM-B components and completing ≥ 30 minutes of moderate to vigorous physical activity per week at 3, 6 and 12 months

Predictor	Outcome: Completing ≥ 30 minutes of moderate to vigorous physical activity per week		
	3 months OR (95 % CI)	6 months OR (95 % CI)	12 months OR (95 % CI)
Self-efficacy	1.8 (0.7-4.4)	3.0 (1.2-7.5)	7.3 (2.0-26.1)
Physical capability	3.1 (1.3-7.4)	1.8 (0.8-4.4)	2.1 (0.7-6.6)
Psychological capability (overcoming barriers)	2.0 (0.90-4.9)	1.5 (0.6-3.5)	2.1 (0.7-6.7)
Social opportunity (friends and family)	1.1 (0.4-2.5)	1.1 (0.4-2.7)	0.9 (0.3-3.3)
Reflective motivation (making plans to be active)	1.8 (0.7-4.4)	2.4 (1.0 -5.8)	63 (1.8-21.6)
Automatic motivation (part of daily routine)	0.5 (0.2-1.2)	1.3 (0.5-3.4)	1.8 (0.6-5.6)

Qualitative data

The following section describes the results from the semi-structured interviews with BLF staff and service users.

Participants (service users and staff)

Semi-structured interviews were conducted with subsets of staff and service users. Subsets of staff included the helpline team (clinical and non-clinical) (n=7), Active Steps team (n=2) and the physical activity and behaviour change lead (n=1). Subsets of service users included those who were fully involved in the Active Steps service, past service users, and those who withdrew from the service. Demographics and clinical characteristics are presented for service users in Table 13.

Table 13. Characteristics of Active Steps service users who were interviewed

ID	Months involved*	Age	Gender	Ethnicity	Lung condition (MRC score)	Comorbid conditions (n)	Total PA (minutes) (change from baseline) [†]
SU1	9	62	F	White	Bronchiectasis (4)	1	10 (+10)
SU2	8	52	F	White	Asthma (3)	3	60 (+60)
SU3	12	59	M	White	COPD, Asthma (3)	3	30 (+30)
SU4	7	61	F	White	COPD (4)	5	0 (0)
SU5	7	68	M	White	Bronchiectasis, Asthma (4)	3	70 (+60)
SU6	6	60	M	White	Nonspecific Interstitial Pneumonia (4)	2	280 (+260)
SU7	5	81	M	White	COPD (4)	2	65 (+45)**
SU8	3	81	F	White	Pulmonary Fibrosis (3)	0	0 (0)
SU9	8	60	F	Mixed	Asthma/Brittle Asthma (3)	0	25
SU10	3	73	M	White	COPD (2)	1	100 (+80)
W1	5	92	F	White	Asthma (5)	3	0 (0)**
W2	5	64	F	White	COPD (5)	2	0 (0)**
W3	5	71	F	White	COPD (2)	1	0 [‡]
W4	1	79	F	White	Bronchiectasis (4)	2	0 [‡]
PSU1	8	65	F	White	COPD, Bronchiectasis (5)	2	0 (0)**
PSU2	10	71	M	White	COPD, Asthma (2)	0	0 [‡]
PSU3	9	82	F	White	COPD, Bronchiectasis (4)	2	0 [‡]
PSU4	9	75	F	White	COPD (4)	3	0 [‡]

*Months passed since interviewees had enrolled in Active Steps prior to the interview; †Minutes in PA based on their most recent follow-up and their change in PA since baseline; ‡ baseline data only; **missing data at the nearest data collection time point and data is displayed from the nearest available time point; SU: Service User; W: Withdrawn; PSU: Past Service User

Key themes from the interviews

There were three overarching themes from the analysis, which included: implementation; mechanisms of impact; and the future of Active Steps. These themes encapsulated the six subthemes, which included: facilitators of implementation; barriers of implementation; factors which impact physical activity (COM-B components); Active Steps fits within wider health care services; improvements to Active Steps components; and finally, improvements to Active Steps procedures. See the concept map in Figure 7, which illustrates the relationship between themes and the subthemes.

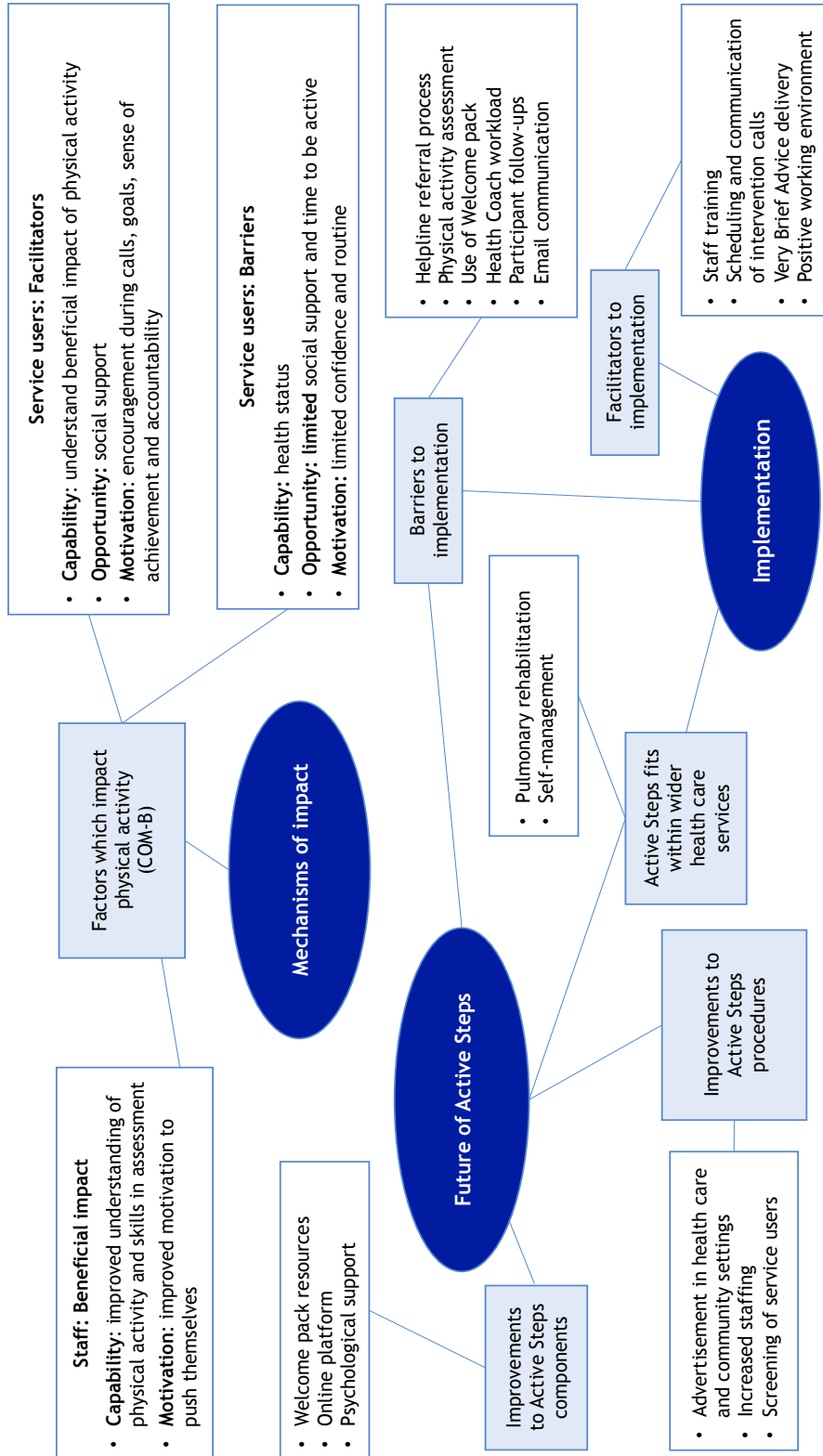


Figure 7: A concept map to illustrate the factors that impacted the implementation, mechanisms of impact, and the future of Active Steps, from the perspectives of BLF staff and participants enrolled in the service.

Implementation

Facilitators of implementation

The helpline team believed that nature of the work associated with Active Steps fitted in with their existing workload (BLF1, BLF2). This was because the helpline team were already familiar with providing information and/or advice to service users over the telephone, meaning that delivery of VBA was considered natural to them (BLF1, BLF2, BLF4, BLF5). Furthermore, the helpline believed that the referral of individuals to Active Steps was straightforward (BLF2).

BLF1: Yeah, absolutely; just because of the nature of the job that I'm doing; so, it's not taking me away from answering calls; it's not taking me away from answering queries or emails. It just goes hand in hand with it, and it works well alongside it. So, when appropriate, you know, it's something that will just be easy to sort of fit into the day to day stuff that I'm doing anyway.

The helpline team were satisfied that delivery of VBA did not feel scripted or unnatural (BLF1, BLF5, BLF6). Sometimes a barrier was not being able to see the service users, but they considered that part and parcel of working on the telephone. The helpline did not consider it appropriate to deliver VBA in certain calls, but they were confident in their ability to recognise an appropriate time to delivery VBA (BLF1, BLF3). The helpline team did not report needing technical skills for their involvement in Active Steps (BLF1, BLF3), as they were already familiar with referring service users to other staff, such as the nursing team (BLF2).

BLF2: I think it's just what we have been doing all the time because we normally refer calls to the nurses, or the teams in the office, or the organisation, so it's just the same really; the process, we just had to get the process changed on our care system because we used to have nurse...we could transfer for nurses, but we had to get transfer to Active Steps, you know, Active Steps dropdown boxes; apart from that it was just a bit of a change.

Though some staff reported that the administrative duties at the beginning of Active Steps were time consuming, they believed this improved throughout the service (BLF3, BLF9, BLF7). Additional administrative support enabled the helpline team to integrate the delivery of Active Steps into their usual routine and helped the Active Steps team to focus on the delivery of motivational interviewing (BLF3, BLF9, BLF10). Overall, staff reported that Active steps had been an enjoyable and interesting project (BLF7).

BLF7: We've got two full time members of staff on it. I think at times it's difficult to manage all the tasks that are associated with the project with just two members of staff; but I don't think it's been unmanageable. Obviously, you'll get their thoughts on it as well. I think the other members of staff who have been involved with it, haven't seen feedback with theirs, but for me, it's been more than anticipated, but it hasn't been an issue.

Staff reported that the BLF work environment was positive, as the proximity of colleagues meant that it was easy to refer service users, to receive feedback on whether the referred individuals were eligible for Active Steps (BLF4, BLF2, BLF5), and the Active Steps team were able to practise motivational interviewing and support each other, for example by discussing previous calls with service users (BLF10). Furthermore, the proximity of the staff enabled the Active Steps team to have weekly meetings and discuss hurdles with the service, such as low referral rates, and methods to address these issues (BLF6, BLF8).

BLF4: Because we have got X and X (Active Steps team) here with us, so, you know, as I've said before, if I've got somebody on the call, you know, sometimes when I explain to them, when I give them the very brief advice, I don't really want to send them away and say someone will call you back in a couple of days...I'd rather be, you know, they've called us for exercise. I don't want them to change their mind in a couple of days, or when we call back there's no answer. So I think that's worked well, so I will say 'I've got this call on, are you happy to have a chat with them now?' and then they'll go straight through to the person there and they've got the information they need, call back and they've dealt with...

Service users reported that the Active Steps team encouraged them to discuss their physical activity levels (SU5, SU4). The Active Steps team built rapport with service users and encouraged them to discuss anything that service users found important to their physical activity, such as existing health issues and upcoming health procedures (SU5, SU4). Furthermore, the Active Steps team were careful to ask service users' permission before providing information and/or advice. Various service users described making plans with the Active Steps team. Service users described how they talked with the health coach about what they would like to achieve, why they would like to achieve it, the best way to achieve the goal, and how they will maintain this goal (SU4, SU5, SU7). Based on the service users' description of the health coaching calls, the Active Steps team actively pursued the service users' autonomy, and enabled them to set their own goals, but were careful to consider and recognise when a goal might be too challenging (SU6).

SU6: Oh yes, I've got the plan in my head, I know exactly what I want to do, and I've discussed it with X and X (health coaches) and they agreed that it would be too much, too quick kind of thing. I'd set a certain pace and it was like a mile in, a mile back and I'd set a time and if I'd

completed that time then I had to progress, getting better and quicker and faster. So, I explained what I was going to do, and they thought it was very good.

Many service users reported that they had received newsletters from the BLF and read the case studies of others' experiences during Active Steps. Service users reported the stories as interesting, inspiring, helpful, and relatable (SU2, W3, SU5, W4, SU6) particularly when the stories were of others with the same lung condition as them.

W3: Well I think you can relate to them because you're in the same position or. So yeah, yeah I do like to read about what's going on, with the COPD especially.

Service users were satisfied with the method that BLF contacted them (SU2, SU5, SU6, SU7, SU10, PSU4). For example, service users enjoyed having a text reminder prior to the health coaching sessions, which enabled them to cancel or reschedule the session (SU6). One service user stated that they were satisfied with the remote nature of the intervention, as it enabled them to stay at home to avoid infections and manage their 'good and bad days' (SU7).

Staff reported that they received information surrounding the delivery of Active Steps, and their role in the service. Another staff member was not sure if this was considered a 'training session' and the helpline team were simply provided information about the role in Active Steps, and were encouraged to identify trigger words such as 'breathlessness' which may encourage the delivery of VBA (BLF3). This information was beneficial to the helpline team, as this enabled them to understand the importance of Active Steps (BLF5) and gave them clues of when and how to deliver VBA during the calls (BLF5, BLF6).

BLF6: Well it was, actually it was a couple hours session, and it was basically the health team that came in and we looked at, obviously ways to pick up on and obviously the triggers words. Um, you know, how to pick up when the person is appropriate to be asked or not appropriate. So, it was really good. I think, other, the other Active Steps team did two days on motivational interviewing? Ours was about half a day if I can remember. It's all a blur now it was that long ago (laughs)

Active Steps team were trained in motivational interviewing for their role in the service. One health coach, who was involved in Active Steps from the beginning, received a two day intensive course, which provided information about Motivational interviewing, including the skills, tools and strategies which are essential in the delivery of this counselling approach (BLF9). Both health coaches also participated in an 8-week online training course, which refreshed their knowledge, and enabled them to practice Motivational Interviewing and receive feedback. As one health coach

joined Active Steps at a later date, they did not receive the formal two-day training. However, both health coaches recognised the importance of practising Motivational Interviewing, and dedicated time to listening and evaluating each other's calls (BLF9, BLF7).

Barriers of implementation

Though the helpline team were confident in delivering (Very Brief Advice) VBA, the number of times VBA was delivered was lower than expected. One suggested reason was that the helpline team had found it challenging to fit VBA into calls, which were perceived as inappropriate. For example, this may have been a call about bereavement or speaking with someone who was unwell (BLF10, BLF8). The deliveries of VBA, and referrals to Active Steps were lower than expected in the project, and the helpline felt demoralised (BLF6, BLF8) and pressured to reach these numbers, although they recognised that this was largely out of their control. Furthermore, recruitment to Active Steps had not been a steady process. For example, requests to join Active Steps had spiked at certain intervals, which had been challenging for the delivery team to manage (BLF7). Furthermore, staff shortages and increased work demands, meant that the helpline team may have forgotten to deliver VBA. Staff suggested that the helpline had increased in their delivery of VBA throughout Active Steps but did not believe this was habitual which was apparent in the number of VBA delivered throughout Active Steps (BLF7).

BLF7: I don't think it has yet. I think there was a time when they were delivering very brief advice much more frequently; that was during the summer months; but again, it has just dropped back down. So yeah, I would say it has not become habitual for them, which is a shame.

Service users sometimes speak to various staff members of the BLF helpline. For example, service users may be referred to the clinical helpline team, or they may be repeat callers. The helpline staff sometimes found it difficult to identify if a service user had already been questioned about Active Steps, as this may not have been reported on the database (BLF5). Staff suggested that the helpline team should not need to deliver VBA if they refer patients to the clinical helpline, as it is part of the clinical team's role (BLF8).

BLF8: Activity is part of a clinical call. It's part of our clinical advice. Because we have to, a lot of the time, be general; so, we talk about diet, exercise and keeping yourself well generally; so therefore, activity comes into that. We always discuss that.

In recognition that VBA was not delivered as frequently as first planned, staff suggested that their initial VBA targets were too high. Staff suggested that Active Steps could have benefitted from more

input from the helpline team during the development of the intervention. This may have improved the implementation of the project, and potentially improved the delivery of VBA.

Although the helpline team reported that Active steps fitted in with their workload, they did report minor teething issues with administrative duties at the beginning of the service. For example, the database initially caused confusion (BLF3, BLF5) and it was difficult for the helpline team to accurately register what they had done, the information they had been provided by service users, and how they have used that information. The helpline team were uncertain whether they had correctly referred callers to Active Steps (BLF1), and they struggled knowing when to book calls in, as they did not want to overbook people into Active Steps (BLF2, BLF5). The helpline team were also concerned that service users struggled to answer all questions over the phone, particularly if they were very breathless (BLF2). One helpline team member suggested that it was difficult to identify whether callers were eligible for Active Steps based on their description of their current PA levels. For example, the delivery of VBA did not necessary result in the referral to Active Steps (BLF5).

BLF5: I think the hardest thing is identifying whether they are actually going to be eligible for it because, as I said you know earlier, someone might say - I'm not as active as I used to be. But they are still too active for Active Steps. And so, we might be delivering very brief advice but ultimately, it's not going anywhere, you know, it doesn't result in a referral; because people are already too active. But in terms of my own workload, it's not an inconvenience to discuss with people; not at all. It often comes up anyway.

The helpline did report receiving training for their role in Active Steps, though some struggled to recall when they received the training (BLF1, BLF2). For example, one staff member believed the training to be six to nine months prior to the start of the project. Another staff member was not sure if this was considered a 'training session', and simply focused on informing the helpline about the project (BLF1).

The Active Steps team did not feel as comfortable as the helpline team in delivering advice, which may stem from their training in motivational interviewing, as this counselling style is centred around asking service users about their thoughts and experiences surrounding physical activity (BLF9). The administrative duties were challenging, and it was suggested that the database to book and reschedule calls did not provide reminders for the Active Steps team. This meant that follow-ups with service users could have been overlooked (BLF10).

BLF10: There's a lot of trying to remember stuff and keeping track where you are in your own head, and not on paper, to try and keep up with it; so from a delivery perspective, that's a

challenge to try and manage all that capacity wise, and cognitively wise to see where you are up to, because there's not as many nudges on the system. We'd like to sort of say that flashes up and says that etc. When you've got things like rearranged calls for example, it doesn't remind you of that; and if someone has not got back to you, you don't remember that someone's not got back to you, because it's very easy with the amount of people you are delivering to, to sort of get lost. So that's a challenge.

Service users did report various issues with the Welcome pack. For example, service users reported that they had limited time to engage with items such as the activity chart and diary (SU1, SU9, W3). One service user found the number of questions in the Active Steps booklet overwhelming, particularly as they were not aware that they should complete the booklet gradually throughout the Active Steps intervention, with help from their Health Coach (W3).

The content of the Welcome pack was not suitable for all service users. For example, one service user who received a DVD within the information pack did not have a DVD player (W1), and another service user could not play the DVD on their laptop (W3). Some service users did not recall receiving a pedometer or DVD (SU1, SU2, SU4, SU5, PSU4), and suggested that they could benefit from these items (SU2, SU4, PSU4). For example, one service user believed that the pedometer could help motivate them to walk a small amount each day (SU2).

SU9: Yeah, I did get a pack. And I did look through it basically. But I haven't had...there's been a lot going on, so I haven't had a lot of time, I have direct payments, so I have my own PA, so a lot has been to keep up these emails from staff and find out where I stand, and what I've got to do; so I haven't really had a lot of time.

I: If you had the chance, would you have wanted a pedometer?

SU2: Yeah. That will be really helpful. I mean I do track my steps on my phone, but a pedometer would be great. Obviously, you don't always take your phone everywhere. Sometimes I forget it or don't have it with me. A pedometer would be great because I am trying to walk a little bit each day if I can.

One Active Steps team member was confident that the Activity booklet complemented the intervention calls with service users and believed that service users could find this useful (BLF9). However, they suggested that the ordering of material in the activity booklet did always not match the flow of the conversations with service users.

Although many service users were satisfied with the communication from BLF (e.g. the newsletters, text and emails), some service users reported issues. For example, some service users did not remember receiving emails from the Active Steps team (SU1, PSU1, PSU2, PSU1, SU9), although some were not sure if this was due to oversight (SU1), or because they did not regularly check their emails (PSU2). One service user reported that they would avoid reading stories of other people with a worse health status than themselves, as they perceived this as an uncomfortable reminder of potential disease progression (PSU4).

PSU4: Well I'll tell you; it sounds awful doesn't it, I don't like to read about people having this condition. I joined a group for COPD. Although the information on there was helpful, I also found it depressing. But these things apply to me and if I stopped to think that these things applied to me, then I stopped doing things. So, no, I didn't read many of the stories.

Mechanisms of impact

Factors which impact physical activity (COM-B components)

Various factors impacted service users' engagement in physical activity, and these were divided into three overarching factors: capability; opportunity; and motivation. The following text describes the facilitators to physical activity, followed by the barriers to physical activity.

Facilitators

Capability

In some cases, physical activity was facilitated by service users' psychological capability. For example, many service users reported that they already understood the beneficial impact of physical activity prior to their involvement in Active Steps (SU1, SU4, W2, SU7, PSU2, PSU4, SU9). Two service users reported that they understood the benefits of physical activity, as they had recently been informed on their pulmonary rehabilitation course (W2, SU5). In many cases, Active Steps had reinforced service user's knowledge about the beneficial impact of physical activity on their general wellbeing (SU1, SU2, PSU2, SU6).

SU1: I always knew the benefits, so it's reinforced my knowledge.

SU6: I think it's made us aware that anyone can do it, in any condition, any physical disability. Little and often, call it what you want, it's just great to have an extra pair of ears when you're having a bad day or it's great to have a pair of ears where you can just tell them what you've been doing. And you've done it yourself, you've completed the task yourself and you know full well that you've got X and X (Active Steps) listening and encouraging you.

Opportunity

Some service users reported that Active Steps had given them new information about the physical activity opportunities in their home and in their local area. For example, the DVD was beneficial in outlining how to do home exercises (SU4). The Active Steps team also delivered information about physical activity opportunities in service user's local area (SU5, W4), such as exercise classes and singing classes. One service user reported that they had more opportunity to be active after they moved to a new house to a more accessible area (SU7).

One individual who withdrew from Active Steps admitted that their physical activity did not change during their time in the service and described themselves as 'all talk and no action'. Nevertheless, they reported leading an active lifestyle due to responsibilities in childcare and dog sitting (W3).

One service user also reported that they were active when they cared for their grandchildren, for example by taking them to the park to play. However, they mainly exercised indoors only, because the cold, wet weather limited their physical activity (SU5). Bad weather impacted various service users (SU5, SU1), but the Active Steps team provided them with helpful suggestions of how to maintain physical activity. For example, one service user had purchased an indoor exercise bike, which enabled them to be active in the comfort of their own home (SU1).

SU1: You know if I come with an obstacle then she'd come up with several suggestions around it or alternative ways with dealing...trying to do some exercise and stuff. Because of her, I've got an indoor exercise bike now. I can sit and watch the birds...cos when it's cold and wet and windy then I can't breathe outside...So I sit on my bike inside and cycle.

Many individuals reported that social support had facilitated their physical activity. Individuals had received support from a wide range of people, including the health coach, friends, family, colleagues, and people they had met through pulmonary rehabilitation and Breathe Easy groups (SU4, W3, SU2, SU6, SU7).

SU4; I've got to be careful in the kitchen because I suffer from severe osteoporosis; it won't be the first time I've dropped a joint of meat coming out of the oven! I've got to give my husband full credit there anyway. Anything like that, he does. I can't lift a pan to strain potatoes or any other things. I can't do that because my wrists aren't strong enough. So my husband is brilliant, he does all the cooking, I have to admit that, I hold my hands up and say that. He's one in a million. When I'm really ill and run down with the weather changing backwards and forwards and that, or I've had a flare up, he's there for my support.

Motivation

Service users reported various factors that motivated them to be active. Some service users reported that they were motivated by the encouragement that they received from the Active Steps, and the knowledge that they could pick up the phone and contact them (SU1, W4). Service users believed that Active Steps kept them thinking about physical activity, and how they were going to achieve their goals (SU5, SU6, SU7, PSU2, SU9).

SU9: Yes (had successes and challenges with the health coach) because my house is very upside down, sorry, sometimes I feel like I'm getting somewhere. If I'm not well, I think - Oh god, pear-shaped a bit, it stops. But I've just started getting used to sort of picking up, and stopping, and picking up again. But, yes, it's good because she sort of encourages me; that's ok; sometimes if I'm not doing it, they'll plan that I'm doing it in other ways, so that's still good.

Active steps had helped physical activity become habitual for service users (SU6, W4). For example, one individual reported integrating physical activity into their daily routine, and ensured they were active at weekends. As a result, they felt they could breathe better, which further motivated them to continue to be active (SU6). Another service user reported that they gained confidence from achieving their goals, which meant that they started reducing their sedentary time, and started making small changes to their behaviour, such as walking up the stairs more often, or taking a walk with a friend instead of going for lunch (SU7).

Another service user found their Fitbit helpful in motivating them to be active (SU1), and felt it was a 'voice of caution'. The same individual reported that the Active Steps team inspired them to be active and they found that small, sustainable goals were essential in motivating them, because they were 'easily demoralised' (SU1).

SU1: yeah very much. I mean she spoke about me setting sustainable goals, cos I'm very easily demoralised. So even if it's just like 'ok so I walked 4 steps further than yesterday', that's a goal that I can achieve. All the goals that I need to try and get me moving more or to help me with my general health, um but they're not so unattainable that I'm not gonna try and do it. I'm gonna try and achieve them.

One service user reported that their motivation to be active stemmed from the shock of being given ambulatory oxygen (SU2). They were depressed and defeated, but they slowly regained their confidence, which was facilitated by Active Steps. Other service users were motivated to be active

to maintain their physical health and wanted to 'fight' against their lung condition and improve their physical health (SU4, PSU1, W4).

SU4: What we do is we normally...I'll say something like about my mobility, and then we'll sit and talk about it, and what would be the best way to approach it, and how to carry on with it, what effect it's having, and stuff like that. Everything comes into it; what the end result is, are you going to take it further? It will be intentional always which I think is good because I think we need that. Otherwise, I've seen people like my next-door neighbour, who literally gave up. No matter what you said to her, she gave up bless her, and it got the better of her in the end. I won't do that. I will fight this all the way. I know I'm not going to win, but I will fight this as long as I can. If there are people like those in Active Steps that can help me, then I'll take it.

Barriers

Capability

Many service users reported that their physical activity had been restricted by physical conditions or their health status (SU9, SU1, SU3, SU7, SU5, SU2, W1, PSU3, SU8, SU9, SU10), and sometimes by the medication that they were taking (SU9). These restrictions could be frustrating for service users, and they sometimes struggled to reach their goals (SU1, SU3, SU7). One past service user recalls a time when they were very ill and believed that this may have caused them to lose touch with Active Steps (PSU4).

SU7: And anything that I've done so far, so walk a bit further and go to here and the nearest shop, so I've gone to the post office which is twice as far away. Um and I do think I try to do things like that most days when I wasn't doing something else but things do crop up and it's sometimes hard to stick to your goals but, I mean I do as much as I, I mean I could possibly do more but then some nights I'm just absolutely exhausted and by the end of the day, I mean by 7 o'clock I'm ready for bed really.

PSU4: Well I think I got flu, and I got it quite badly and I wasn't interested in anything at all. In fact, I'm still coming out of it. And I don't know how I lost touch with it, you know. I know that we'd arranged a phone call and I think it was X (health coach), I think, that when she rang up I just wasn't able to speak. And if she's rung since then, I've missed her call. And didn't know who it was. And if it was a number that's unfamiliar for me then I don't answer.

Some of those who withdrew from the service felt like they were not capable of doing any physical activity and believed that they could not benefit from Active Steps (W1, W2). One past service user described that they had major surgery and the long recovery meant they lost contact with Active Steps (PSU1).

W2: I try, my bathroom, my bathroom is nothing but 10 yards from me, and I can, on a bad day I am gasping walking to the bathroom so whatever help there is out there, it's too late for me now.

PSU1: No, I haven't got it (support from Active Steps) yet. Because as I say, I've had to go into hospital and have major surgery. When I came out, I had to rest for 6 weeks. So, it was a long recovery and I just lost that, because I couldn't be bothered.

Staff reported that many service users have health conditions other than lung diseases, such as mental health problems (diagnosed and undiagnosed), and other comorbid conditions, which act as key barriers to their engagement in physical activity (BLF10).

Opportunity

Service users reported various factors which impacted their opportunity to be physically active. One service user's physical activity was limited by their responsibilities to care for their family (SU1). Also, an individual who had withdrawn from the service reported that they had many opportunities to be active in their local area, but they did not have the time to be active because of their family commitments (W3).

Others reported very few opportunities to be active in their local community, and attributed this to cutbacks in funding, and limited transport to classes which were further afield (W1, SU5, PSU4, SU4, SU9, SU4). One service user's physical activity was limited by the weather, as they could not exercise in cold, wet weather (SU5).

PSU4: Yeah, they (Active Steps) told me about one group that is reasonably near to me, but the problem being that there's not X (audio unclear) to the place where it was holding on. I went into the rehab programme, you know, and I did that for six weeks, and I really enjoyed that. I was sorry when it came to an end. In fact, I made one good friend from there who is still in contact. But that, again, was miles away, miles away, and I had to go by taxi. And you can't always afford taxis, can you?

Limited perception of social support was detrimental to individuals' motivation to be physically active (W24), and one individual felt let down by Active Steps, as they did not feel they were receiving the support they expected (SU8). One individual reported that they withdrew from Active Steps because they did not have the opportunity to be physically active and considered the advice from Active Steps as unhelpful (W1).

W1: Because of the cut back, they cannot help me. So, it's pointless really. So, everything they told me to do, I needed help with; exercise classes were miles away. So really there is no help out there for someone who can't, who hasn't got transport.

Motivation

One individual who withdrew from the service reported that the health coaching calls were helpful, and they had positive intentions to stay active, but these intentions did not translate into increased physical activity behaviour (W3). Service users reported that they had the time and the intention to be active but struggled to motivate themselves to be active, which was attributed to their various medical conditions (SU5, PSU3). Some service users reported that their physical activity was impacted by their limited confidence to be active (SU5, SU10, VBA001). It was especially difficult to start being active again after some time off (PSU3), and service users reported that they struggled to get into a routine of being active because of their physical conditions (VBA001, SU10). For example, service users often took things day by day, meaning that their motivation was also up and down.

SU5: I have time because I'm retired. I do have the time, it's the motivation really. Sometimes I've got these various medical conditions, and sometimes you just can't be bothered, you know?

VBA001: Yes I have to (take it day by day) because otherwise I would feel like I...and I think I would be negative in my body and I struggle sometimes for using my words now, gosh, I can't let myself feel as though it's me and that's why I have to take it like that because otherwise you would feel like you're useless. And it's not me that's useless, it's my disease. So if I don't tell myself that, it is a very very changeable disease and if you suddenly think you go down, cos I have been in the past, depressed, because I feel as though I'm not getting anywhere because I was further on last week than I am now.

Staff (factors which impact their physical activity and the support they deliver to callers and service users)

Capability (Improved understanding of physical activity and skills in assessment)

Active Steps had improved the helpline teams' ability to assess callers physical activity over the phone (BLF1). For example, the helpline now listens for 'trigger words' and prompts (BLF1, BLF3, BLF6). Although, staff believed that they were already skilled in assessing callers physical activity, as they often discussed physical activity prior to Active Steps (BLF1).

BLF1: It's just made me look out for trigger words, and things like that. Again, part of the role that I'm doing anyway is having conversations with people and listening out for things. So, it's not really given me anything new or different to what I'm already doing, it's just sort of highlighted, you know, let's look for things in that area...

Staff reported that there were already aware of the beneficial impact of physical activity for people with lung conditions in Active Steps (BLF1, BLF3, BLF5, BLF6, BLF7, BLF8), and the helpline were experienced in delivering information about the benefits of physical activity.

BLF2: Yeah, I think it's made us more aware that it doesn't have to just be like physical exercise; it could be, you know, simple things that people can do, I think before it was more about PR which is more like a course led by someone who is trained in exercise and how to deal with respiratory patients. So, I think the good thing is that, you know, we refer people for activity rather than exercise. So it is kind of useful for them to kind of think they don't have to do like a structured class, it could be on their own time, and in their own home, or I their own area, so they don't have to kind of go anywhere, be told what to do...

However, the information and training delivered for Active Steps reiterated their knowledge of the benefits of physical activity (BLF1, BLF2, BLF4). Furthermore, it has made staff aware of the benefits of daily physical activity, and the simple ways that callers can incorporate activity into their lives (BLF2). For non-helpline staff, the positive feedback from Active Steps service users has highlighted the real-life impact of physical activity on people living with lung conditions and reaffirmed staff's understanding of the importance of physical activity (BLF7, BLF9, BLF10). Staff expressed interest in learning more about the importance of physical activity in people with lung conditions (BLF9).

BLF7: Yeah, I think so. I suppose my input has been from a very theoretical perspective, but during the project, I've heard real life experiences of the people involved, and that's kind of brought it to life for me; actually made me think...well I always thought it was important, obviously, but it's

really affirming to hear the feedback we've been getting from participants around how it's changing their lives and how they are becoming more active, and how they have been able to do these different things that they couldn't do before, and that is down to X and X (health coaches) support and also how we've designed the project to get it into those factors, from the evidence we felt we needed to change to support people; so yeah, I guess it has just re-affirmed it all for me, and brought it to life a bit more

Motivation

Staff mostly reported that they enjoyed physical activity and were already active prior to their involvement in Active Steps (BLF5, BLF7, BLF1, BLF10). For those who already prioritised physical activity, some believed that their beliefs and experiences surrounding physical activity had helped them to deliver information and advice to callers and service users, and increased their motivation for the Active Steps to impact service users (BLF5, BLF7). For example, they were able to relate to their personal experiences and provide anecdotes with callers and service users (BLF5).

BLF5: Well yeah, it does, and you can speak from personal experience, can't you? I know that on the nights that I walk home from work, for example, when I get home, I feel great. You know I have walked four and a half miles, and I feel good. I know if I go for a swim, I may not feel like going for a swim, but I know afterwards I'm going to feel really glad I did that. So, I can talk to callers about my experience to say - It's lovely when that happens isn't it? It's great how much better you feel even if you think you don't have to do it for any other reason than to feel better. It really does work. I guess it's just anecdotal; it's just conversation isn't it? But it is nice if someone is trying to sell you something, if they say that they use it.

BLF7: I wouldn't say Active Steps has affected it, but I mean I've always been active, so it's always been important to me; it hasn't been as a result of being involved in the project. But I guess my whole job is related to being active, and I've always been active, so that's probably led me to the job that I'm in; because of my interest in it, so.

However, some staff reported that their involvement in the delivery of physical activity advice had motivated them to push themselves to be more active (BLF9, BLF2). Some staff started to push themselves outside of their comfort zone and try new activities which they originally perceived as difficult (BLF9, BLF2). This was to take their own advice around the beneficial impact of physical activity (BLF4, BLF2, BLF10) and gain understanding of some of the challenges that service users may experience when making changes to their physical activity (BLF9). Staff recognised that their increased physical activity had a beneficial impact on their own psychological and physical health (BLF7, BLF1, BLF5).

BLF4: Definitely, I need to be doing something, talking to a lot of people about physical activity (laughs). I need to do something myself (laughs).

Though one staff member reported that they were not active, they were in the ‘thought process’ of becoming more active. This illustrates staff’s understanding of the beneficial impact of physical activity, but also the barriers surrounding the uptake of physical activity (BLF6).

Future of Active Steps

Active Steps fits within wider health care services

Staff reported that Active Steps could have a beneficial impact on other health care services. Engagement in Active Steps may improve service users’ ability to manage their condition and improve their physical and psychological health. This could mean that service users are less likely to contact health care services, thus relieving the pressure on the NHS (BLF1, BLF7, P008, BLF10).

BLF1: Well in theory if people are becoming more active, I think hopefully for some people anyway, it would reduce the number of times that they need to go to the doctor. It might reduce the number of infections that they get because they are keeping in control of their condition a bit more. Obviously that’s not always going to be the case but it’s going to help them become, not less reliant on certain healthcare professionals, it’s going to help them, I think, if they are becoming more active that’s positive for their health anyway; but when you are living with a lung condition, it’s going to be positive for your lungs.

Active Steps had helped service users manage their condition (PSU2, SU4). For example, Active Steps had helped one service user control their breathing and reduced the likelihood of them calling an ambulance due to distress of any breathlessness (SU4).

On the other hand, involvement in Active Steps may empower service users to contact the health care services that they would benefit from (BLF7). Staff also reported that service users wanted Active Steps to help reduce their medications (BLF10). One service user reported that Active Steps had empowered them and increased their willingness to reach out for additional support from health care professionals when required (SU2, SU4).

SU2: More definitely, yeah. I’m not ready to reach out and ask for the help, but I might need now, I’m more willing to just ask for that support.

However, some service users had not changed their use of health care services during Active Steps (W4). One reason was that their existing health conditions mean that they regularly attend the hospital for treatment (SU5, SU7). Another reason was that service users already felt confident in accessing health care services (PSU4 PSU, SU9, SU10).

It was also reported that Active Steps could be beneficial in bridging the gaps from other health care providers. For example, GP practices may not have the time and resources to provide detailed information about the management of lung conditions. Active Steps can be the access point for individuals with a lung condition who want to learn how to manage their condition (BLF5) and has the resources to help motivate individuals to be active (BLF6).

BLF5: I guess, to be honest with you, we speak to people regularly who have been diagnosed with a condition, and they come out from seeing the consultant or physician, or whoever it is who gives them their diagnosis, and they know very little; and there's no one place you can go for all the information that you need. And so, having somewhere like our helpline where we can offer a little bit about a lot, then maybe a bit of a lifeline.

Various staff believed that Active Steps could act as a stepping stone towards pulmonary rehabilitation (BLF2, BLF3, BLF4, BLF7, BLF7, BLF9, BLF10). For example, Active Steps could physically and mentally prepare patients for pulmonary rehabilitation (BLF7). One service user believed that Active Steps could be a suitable alternative to pulmonary rehabilitation to some individuals, for example those who are too ill to attend the programme (SU1).

BLF2: think it's like I just said then about people waiting for a long time for PR; so I think if people are getting transferred through to the NHS services, we can say - In the meantime, while you are waiting for this service, there's also this Active Steps service; which kind of gives people help on how to be a bit more active before they get to do the course. So I think it might help that way: to give people a bit more confidence and kind of say - Well I can be a bit more active; doing a bit more exercise each day would help me to work up to the pulmonary rehab which can be quite straining for some people.

Improvements to Active Steps Components

Both staff and service users reported ways to potentially improve Active Steps. One service user reported that they could have benefitted from having another physical activity booklet sent out to them halfway through the course, which would facilitate their engagement in Active Steps (SU2). One past service user felt like they would have benefitted from something to help their physical

symptoms, such as their breathing (PSU3). Various service users were also interested in further social support during Active Steps, for example they suggested integrating a face-to-face element of support, or putting service users in contact with each other (W1, PSU4, SU8), giving them the opportunity to meet and support each other in their local community.

PSU4: Maybe, maybe to be put in contact with somebody local that is on the programme. Just arrange to do little things around where I live, you know. To kind of add a social norm. And to walk up and meet for a coffee or to go and walk around a park. Just all those things. It's nice to walk around a park. It's even better if you've got somebody to chat to on the way round who understands that you may have to stop, you may have to....cos they may have to as well. So maybe, something very local, very local.

One service user complained that their telephone calls were irregular and believed that their experience could have been improved by agreeing on a precise time for the calls and having weekly or fortnightly calls from the Active Steps team (PSU1).

Staff suggested various methods to improve Active Steps. For example, to integrate a digital aspect to Active Steps (BLF1, BLF7), such as an online portal to complement the health coaching calls (BLF1). This would enable service users to keep notes, provide suggestions and communicate with the Active Steps team.

BLF1: I know it's a tele coaching course, so I know most of it is done on the phone; but part of me is thinking all the time about, you know, more and more people of the older generation are becoming more digitally aware, and things like that, and I just think obviously it's all these sorts of things and suggestions are always going to be constrained by money and budgets, but something like an online portal that would go hand in hand with the phone calls maybe? You know, so when they sign on to the course, they are given a login or something like that where they can logon to this portal and, I don't know, keep notes and make links, or suggestions, send messages to X and X (health coaches).

Staff also suggested that service users could benefit from more psychological support, for example, the option to be referred to counselling within BLF, rather than signposted to a separate organisation, thus enabling BLF to provide a more holistic approach to healthcare. Although service users were provided with information about opportunities in the local area to be active, staff suggested that Active Steps could improve their local knowledge of physical activity opportunities and provide this to service users when relevant (BLF3).

Staff recognised the potential beneficial impact of Active Steps beyond lung conditions. As many service users have various comorbid conditions, they reported that Active Steps showed its suitability for managing people with complex health needs (BLF8, BLF10, BLF1, BLF2, BLF3, BLF4, BLF5, BLF7, BLF9). Staff reported that Active Steps could benefit people with other long-term conditions, for example people with, heart problems, or mental health, and those who had recently been discharged from hospital.

BLF10: I think it has a scalable opportunity to be put into other long-term conditions, and be a platform to be able to do that; many of the issues that get brought up for us, are outside the scope of a lung condition; many of the barriers, are in addition to their lung condition; whether that's arthritis, a heart condition; whether hugely around mental health, and actually their psychological state of where they are at. So, we are dealing constantly with other long-term conditions on the service anyway, as well as the breathlessness of the lung condition. So, I think that's evidence enough to say that it can work in other platforms because we're having to do that at the moment.

Finally, Staff suggested that the fixed duration of Active Steps (12 months) did not suit all service users. For example, some service users may benefit from having the choice to shorten or lengthen their time with Active Steps, and the opportunity to take a break from the service in times of ill health, or other personal demands (BLF9).

Improvements to Active Steps procedures

Some Staff considered it important to improve the promotion of Active Steps (BLF2), and suggested methods of doing this. For example, they believed that Active Steps should be advertised through existing BLF services, such as Breathe Easy (BLF3), and via health care workers, such as health promoters and respiratory specialists, and believed that Active Steps should be advertised in health care settings, such as GP surgeries (BLF2, BLF5). Furthermore, Active Steps should be promoted in community settings such as pubs and hairdressers, thus potentially accessing those people who are harder to reach (BLF9).

BLF2: So, I think other services would be good; to advertise in hospitals, maybe, to say - Are you inactive? Do you struggle with activity? Call us for advice on how you can be more active. It's just getting the number out there, getting the name. If it's got our number on as well, mention it in the Respiratory Clinic, or in the Respiratory departments in the hospitals; that might be quite useful as well. So yeah, I just think if it was advertised in public places that might be good.

Staff commented on the length of the screening calls with potential service users and data collection calls, suggesting that this process could be improved (BLF7, BLF5). For example, by providing service users with a copy of the questionnaire prior to the calls, or to give service users the option to complete the questionnaires online by themselves (BLF7).

Prior to any implementation of Active Steps as business as usual, it was suggested that BLF would require a larger team to deliver and evaluate the programme (BLF9), as workloads for the Active Steps were very demanding. Staff also recognised the importance of developing an excellent rapport with stakeholders who could be involved in the delivery of Active Steps in the future. This may be possible via engagement events with health care practitioners, and other health care professionals who could signpost individuals to Active Steps (BLF10). Furthermore, staff recognised the importance of co-designing an intervention with the population whom it is intended to target (BLF7).

Overall, staff were confident that Active Steps should be implemented as business as usual within the BLF (BLF1, BLF2, BLF3, BLF4, BLF5), and were willing to make modifications to improve the delivery and evaluation of Active Steps (BLF7, BLF10, BLF9).

BLF3: I think that's good because that will help patient; because patients always want things, and we are here to help patients; all the patient services are very patient focussed; anything to help patients and make their lives better to improve the quality of their life, is a good thing.

Results: Economic evaluation



Key points

- For the main evaluation, the Active Steps and Control groups were heterogeneous and not well balanced for economic comparison, where service users:
 - on average experienced significantly more severe exacerbations of their lung condition (hospitalisations) in the 3 months of self-recall leading up to baseline
 - had significantly lower baseline health utility scores due to greater restrictions in usual activities brought about by relatively worse respiratory disease and worse mental health.
- In the main economic evaluation Active Steps was dominated by the Control group - Active Steps incurred the greater health care use cost and has lesser health benefit - but the two groups were not well matched.
- Better matching of Active Steps and Control at baseline was seen in a target subgroup of interest, which was adults with chronic lung conditions that consider themselves functionally disabled by breathlessness (MRC Dyspnoea grade 3 or higher).
- In this subgroup evaluation the costs of Active Steps were marginally greater than Control but this was countered by better health benefits, with an estimated £2,237/QALY.
- At threshold £10,000 per QALY, the probability that Active Steps will be cost-effective against standard care in this subgroup (MRC Dyspnoea grade 3 or higher) was predicted to be 60%.



Results

Data

Over the course of the evaluation, including baseline, a combined total of 246 participants, 166 in Active Steps and 80 in Control, responded by giving their economic data on 668 occasions (baseline=244, 1st follow-up (3 months) =160, 2nd follow-up=154 (6 months), 3rd follow-up=110 (12 months). On 4 further occasions utility scores were imputed for 4 (of the 5) participants who died.

Those participants that were absent follow-up data were not included in the economic evaluation. There were 62 participants who were not included, comprising 59 in Active Steps and 2 in Control giving only baseline data, and a further 1 in the Control for which no economic data were given. The characteristics of Active Steps service users who provided baseline data only (n=59) were compared to service users who were included in the economic evaluation (n=107), which revealed no statistically significant differences (see Table 14).

The numbers of participants in the main evaluation were 184 (107 in Active Steps and 77 in Control). For the main evaluation, the Active Steps and Control groups were heterogeneous and not well balanced for economic comparison, where in comparison of baseline characteristics, only the difference in average baseline cost (i.e. health care use) was not statistically significant (Table 15). In particular, at baseline, health status reported in Active Steps service users was significantly worse than Control. For example, in the 3 months of self-recall leading up to baseline, Active Steps service users on average experienced significantly more severe exacerbations of their lung condition (hospitalisations) than did those in Control. This was also reflected in responses at baseline to the EQ-5D dimensions. The disparity in health at baseline between Active Steps service users and Control was due not only to added restrictions in usual activities brought about by relatively worse respiratory disease but also to worse mental health of those in Active Steps.

A potentially important target subgroup of Active Steps are adults who consider themselves functionally disabled by breathlessness, indicated by MRC Dyspnoea grade 3 or higher. There were a total of 135 participants in this analysis, 82 in Active Steps and 53 in Control. This subgroup evaluation was more suited for economic comparison than the main evaluation due to similar baseline characteristics between Active Steps and Control (Table 16).

Table 14. Baseline characteristics of Active Steps service users included and excluded from the economic evaluation

Parameter	Active Steps Baseline only (n=59)	Active Steps baseline and at least one follow-up (n=107)	p-value
Mean baseline cost (£) ± SD	882 ± 1704	876 ± 1529	0.983
Mean baseline utility ± SD	0.483 ± 0.247	0.491 ± 0.256	0.842
Proportion female (%)	76%	68%	0.274
Mean age (yrs) ± SD	63.5 ± 11.9	65.1 ± 11.1	0.409
Mean severe exacerbations ± SD	0.36 ± 1.14	0.26 ± 0.74	0.523

Table 15. Baseline characteristics of Active Steps and Control in the main evaluation

Parameter	Active Steps (n=107)	Control (n=77)	p-value
Mean baseline cost (£) ± SD	876 ± 1529	860 ± 2083	0.951
Mean baseline utility ± SD	0.491 ± 0.256	0.612 ± 0.280	0.003
Proportion female (%)	68%	53%	0.039
Mean age (yrs) ± SD	65.1 ± 11.1	70.0 ± 11.0	0.003
Mean severe exacerbations ± SD	0.26 ± 0.74	0.08 ± 0.27	0.040

Table 16. Baseline characteristics of Active Steps and Control in the subgroup evaluation (participants reporting MRC Dyspnoea grade 3 or higher)

Parameter	Active Steps (n=82)	Control (n=53)	p-value
Mean baseline cost (£) ± SD	888 ± 1589	1070 ± 2457	0.603
Mean baseline utility ± SD	0.464 ± 0.261	0.505 ± 0.266	0.378
Proportion female (%)	66%	53%	0.130
Mean age (yrs) ± SD	65.2 ± 10.3	68.6 ± 10.4	0.063
Mean severe exacerbations ± SD	0.23 ± 0.69	0.11 ± 0.32	0.241

Resource use and costs

The economic evaluation intended to collect a recall of 12 months of health care resource use in Active Steps service users and Control. Both groups fell short of full recall (i.e. 12 months) reflecting the disruptions of the COVID 19 pandemic on study management. For Active Steps service users, recall years in the main evaluation averaged 0.59 years per participant, or 63 years in total. The costing adjustments due to overlap in timing of follow-ups (page 22) covered 8.9 years in total, while gaps where costs were missed altogether totalled 58.6 years.

In the main evaluation, annual resource use cost by participant yielded averages of £3,112 per annum (pa) and £2,902 pa (£2,035 pa outlier removed) across Active Steps and Control, respectively. When these costs are compared to £850 (or an estimated annual cost of £3,400 pa), the average cost of both groups for the 3 months prior to baseline (all baselines were taken in “normal times” prior to the first COVID-19 lockdown in England, 23 March 2020), usage of NHS resources appears lower than expected over the course of the main evaluation. Underuse of NHS services again reflects the disruptions caused by COVID-19, whereby many of the participants (likely classified as clinically extremely vulnerable due to their lung condition and recommended to shield) were less likely to access health care.

When itemised, the largest single contributor to costs in the economic evaluation were severe exacerbation of lung condition, which required use of emergency services and resulted in inpatient hospitalisation.

Utilities

Utility health-scores are calculated from ratings to the 5 dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression) of the EQ-5D-5L. For each dimension, participants were asked to rate on a scale of 1 (no problems) to 5 (extreme problems/unable to). The ratings were combined to produce a 5-digit number reflecting the participant’s self-perceived health status (ranging from 11111 to 55555). This is converted to a utility score that can range from -0.594 (worst possible health) to 1.000 (best possible health).

At baseline, the average utility score in Active Steps service users was significantly lower (worse) than Control ($p < 0.01$). Beyond baseline, average utility scores were greater in the Control group at each stage of the follow-up, although none of the differences were statistically significant (Table 17). Box plots of the distribution of utility scores are displayed in Figure 8. The pattern in utility scores in Active Steps service users is evidence of health improvements generated during the early stages of Active Steps, which were maintained over the remaining 12 months of the service.

Table 17. Utility scores for Active Steps and Control group at baseline and follow-ups of the economic evaluation: Baseline: Active Steps n =166, Control = 78; 1st Follow-up: Active Steps n =85, Control n = 75; 2nd Follow-up: Active Steps n =84, Control n = 70; 3rd Follow-up: Active Steps n = 49, Control n = 60). Data shown as mean \pm standard deviation.

Period	Active Steps	Control	p-value
Baseline	0.488 \pm 0.25	0.611 \pm 0.28	0.0007
1 st follow-up	0.587 \pm 0.26	0.597 \pm 0.30	0.827
2 nd follow-up	0.576 \pm 0.24	0.643 \pm 0.31	0.135
3 rd follow-up	0.615 \pm 0.26	0.624 \pm 0.29	0.865

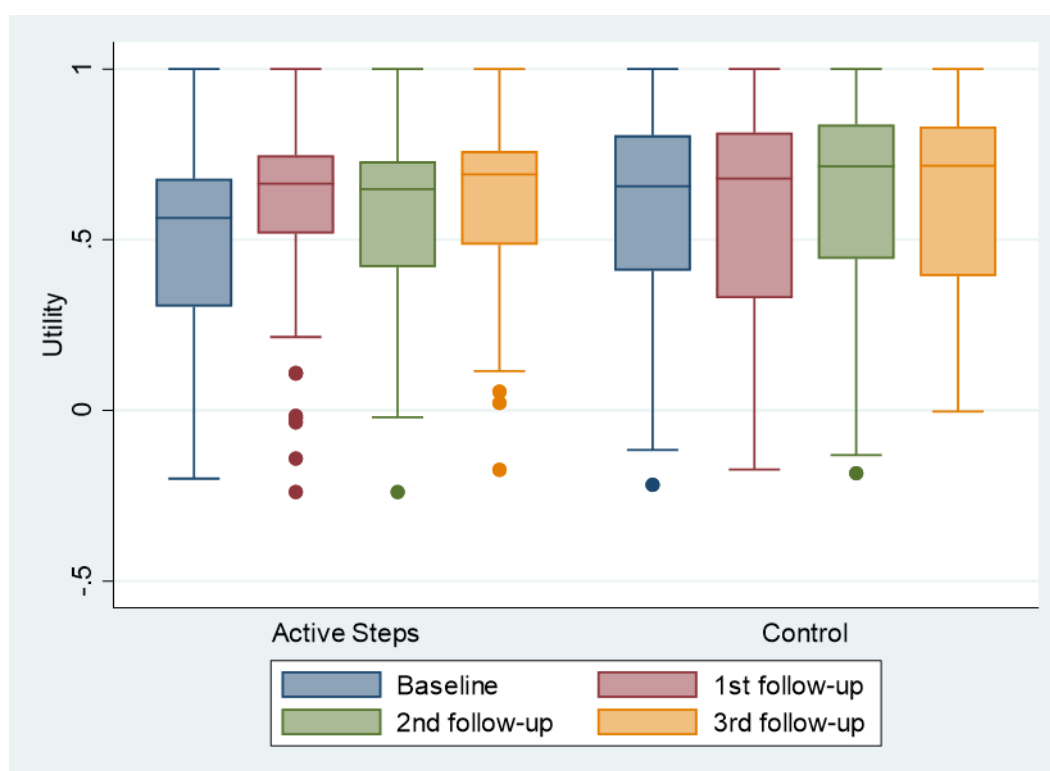


Figure 8. Box plots of utility scores by Active Steps and Control

Incremental Analysis

Results for the main evaluation are given in Table 18. The total costs and recall years formed across 107 Active Steps and 77 Control participants were, respectively, £163,751 and £157,276, and 63.0 and 60.4 years. These generated estimates of annual total costs that are almost equivalent, being £2,601 in Active Steps and £2,604 in Control. The latter was, however, heavily influenced by the inclusion of the study outlier. Upon its removal, the Control estimate plummets to £1,783 leaving a cost difference of £818 that is unfavourable to Active Steps (i.e. higher resource cost than control).

The total health benefits in Active Steps and Control were, respectively, 43.7 QALY over 77.6 life years and 39.1 QALY over 63.0 life years. These generate average annual estimates of 0.562 QALY in Active Steps and 0.620 QALY in Control. There were greater health benefits in the Control group, whether or not the study outlier was removed. The disparities in health between the groups at baseline carry throughout the course of the main evaluation.

In the main evaluation Active Steps was dominated by the Control group (standard care) - Active Steps incurred the greater cost and has lesser health benefit - but the participants in the two groups were not well matched. Better matching of the groups was seen when selecting subgroups of participants that face more similar circumstances in terms of disease severity. In particular, a target subgroup for Active Steps was adults with chronic lung conditions that consider themselves functionally disabled by breathlessness (MRC Dyspnoea grade 3 or higher). We further imposed the condition that participants remained included in this subgroup evaluation provided they did not undertake pulmonary rehabilitation. If pulmonary rehabilitation was undertaken, the follow-up periods from when that occurred were removed from the evaluation.

Participant numbers in this subgroup total 115, comprising 63 in Active Steps and 52 in Control. Once again, the inclusion of the study outlier distorted Control costs, so results where the outlier was removed was the focus (Table 19). The costs of Active Steps were marginally greater than Control (standard care) (£53 pa) but this was countered by better health benefits (0.024 QALY pa). The incremental cost-effectiveness ratio (ICER) was estimated to be £2,237/QALY, indicating the addition to NHS costs should Active Steps be implemented for every additional year of full quality health that it creates.

Table 18. Summary of deterministic economic results: main case

	Aggregate cost (£)	Recall years	Total cost (£ pa)	Total QALY	Life years	QALY (QALY pa)	ICER (£/QALY)
Main case							
Active Steps (n=107)	163,751	63.0	2,601	43.7	77.6	0.562	
Control (n=77)	157,276	60.4	2,604	39.1	63.0	0.620	52
difference			-3			-0.058	
Main case (outlier removed)							
Active Steps (n=107)	163,751	63.0	2,601	43.7	77.6	0.562	-12,329
Control (n=76)	106,357	59.7	1,783	39.1	62.1	0.629	Active Steps dominated
difference			818			-0.066	

Table 19. Summary of deterministic economic results: MRC Dyspnoea 3-5 subgroup

	Aggregate cost (£)	Recall years	Total cost (£ pa)	Total QALY	Life years	QALY (QALY pa)	ICER (£/QALY)
MRC Dyspnoea 3-5							
Active Steps (n=63)	67,940	30.1	2,254	20.7	37.8	0.547	-34,531
Control (n=52)	135,591	39.2	3,456	20.9	40.8	0.512	Active Steps dominates
difference			-1,203			0.035	
MRC Dyspnoea 3-5 (outlier removed)							
Active Steps (n=63)	67,940	30.1	2,254	20.7	37.8	0.547	
Control (n=51)	84,671	38.5	2,200	20.9	39.9	0.523	2,237
difference			53			0.024	

The bootstrap results for the MRC Dyspnoea grade 3 or higher (outlier removed) subgroup are displayed in Figure 9. From these, 490 replicates out of 1,000 were counted in which Active Steps costs were less than Control costs, and 296 replicates in which Active Steps QALYs were less than Control QALYs. Together, these imply that the cost-effectiveness acceptability curve (CEAC) spans the interval (0.49, 0.704) for willingness to pay thresholds exceeding zero; see Figure 10. For example, at threshold £10,000 per QALY, the probability that Active Steps will be cost-effective against standard care in this subgroup (MRC Dyspnoea grade 3 or higher) was predicted to be 60%.

Finally, the per service user cost of implementing Active Steps in the NHS was estimated at £153. We note that variation to that cost, added to say by £x (x>0), all other factors held constant, impacts the predicted ICER according to the approximate formula $ICER = (53 + x) / 0.024$ which can be deduced directly from Table 19. For example, if the cost of Active Steps doubled to £306 per service user (i.e. x=153), the ICER would be predicted to increase to close to £8,600 per QALY. In other words it could cost the NHS an additional £8,600 to implement Active Steps for every additional year of full quality health that it creates.

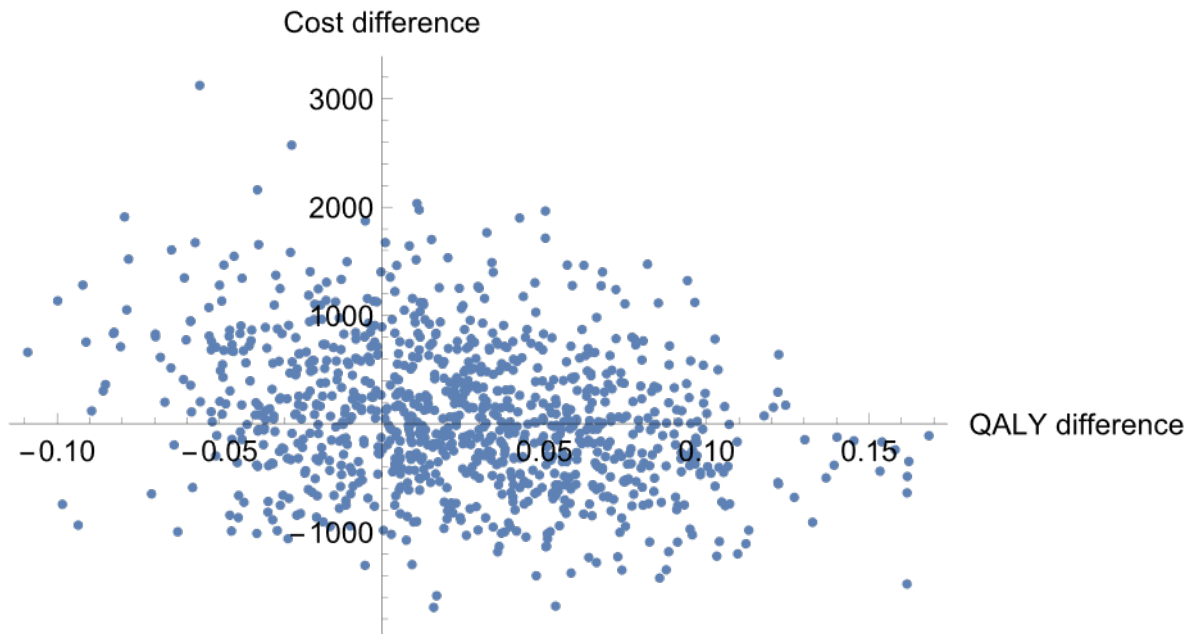


Figure 9. Incremental cost-effectiveness plane: MRC Dyspnoea 3-5

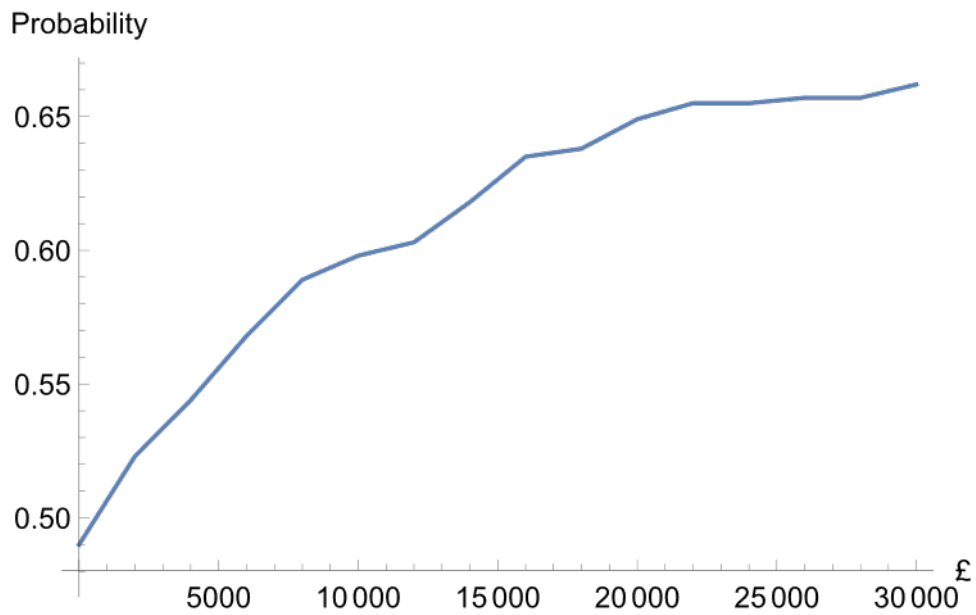
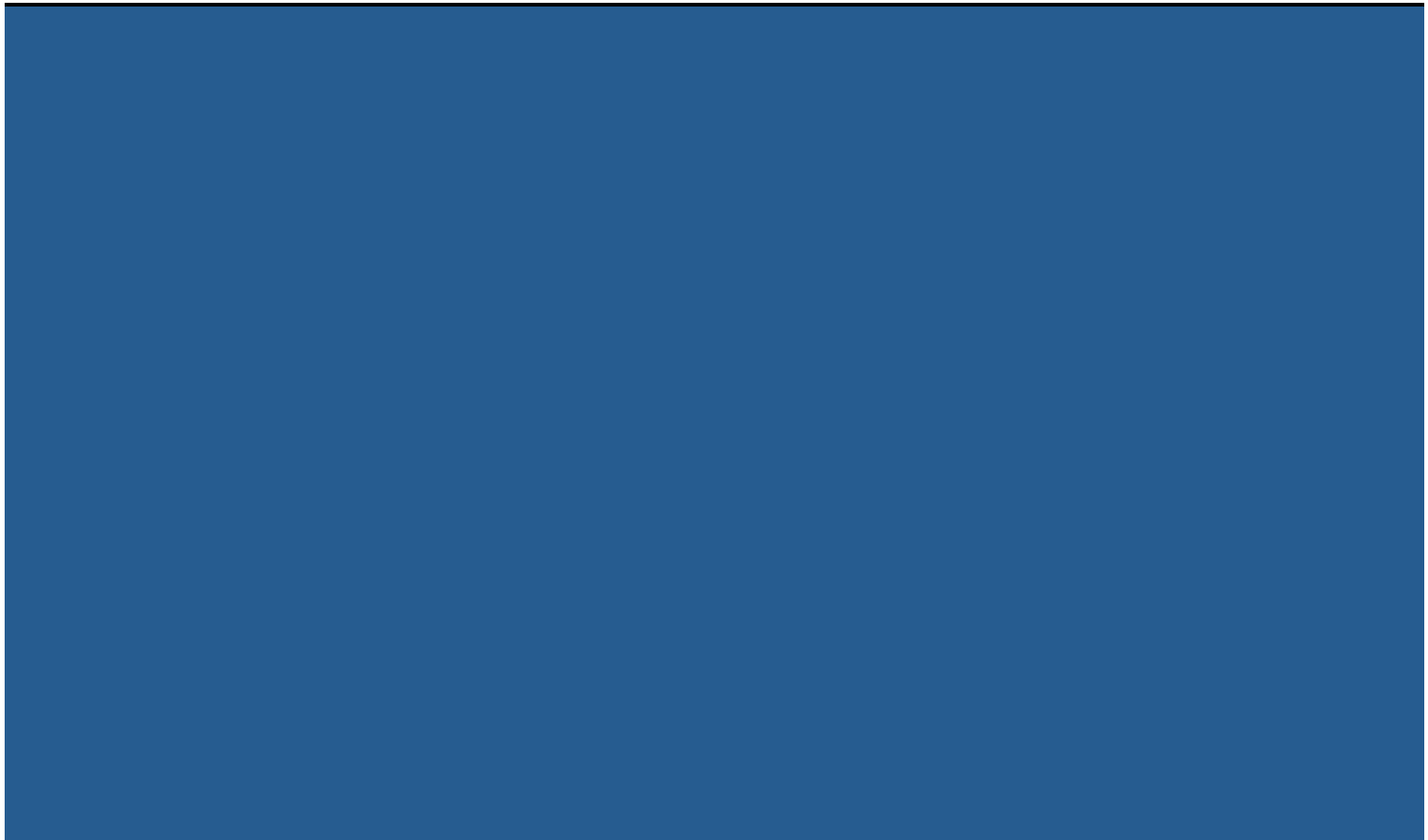


Figure 10: Cost-effectiveness acceptability curve: MRC Dyspnoea 3-5.

Key findings and recommendations



Key Findings

The Active Steps Service was designed to support adults with lung conditions to become and stay physically active over 12 months. This section summarises the key findings of the evaluation of Active Steps.

Active Steps service users were twice as likely to be physically active at 12 months than a control group. The proportion of Active Steps service users (46%) who were active at this point was lower than anticipated in the delivery plan and the differences between groups were only statistically significant when unadjusted by potential confounders.

Active Steps service users were 9 times and 17 times more likely to be physically active at 3 months and 6 months. The differences between the groups were statistically significant at both timepoints but only data at 3 months saw the proportion of service users (56%) achieve the anticipated activity levels in the delivery plan.

Compared to a Control group, there was a clinically meaningful improvement in self-perceived health (measured by the EQ-VAS) from baseline to 12 months in Active Steps service users. The minimal clinical important difference of EQ-VAS is a change in score of 7.0.^{40,54} Active Steps service users had presented with worse self-perceived health than the control group at baseline, with a greater number of the former reporting problems with usual activities and anxiety/depression.

Compared to a Control group, there was a clinically meaningful improvement in self-perceived health from baseline to 3 months, but not to 6 months in Active Steps service users. For change from baseline to 3 months, the improvement in EQ-VAS score due to Active Steps was clinically meaningful and statistically significant when unadjusted or adjusted for potential confounders.

Changes from baseline to 3 months, 6 months and 12 months in disease specific symptoms (dyspnoea, fatigue, emotional function) within Active Steps service users were statistically significant and clinically meaningful. Statistically significant and clinical meaningful differences were also seen for the mastery domain at 3 and 6 months but the average change at 6 months (0.4) fell short of the minimal clinical important difference for domains of the short-form Chronic Respiratory Disease Questionnaire (0.5).⁵⁴

50% of Active Steps service users had increased self-efficacy over 12 months, and there were also statistically significant increases in physical capability to be active, knowledge of how to overcome barriers that stops them from being active, ability to make plans to be active, and activity now

becoming part of their daily routine. These changes provide the potential mechanisms for the change in physical activity in service users. Not all of these were anticipated effects of Active Steps. Physical capability was not a specific target of the service, but it is likely that the changes that were brought about the service (i.e. increased physical activity) improved physical health so that service users felt more capable of being active. The increase in self-reported measures of psychological capability, reflective motivation, and automatic motivation provide evidence that intervention was delivered as intended. Given that awareness of the importance to be active was high on entry to Active Steps and did not change across the 12 months in service users, this may suggest that self-monitoring of behaviour, feedback on behaviour and were key to improvement in physical activity. Indeed exploratory analysis of the Active Steps service users showed that improvement in self-efficacy and reflective motivation (making plans to be active) were significant predictors of becoming physically active.

Social support from health coach and friends or family alongside encouragement and goal setting in the intervention calls were also facilitators to physical activity. The importance of encouragement from Active Steps team was a major theme in the qualitative data and the importance of friends/family support to be active was apparent in both quantitative and qualitative data. This is further evidence that active ingredients of the Active Steps were delivered as intended. This also adds evidence to the research literature reporting the success of interventions with goal setting as a component and where social support has been found to be an important factor in determining physical activity in people with lung conditions.^{55,56}

Other chronic conditions and lack of opportunities to be physically active in the local community were barriers to physical activity in service users. The lack of opportunities to be physically active was apparent in both the quantitative and qualitative data. Active Steps components had been designed to support service users with identifying local opportunities to be active but a measure of the physical opportunity of the COM-B model remained unchanged. The qualitative data suggested that this may be due to the lack of available activities in the local community or where opportunities were available, the need for travel or health status impacted access.

Active Steps engaged with a range of chronic lung conditions from various socioeconomic backgrounds but the service largely recruited females with a White Ethnic background. The demographic profile, however, is similar to previous BLF projects and the ethnicity profile was similar to the Control group used in the current evaluation. Given that gender may influence participation in physical activity, this was controlled for in the analysis of differences in physical activity and self-perceived health between Active Steps and the Control group.

Active Steps reached 1417 adults with lung conditions, with 61% first making contact via the Active Steps webpage. The number of individuals reached by the service was lower than the anticipated 2000 in the delivery plan. Although the webpage was able to reach a larger number of potential service users, a smaller proportion of these compared to helpline referrals resulted in successful screening calls. Delivery of Very Brief Advice and referral rate to Active Steps via BLF Helpline fell below the proposed target in the delivery plan. The helpline team were aware of this shortfall during the project and felt pressured to meet the original target despite also accepting that there were aspects of this out of their control. It was not always straightforward to confirm whether callers to the helpline were eligible for Active Steps.

Familiarity of the BLF helpline to provide advice over the telephone and the close working relationship of the helpline to the Active Steps team were facilitators to implementation of Active Steps. Once initial administrative changes were overcome, helpline team felt the delivery of very brief advice was similar to other aspects of their day-to-day role. Having the helpline team located with the Active Steps team allowed for efficient follow-up with service users and service troubleshooting.

Behaviour change counselling and motivational interviewing were delivered as intended in intervention calls by the Active Steps team but frequency and number of calls were lower than anticipated. The relatively high success rate of attempted intervention calls (88%) is similar to previous health coaching studies.⁵⁷ The coding of intervention calls revealed that the Active Steps team were competent in motivational interviewing and behaviour change counselling. Active Steps was designed to be person-centred but to estimate capacity of the service, the original delivery model anticipated an average of 12 calls, tapered over 12 months (fortnightly calls during first 3 months, monthly calls from month 4 to 6 and then bimonthly calls thereafter). This was based on previous evidence of telephone coaching interventions suggesting higher frequency (> 12 calls), longer duration (>6 months) and a tapered approach being associated with better outcomes.⁵⁸⁻⁶² Although the number of calls received by service users (>12 calls) were not associated with physical activity levels, service users who had received calls for 6 months or more were more likely to be physically active at 12 months.

Administrative workload, staff shortages and fluctuating service users recruitment were barriers to implementation of Active Steps. Two different project managers for Active Steps left their positions during the project period. The vacancy for the second project manager was not filled in the second year of the project due to the national lockdown for the COVID-19 pandemic. Keeping up-to-date with the evaluation calls, particularly during the busiest recruitment periods of the service were challenging. A new member of staff was recruited to support completion of evaluation calls. However, as the project manager also had responsibility for delivery of intervention calls, it may be

suggested that there were large parts of the project where the service was not fully staffed or at least to meet the demand. The reported time consuming nature of evaluation calls alongside service delivery may partly explain why only 51 - 55% of service users provided data across all timepoints.

Of those who joined Active Steps, 26% withdrew from the service, including some who became motivated to be active and did not require any further support from the service. These withdrawals mostly occur during the first 3 months of service delivery where contact was lost, service users felt the service was not for them or ill health or personal reasons prevented them continuing. Some also opted to leave the service because they felt motivated to be active and did not require any further support from Active Steps. An interview with one past service user indicated that the intervention calls were not scheduled routinely enough for them while staff reported that some service users wanted the option to extend or shorten the support. This supports the design of Active Steps to be person-centred but future implementation may seek to test further flexibility or alternative delivery models for the service (for duration of support) albeit the value of this over the intended outcomes (e.g. improve long-term physical activity) would need to be considered).

Active Steps can complement other health care services including being a source of disease specific advice and increase access to pulmonary rehabilitation, but more advertisement and promotion would be required. At all timepoints, more than 1 in 5 service users were accessing pulmonary rehabilitation. A key theme from the qualitative data was that Active Steps could act as a stepping stone for pulmonary rehabilitation. There is preliminary evidence in the research literature that health coaching interventions can increase attendance at pulmonary rehabilitation.⁶¹ There is also evidence to suggest that a combination of pulmonary rehabilitation and counselling interventions are one of the most effective interventions in improving physical activity in COPD.⁶² Hence, consideration of how Active Steps can integrate with existing services for people with lung conditions is worthwhile.

Active Steps would benefit from connecting service users virtually or face-to-face in their local communities. Whilst impact of the social support from Active Steps and friends or family was evident in the evaluation, service users and staff both reported that a service refinement to allow for virtual or face-to-face peer support would be of additional benefit. This is similar to findings in the literature^{56,63} where key facilitators to structured physical activity or maintenance of physical activity followed structured programmes is peer support. BLF may have capacity within their existing portfolio (e.g. Breathe Easy) to achieve this.

In adults living with a lung condition and a MRC Breathlessness score of 3-5, the tested Active Steps service improves health but would do so at increased cost to the NHS. Implementing Active Steps is expected to be cost-effective against standard care for adults with lung conditions provided the

NHS is prepared to pay at least £2,237 to achieve an additional year of full health. People with chronic lung conditions are indicated for structured physical activity programmes if they report to be functionally disabled due to breathlessness. One such cost-effective intervention is pulmonary rehabilitation.⁶⁴ We view Active Steps as complementary to pulmonary rehabilitation in the treatment of chronic lung conditions. The participants in this evaluation were largely patients waiting for access to pulmonary rehabilitation. Future designs may consider use of Active Steps following pulmonary rehabilitation, evaluating how it may help to maintain or build upon the health gains made due to pulmonary rehabilitation.

Incorporating uncertainty, at a willingness to pay threshold of £10,000 per QALY there is a 60% chance that Active Steps will be cost-effective over standard care. Remote coaching interventions delivered through internet and telephone have potential to be cost-effective against standard care in diverse disease settings.⁶⁵ Our results for the telephone-based health coaching of Active Steps point towards this too, for adults with chronic lung conditions. For patients that are functionally disabled due to breathlessness we estimate the Incremental Cost-Effectiveness Ratio (ICER) associated with Active Steps versus standard care to be £2,237/QALY, lying below commonly adopted commissioning thresholds, such as National Institute for Health and Care Excellence (NICE)'s £20,000/QALY.

Strengths and limitations

A key strength of this evaluation is that it is the first analysis of a nationwide behaviour change service for people with lung conditions in the UK. Whilst the Active Steps service delivery team collected data on Active Steps service users, data were immediately sent to the evaluation team via a web-based system to keep the evaluation as independent as possible. Service users received intervention calls from the same health coach of the Active Steps team. Evaluation calls for all service users were conducted by a member of the Active Steps team who was not actively supporting them (i.e. not the health coach of the service user) to help reduce the risk of bias. Another strength of this evaluation was the inclusion of a control group. Although the nature of the evaluation (i.e. lack of randomisation) does not eliminate the risk of bias the use of a control group allowed for better scrutiny of changes in physical activity and health status due to Active Steps, compared to typical service evaluations. A key strength of the process evaluation also included input from a range of stakeholders including those who withdrew from Active Steps.

A major limitation with the impact evaluation data was the completeness of follow-up. Almost half of service users did not provide data at 3 months, 6 and 12 months. The primary objective for the evaluation was to assess the change in physical activity. To support collection of the primary outcome, BLF sent a letter to all service users prior to the follow-up at 12 months to encourage

completion. This was partly successful in by having service users who had withdrawn from the service come forward to provide data at 12 months. Service users were given the option of only providing data for the primary outcome. Some service users opted for this but it did not improve on overall completion rate compared to earlier timepoints, but did prevent further missing data at 12 months. Challenges in the long-term follow-up of populations with lung conditions are common. However, due to the level of missing data in this evaluation, the analysis of Active Steps was largely limited to efficacy of the service. An effectiveness analysis was not performed. Caution is urged when interpreting the “true” impact of Active Steps on patient reported outcomes.

The impact and economic evaluation in this report compared Active Steps to standard care using data obtained from a concurrent cohort study rather than a randomised control trial. Baseline imbalances were observed in characteristics such age, gender, mental health condition, heart condition and diabetes. Analyses on physical activity and self-perceived health were performed with adjustments for these baseline imbalances and hence help reduce the risk of confounding bias in the findings. Heterogeneity by cohort arm were also realised in the main economic analysis. Active Steps service users had a worse self-perceived health at baseline. Targeting of a patient-type relevant to other physical activity programmes managed to overcome this heterogeneity, but it is a limitation that selection was made post- rather than pre-evaluation.

Conclusions

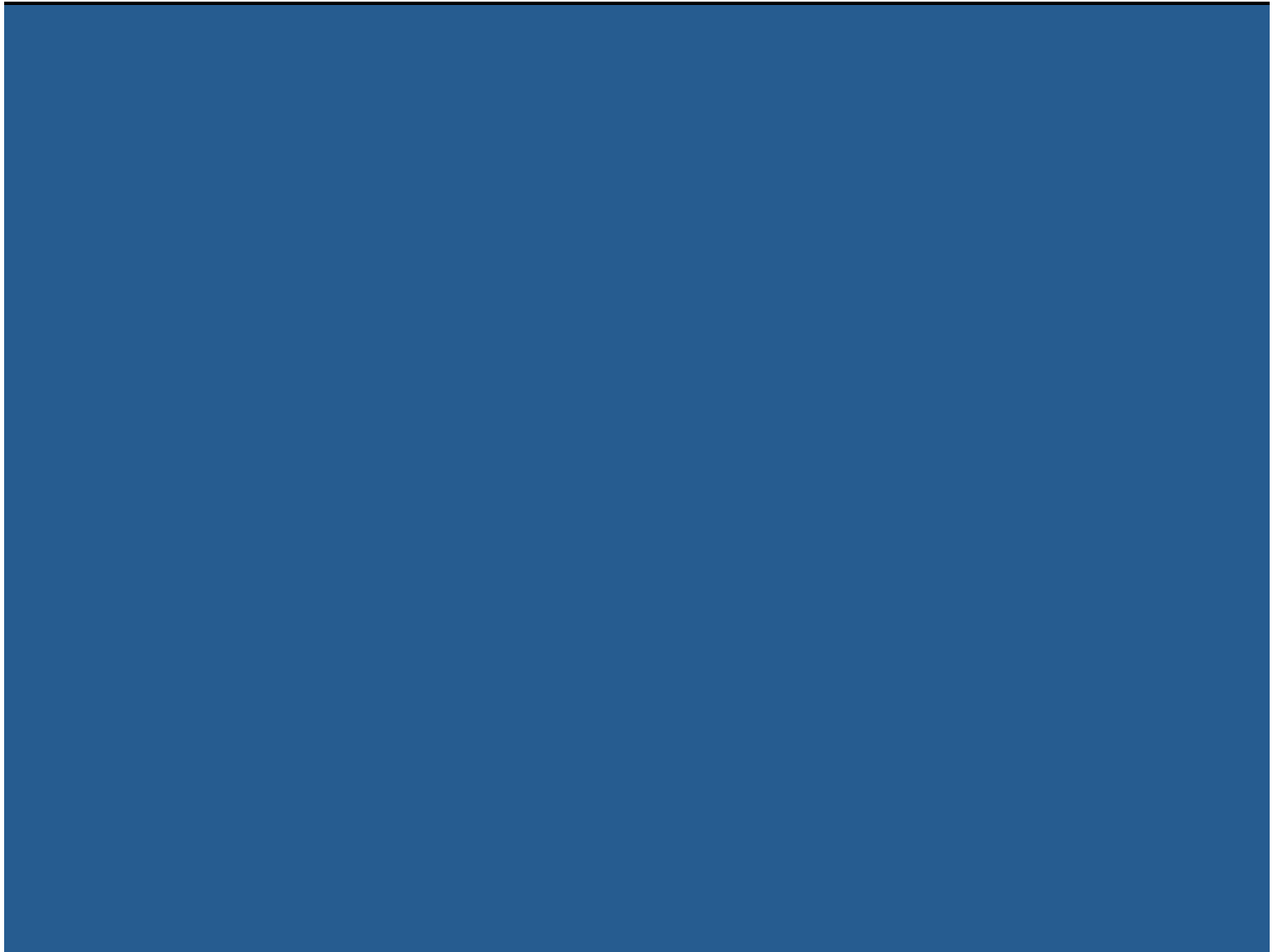
Active Steps was an efficacious service delivered by BLF that resulted in improved physical activity at 3, 6 and 12 months. These changes in physical activity coincided with service user changes in knowledge of how to overcome barriers that stops them from being active, ability to make plans to be active, and activity now becoming part of their daily routine. The current delivery model led to a high administrative and demanding workload on the Active Steps team, which impacted on capacity to deliver intervention calls and complete follow-up of service users. Physical symptoms, comorbidities and lack of physical opportunities for service users to be active were key barriers to implementation of Active Steps. Interest in Active Steps was greater from the BLF website but the setting and close working relationship of the helpline team with the Active Steps team supported implementation. Active Steps service users were largely females with a white ethnic background; hence caution is advised on generalisability of the findings.

Recommendations

Based on the findings presented in this report, the following recommendations are provided:

- Provide telephone support for > 6 months for long-term change in physical activity but alternative, shorter delivery models should be explored including as strategies to support other interventions for lung conditions (e.g. pulmonary rehabilitation).
- Provide resources from the welcome pack on the BLF website to allow long-term access for service users and/or achieve benefit beyond Active Steps users alone.
- Based on the tested delivery model, enrolment of service users in 'cohorts' rather than rolling enrolment would allow for better management of resources.
- Provide a virtual platform for service users to engage with each other and ensure timely integration of other BLF resources (e.g. clinical nurses, Breathe Easy groups).
- Refine the website to be a screening form for the service, which (subject to eligibility) would provide information for the potential service users to contact the helpline for Active Steps service (if eligible) or be signposted to a more relevant BLF service.
- Any future delivery of Active Steps should consider insight work to understand the acceptability of the service in other ethnic backgrounds and/or consider specific refinements to the service components to increase engagement (e.g. targeted case studies).
- The tested model of Active Steps should be targeted at adults with lung conditions with an MRC breathlessness score of 3 or higher.

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Appendices



Appendix 1

BLF Active Steps Evaluation Call Script Template

Start of Block: Physical Activity

Q1 In the past 7 days, have you done a continuous walk lasting at least 10 minutes?

Yes

No

If Yes

Q2 In the past 7 days, on how many days did you do a walk lasting at least ten minutes?

0

1

2

3

4

5

6

7

Q3 How much time did you usually spend walking on each day that you did the activity?

Q4 Was the effort you put into walking usually enough to raise your breathing rate, above any usual breathlessness you experience?

Yes

No

Appendix 1

Q5 In the past 7 days, have you done a cycle ride?

Yes

No

If Yes

Q6 In the past 7 days, on how many days did you do a cycle ride?

0

1

2

3

4

5

6

7

Q7 How much time did you usually spend cycling on each day that you did the activity?

Q8 Was the effort you put into cycling usually enough to raise your breathing rate, above any usual breathlessness you experience?

Yes

No

Appendix 1

Q9 In the past 7 days, have you done sport, fitness activity (such as gym or fitness classes), or dance?

Yes

No

If Yes

Q10 In the past 7 days, on how many days did you do a sport, fitness activity (such as gym or fitness classes), or dance?

0

1

2

3

4

5

6

7

Q11 How much time did you usually spend doing sport, fitness activity, or dance on each day that you did the activity?

Q12 Was the effort you put into doing sport, fitness activity, or dance usually enough to raise your breathing rate, above any usual breathlessness you experience?

Yes

No

End of Block: Physical Activity (non-web)

Appendix 1

Start of Block: Consent

Q13 Participant ID

Q14 Enter a date:

Q15 We (British Lung Foundation) have received funding from Sport England to develop and deliver a new service called Active Steps. We are required by Sport England to evaluate the impact of this project and would value your feedback and input. We are working with the University of Lincoln and Traverse Ltd to perform an evaluation of this service.

In order to help us with the evaluation, our evaluation partners require information from people who do or do not receive support through the new service. To do this, they would like to:

- **Collect anonymised results on your physical and mental wellbeing based on the questions asked to you by the British Lung Foundation at the start of the service, 3 months, 6 months and 12 months later.**
- **Listen to a small number of the Active Steps telephone calls for purposes of training and monitoring of service delivery.**
- **Collect information on physical activity by some people with lung conditions wearing an activity monitor for 7 days at the start and end of the service**
- **Complete a telephone interview with some people with lung conditions, lasting 30 - 60 minutes to understand more about your experience of the service.**

You are being invited to take part in this evaluation. Please be assured that your responses will be kept completely confidential. Before proceeding, we need your consent to take part in the evaluation. I am now going to read out a number of a statements of consent, please answer yes or no at the end of each statement. Please ask if you would like me to re-read any of the statements.

Appendix 1

Q16 You understand that your participation is voluntary and that you are free to withdraw at any time without giving any reason, without your legal rights being affected. You understand that should you withdraw then the information collected so far may not be erased and that this information may still be used in the project evaluation.

Yes

No

Q17 You consent for your anonymised results from all evaluation questionnaires to be shared with our evaluation partners.

Yes

No

Q18 You understand that relevant sections of data collected during the evaluation, may be looked at by individuals from the University of Lincoln, from regulatory authorities, where it is relevant to my taking part in this research. You give permission for these individuals to have access to your records and you understand that your personal details will be kept confidential.

Yes

No

Q19 You understand that you may be asked to wear an activity monitor at the start and end of the service and agree for the University of Lincoln to contact you via telephone

Yes

No

Appendix 1

Q20 If contacted by the University of Lincoln, you understand that you will be asked to provide a postal address so that you can receive a physical activity monitor and this will need to be returned to the University of Lincoln

Yes

No

Q21 You understand that you may be asked to participate in an interview and agree for the University to Lincoln to contact you via telephone.

Yes

No

If Yes

Q22 Telephone number

Q23 If contacted by University of Lincoln, you agree for the interview to be digitally recorded, typed up and for your comments (in anonymised form) to be quoted in reports, articles or presentations of the project.

Yes

No

Q24 You agree for the University of Lincoln to listen to any recorded calls you receive as part of the new service at the British Lung Foundation Headquarters.

Yes

No

Appendix 1

Q25 You agree to take part in this evaluation.

Yes

No

End of Block: Consent

Appendix 1

Start of Block: Demographics

Q26 What is your gender?

- Male
 - Female
 - Other
 - Prefer not to say
-

Q27 What is your age?

Q28 Which of the following best describes your ethnic group or background (please select one option)?

- White
- Mixed
- Asian or Asian British
- Black or Black British
- Other Ethnic Group

Q29 Do you have any long-term physical or mental health conditions, disabilities or illnesses? By long-term we mean anything lasting or expected to last 12 months or more. Please include conditions related to old age.

- Yes
 - No
 - Don't know
 - Prefer not to say
-

Appendix 1

Q30 Which, if any, of the following long-term conditions do you have?

- Alzheimer's disease or other cause of dementia
- Arthritis or ongoing problem with back or joints
- Blindness or partial sight
- A breathing condition such as asthma or COPD
- Cancer diagnosis or treatment in the last 5 years
- A developmental disability such as autism or ADHD
- Diabetes
- A heart condition such as angina or atrial fibrillation
- High blood pressure
- Kidney or liver disease
- A learning disability
- A mental health condition
- A neurological condition such as epilepsy
- A stroke which affects your day-to-day life
- Another long-term condition or disability
- I do not have any long-term conditions

Q31 What is your postcode?

Appendix 1

Q32 What lung condition(s) do you have?

- Chronic Obstructive Pulmonary Disease (Chronic Bronchitis or Emphysema)
 - Bronchiectasis
 - IPF
 - Lung Cancer
 - Mesothelioma
 - Pulmonary Fibrosis
 - Asthma
 - Other _____
-

Q33 Are you prescribed oxygen?

- Yes
- No

If Yes

Q34 Please specify oxygen prescription

- Ambulatory oxygen
 - Long term oxygen therapy
-

Appendix 1

Q35 How did you find out about the service?

- BLF Helpline
- Facebook
- Other _____

End of Block: Demographics

Start of Block: MRC-Degree of breathlessness related to activities

Q36 How would you describe your breathlessness?

- Not troubled by breathlessness except on strenuous exercise
- Short of breath when hurrying or walking up a slight hill
- Walks slower than contemporaries on level ground because of breathlessness, or has to stop for breathe when walking at own pace
- Stops for breath after walking about 100m or after a few minutes on level ground
- Too breathless to leave the house, or breathless when dressing or undressing

End of Block: MRC-Degree of breathlessness related to activities

Appendix 1

Start of Block: Self-efficacy

Q37 To what extent do you agree with the statement 'I can achieve most of the goals I set myself?'

- Strongly Agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- Don't know
- Prefer not to say

End of Block: Self-efficacy

Start of Block: Quality of life

Q38 How would you rate your quality of life?

- Very poor
- Poor
- Neither poor or good
- Good
- Very good

End of Block: Quality of life

Appendix 1

Start of Block: COM-B

Q39 Capability, Opportunity, Motivation

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I am physically capable of being active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know how to overcome the barriers which stop me from being active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are opportunities for me to be active either at home or near to where I live	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have enough time to be active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My friends and family support me to be active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Active Steps supports me to be active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe it is important for me to be active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am motivated to be active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I make plans to be active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being active is part of my daily routine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: COM-B

Appendix 1

Start of Block: Short-form CRQ

Q40 Please indicate how much shortness of breath you have had during the last 2 weeks while walking on a flat surface?

- Extremely short of breath
 - Very short of breath
 - Quite a bit short of breath
 - Moderate Shortness of breath
 - Some Shortness of breath
 - A little Shortness of breath
 - Not at all short of breath
-

Q41 Please indicate how much shortness of breath you have had during the last 2 weeks while sleeping?

- Extremely short of breath
 - Very short of breath
 - Quite a bit short of breath
 - Moderate Shortness of breath
 - Some Shortness of breath
 - A little Shortness of breath
 - Not at all short of breath
-

Appendix 1

Q42 How often over the last 2 weeks have you felt worn out or sluggish?

- All of the time
 - Most of the time
 - A good bit of the time
 - Some of the time
 - A little of the time
 - Hardly any of the time
 - None of the time
-

Q43 How much energy have you had in the last 2 weeks?

- No energy at all
 - A little energy
 - Some energy
 - Moderate energy
 - Quite a bit energy
 - Very energetic
 - Full energy
-

Appendix 1

Q44 In general, how much of the time during the last 2 weeks have you felt frustrated or impatient?

- All of the time
 - Most of the time
 - A good bit of the time
 - Some of the time
 - A little of the time
 - Hardly any of the time
 - None of the time
-

Q45 In general, how much of the time did you feel upset, worried, or depressed during the last 2 weeks?

- All of the time
 - Most of the time
 - A good bit of the time
 - Some of the time
 - A little of the time
 - Hardly any of the time
 - None of the time
-

Appendix 1

Q46 How often during the last 2 weeks did you have a feeling of fear or panic when you had difficulty getting your breath?

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- Hardly any of the time
- None of the time

Q47 How often during the last 2 weeks did you feel you had complete control over your breathing problems?

- None of the time
- Hardly any of the time
- A little of the time
- Some of the time
- A good bit of the time
- Most of the time
- All of the time

End of Block: Short-form CRQ

Appendix 1

Start of Block: EQ5D-5L

Q48 We are trying to find out what you think about your health. First, I am going to read out some simple questions about your health TODAY. Each question has a choice of five answers. I will then ask you to rate your health on a measuring scale.

Q49 First I'd like to ask you about mobility. Would you say that:

- You have no problems in walking about
 - You have slight problems in walking about
 - You have moderate problems in walking about
 - You have severe problems in walking about
 - You are unable to walk about
-

Q50 Next I'd like to ask you about self-care. Would you say that:

- You have no problems in washing or dressing yourself
 - You have slight problems in washing or dressing yourself
 - You have moderate problems in washing or dressing yourself
 - You have severe problems in washing or dressing yourself
 - You are unable to wash or dress yourself
-

Appendix 1

Q51 Next I'd like to ask you about usual activities, for example work, study, housework, family or leisure activities. Would you say that:

- You have no problems doing your usual activities
 - You have slight problems doing your usual activities
 - You have moderate problems doing your usual activities
 - You have severe problems doing your usual activities
 - You are unable to do your usual activities
-

Q52 Next I'd like to ask you about pain or discomfort. Would you say that:

- You have no pain or discomfort
 - You have slight pain or discomfort
 - You have moderate pain or discomfort
 - You have severe pain or discomfort
 - You have extreme pain or discomfort
-

Q53 Finally I'd like to ask you about anxiety or depression. Would you say that:

- You are not anxious or depressed
 - You are slightly anxious or depressed
 - You are moderately anxious or depressed
 - You are severely anxious or depressed
 - You are extremely anxious or depressed
-

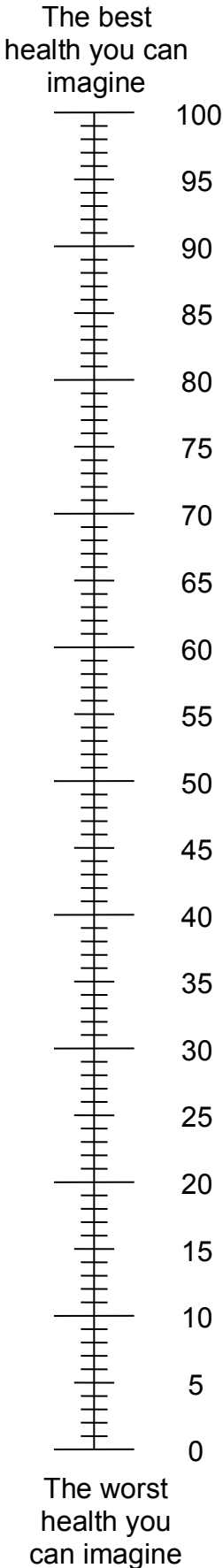
Appendix 1

Q54 Now, I would like to ask you to say how good or bad your health is TODAY.

I'd like you to try to picture in your mind a scale that looks a bit like a thermometer. Can you do that? The best health you can imagine is marked 100 (one hundred) at the top of the scale and the worst health you can imagine is marked 0 (zero) at the bottom.

I would now like you to tell me the point on this scale where you would put your health today.

End of Block: EQ5D-5L



Appendix 1

Start of Block: NHS resource use

Q55 In the last 3 months, have you seen a nurse or a GP because of a worsening of your lung problems due to an exacerbation/chest infection?

Yes

No

If Yes

Q56 How many times have you seen a nurse or a GP?

Q57 Did the nurse or the GP prescribe additional medication (steroids and/or antibiotics) for a short period to help you get better?

Yes

No

If Yes

Q58 How many times did the nurse or the GP prescribe additional medication?

Q59 In the last 3 months, have you experienced an exacerbation/chest infection so severe that you had to go to the hospital?

Yes

No

If Yes

Q60 How many times have you had to go to hospital?

Appendix 1

Q61 We want to find out how your lung condition affects your use of health services. The following questions are about this. Please consider all visits and stays. In the last 3 months, have you attended hospital?

Yes

No

If Yes

Q62 How many times have you attended hospital?

	Because of your lung condition	For other reasons only
	Number of times	Number of times
Hospital overnight stay		
If yes, how many days in total?		
Days in intensive care		
Emergency admission		
Outpatient consultation		
Other, please specify:		

Q63 For any of these hospital visits, did you go to the hospital by ambulance?

Yes

No

Q64 How many times did you go to the hospital by ambulance?

Appendix 1

Q65 In the last 3 months, have you consulted your GP?

Yes

No

If Yes

Q66 How many times have you consulted your GP?

	Because of your lung condition Number of times	Because of other reasons only Number of times
At the GP surgery		
Over the phone		
At home		

Q67 In the last 3 months, have you consulted a nurse from your GP surgery?

Yes

No

If Yes

Q68 How many times have you consulted a nurse from your GP surgery?

	Because of your lung condition Number of times	Because of other reasons only Number of times
At the GP surgery		
Over the phone		
At home		

Q69 We would like to find out if people with lung conditions see other health care professionals. The following questions are about this. In the last 3 months, have you seen other health care professionals?

Yes

No

Appendix 1

If Yes

Q70 How many times have you seen other health care professionals?

	Number of visits:	Number of phone calls:
District nurse		
Community matron		
Specialist nurse or oxygen nurse		
Physiotherapist or occupational therapist		
Other, please specify:		

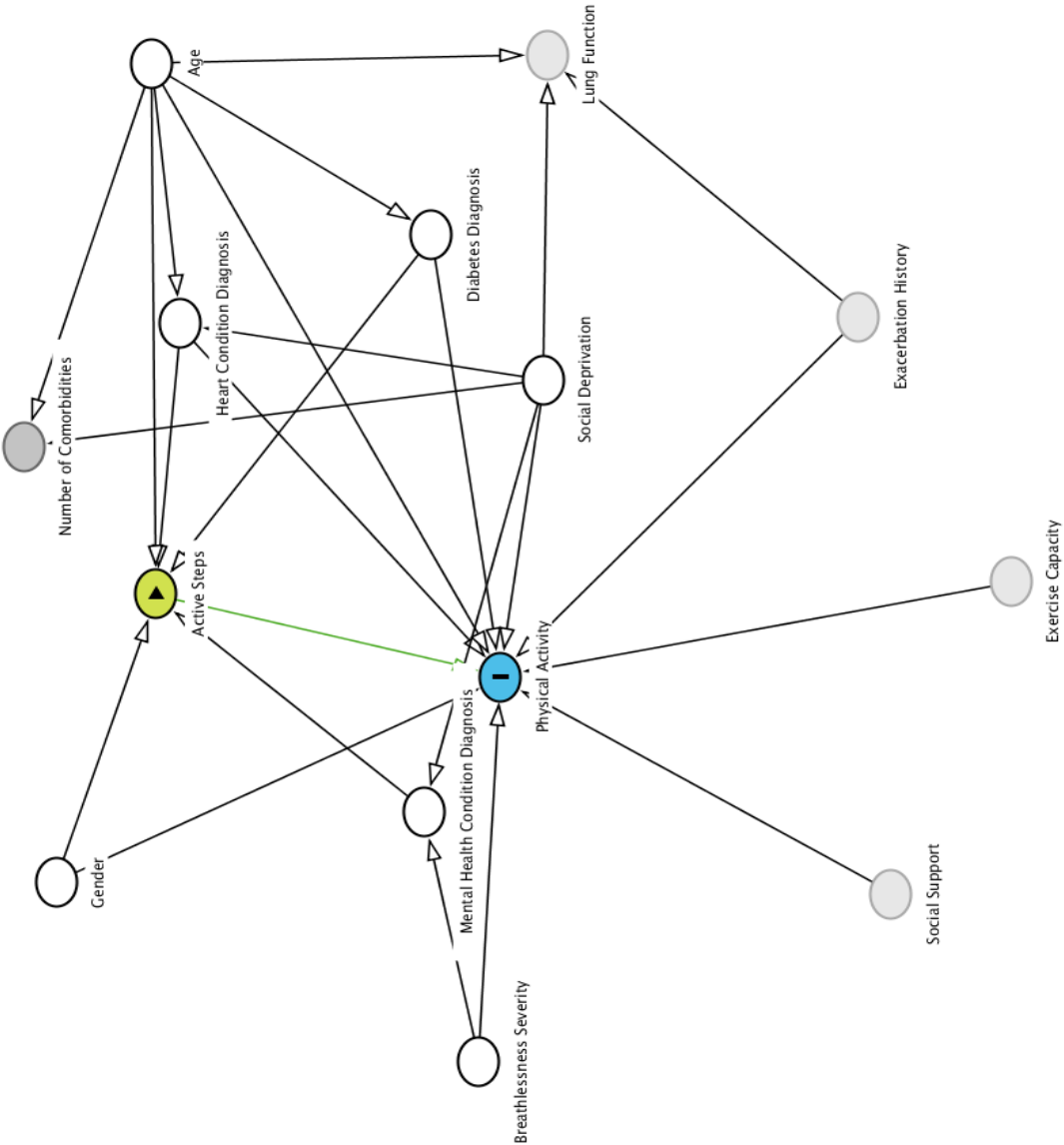
End of Block: NHS resource use

Start of Block: End of Questions

Thank you for your input. We will take good care of your information, please feel free to check out our privacy policy at www.blf.org.uk/privacy. Your responses to the questions will be shared in anonymised form with the University of Lincoln. We will send you information by post or email on how the University of Lincoln will process your data.

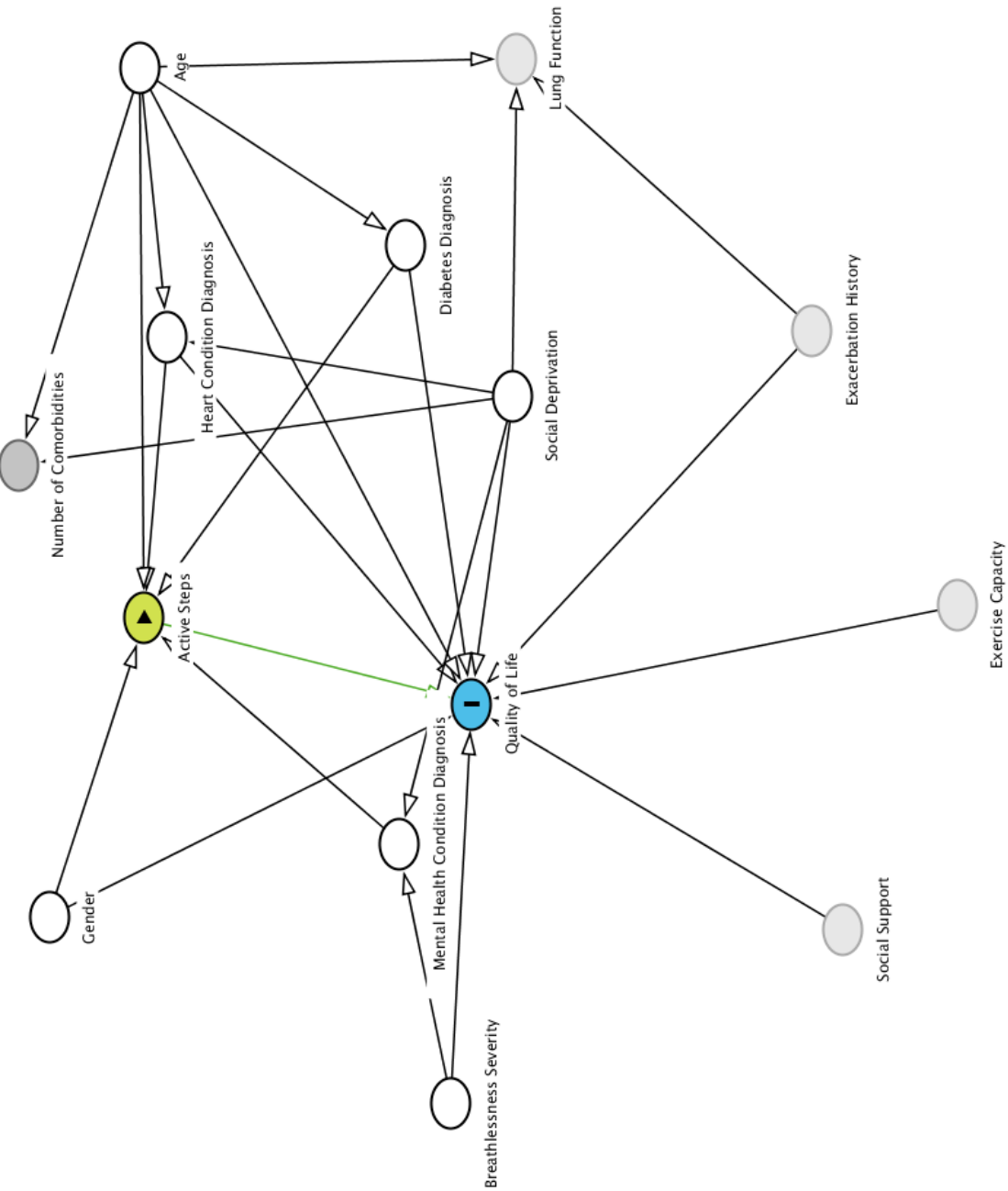
End of Block: End of Questions

Appendix 2



Causal Directed Acycling Graph illustrating the relationship of Active Steps (exposure) to Physical Activity (Outcome). This includes 12 covariates which are potentially linked to Active Steps (baseline differences to independent control group) or physical activity (based on previous literature). Covariates (Age, Breathlessness Severity, Diabetes, Gender, Heart Condition, Mental Health, Social Deprivation) which were linked to both exposure and outcome were adjusted for in the estimates of effect of Active Steps on physical activity.

Appendix 2



Causal Directed Acycling Graph illustrating the relationship of Active Steps (exposure) to self-perceived health (EQ-VAS) (Outcome). This includes 12 covariates which are potentially linked to Active Steps (baseline differences to independent control group) or self-perceived health (based on previous literature). Covariates (Age, Breathlessness Severity, Diabetes, Gender, Heart Condition, Mental Health, Social Deprivation) which were linked to both exposure and outcome were adjusted for in the estimates of effect of Active Steps on self-perceived health.

Appendix 3

Interview topic guide for withdrawn Active Steps patients

Open Interview

Introduce yourself to the participant. Talk through the topic of conversation for the telephone interview and how long it may last.

Hello, my name is X and I am a Researcher at the University of Lincoln. The British Lung Foundation received funding from Sport England to develop and deliver a new service called Active Steps. They are required by Sport England to evaluate the impact of this project and would value your feedback and input. We (the University of Lincoln) are working with the British Lung Foundation to perform an evaluation of this service. You have previously consented to taking part in a telephone interview. Thank you for this, your contribution will help towards supporting people with lung conditions to become active. Today I will ask you a series of questions to explore your experiences of your invitation to take part in Active Steps, the support you received through Active Steps and how you feel this has affected your health and current or future physical activity. The interview should not take longer than 60 minutes.

Provide opportunity for questions about the interview, re-confirm that patients agree to take part:

Q. Do you have any questions before we start the interview? Can I confirm that you still agree to take part in this interview?

Note: Ask the questions that are relevant to each patient. Only ask the questions and use the prompts when required, e.g. do not repeat questions or prompts.

Active Steps Invitation

I am first going to ask you a few questions about how you were approached to take part in Active Steps Service

Q. Tell me about the way you accessed Active Steps.

Prompts: What did you like/dislike about this process? Could this be improved?

Q. What was your initial reaction to receiving the offer to take part in Active Steps?

Prompts: How did you feel about the service?

Q. Tell me your reasons for deciding to join Active Steps.

Q. What were your expectations when you decided to join Active Steps?

Information Pack

I am now going to ask you a few questions about the Information Pack you received in the post when you joined the service. This included:

- *Keep Active booklet*
- *Active Steps Plan (behaviour change tasks, including an activity diary)*
- *A3 wallchart*
- *Letter to give to their GP*

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- *Stay active stay well DVD*

You may have also received an exercise handbook or pedometer.

Q. What did you think of the Keep Active Booklet

Prompts: Was/Is there anything you like or dislike about it? Do you still read/refer to the Booklet?

Q. What did you think of the Active Steps plan?

Prompts: Was/Is there anything you like or dislike about it? Do you still use the plan?

Q. What did you think of the activity chart?

Prompts: Was/Is there anything you like or dislike about it? Do you still use the chart?

Q. What did you think of the GP letter?

Prompts: Was/Is there anything you like or dislike about it? Was it useful to have?

Q. What did you think of the Stay active, stay well DVD?

Prompts: Was/Is there anything you like or dislike about it? Was it useful to have?

Q. Have you received/Did you receive an Exercise Handbook/ Stay active, stay well DVD? What do you think of it?

Prompts: Do you use/have you used them? How easy are/were they to use? Was/Is there anything you like or dislike about them?

Q. Have you received/Did you receive a Pedometer? What do you think of it?

Prompts: Do you use/have you used it? How easy is/was it to use? Was/Is there anything you like or dislike about it? How does it compare any other step counters you have used before?

Health Coaching

I will now ask you questions about the telephone calls you have been receiving from the BLF team to support you to become and stay active

Q. Tell me what it was like receiving regular support via telephone? What did you find most helpful or least helpful? How, if at all, did it meet your needs?

Prompts: How did you find the frequency of calls frequent enough? How did you find the duration of calls? What did you think of the total duration of support available for you? Was it important that the service was being delivered by BLF?

Q. What did you think of information given about the schedule of calls?

Prompts: Were time/dates provided clearly/with enough notice? Was it clear what would be discussed in next call/conversation? =

Q. How did having access to this support, if at all, affected your levels of independence?

Prompts: Have you relied less on help from carers/family/friends?

Q. Tell me about your relationship with your health coach

Prompts: Did the coach invite/encourage you to talk about your current physical activity/ levels changing physical activity? Was the coach open to talking about

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other issues? Did the coach recognise your strengths?

Q: What did you think of the conversations you had about physical activity?
Prompts: Who do you feel was in control of the conversations? Did you think that you had the opportunity to present your own ideas to change your physical activity? Do you feel that your ideas/preferences were listened to? Did the coach show interest in your situation/perspective?

Q. What did you think of the way that information was delivered to you during these calls?
Prompts: Did the coach check your interest in receiving information before providing it to you? Was the coach sensitive to your concerns/understanding when providing information?

Q. Describe your experience of making plans with the coach over the telephone?
Prompts: Did you feel that you were ready to make a plan to change your physical activity? Was setting goals helpful for you to make plans? Did you prefer to set short-term or long-term goals?

Q. What successes or challenges did you experience with your health coach?
Prompts: Did you always achieve your goals? Were your achievements acknowledged? How did you deal with overcoming any barriers to achieve your goals? When goals were not met or changes in your outcomes were not positive, how have were you made to feel?

Capability, Opportunity and Motivation (Physical Activity)

I will now ask you questions about how Active Steps impacted on your physical activity. I am interested in the factors that may affect your capability, opportunity and motivation to be physically active.

Q. How did Active Steps, if at all, affect your level of physical activity?
Prompts: What activities have they become active in?

Q. How did Active Steps, if at all, affect your physical condition/capability to be active?
Prompts: Are there are any physical symptoms that make physical activity more difficult? How do you work around/take control of these symptoms?

Q. How did Active Steps, if at all, affect your understanding of the benefits of being physically active?
Prompts: How important is physical activity to you/your family? How do you think physical activity can impact on your condition?

Q. How did Active Steps, if at all, affect your understanding of what is available for you in your local community or at home to be physically active?
Prompts: What facilities / services do you access to be active? Does this change throughout the year? Are there any resources/equipment which help you to be active?

Q. How did Active Steps, if at all, make you aware of the social support you can receive to be physically active?

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Prompts: Do you have the opportunity to be active with others/friends/family? Who encourages you to be active?

Q. How did Active Steps, if at all, affect the time you have to be physically active?

Prompts: Do you have a dedicated time to being active? What interferes with your time to be active?

Q. How did Active Steps, if at all, affect your confidence in taking part in physical activity?

Prompts: Do you have any positive or negative beliefs about physical activity? What activities do you feel are right for you? Are there any past experiences that influences your view?

Q. How did Active Steps, if at all affect your motivation to be physically active?

Prompts: Do you enjoy being physically active? Is it something you generally intend to do/is it a priority for you?

Q. How did Active Steps, if at all, help physical activity become a habit for you?

Prompts: Is it something you do without having to think about it? If no, what would be helpful in developing it into an everyday habit/routine?

Q. Was there anything else (other than what we discussed) that you think has any impact on your physical activity levels?

Impact of Active Steps on physical and mental health

I will now ask you a series of further questions about how you think Active Steps, if at all, impacted on your physical and mental health

Q. How did Active Steps, if at all, affect your mobility and day-to-day activities?

Prompts: Have you noticed any difference in your mental and/or physical well-being? If so, could you tell me about these differences?

Q. Did Active Steps have an impact on your quality of life, and if so how?

Prompts: Have you noticed any difference in your mental and/or physical well-being? If so, could you tell me about these differences?

Q. Did Active Steps have any impact on the control of your condition, and if so how?

Prompts: Have you noticed any difference in your ability to self-manage? If so, could you tell me about these differences?

Q. Did Active Steps have any impact on your physical symptoms, and if so how?

Prompts: Have you noticed any difference in symptoms such as shortness of breath, pain, tiredness? If so, could you tell me about these differences?

Q. Did Active Steps have any impact on your mental health, and if so how?

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Prompts: Have you noticed any difference in levels of anxiety or depression? If so, could you tell me about these differences?

Q. Did Active Steps have any impact on your use of healthcare services, and if so how?

*Prompts: Have you **noticed** whether you are now in contact with more or less healthcare professionals? Could you explain why?*

Email and text message communications

I will now ask you questions about other BLF communications. You may have received emails and/or text messages.

Q. Did you receive the newsletters via email?

Prompts: What did you think of the stories of others with a lung condition? Was/Is there anything you like or dislike about them

Q. What did you think of the general communications from BLF?

Prompts: Was/Is there anything you like or dislike about the way you are contacted? Was/Is it useful to have email/text message reminders for the Active Steps Service?

Final comments

Q. Tell me your reasons for deciding not to continue with Active Steps?

Prompts: Were your expectations not met? Could your experience have been improved?

Q. How would you summarise your experience?

Q. Is there anything else you want to tell us about your experiences of Active Steps?

Prompts: How could Active Steps be improved in the future to help people become and stay active? What would you say to other people with a lung condition who are thinking about becoming more active

Future plans

Q. How physically active are you at the moment?

Q. Do you have any plans to become/keep active, and if so how?

Q. What support, if any, would you like to be/remain active?

End interview

Q. Thank you for taking part in this telephone interview. Is there anything else you wish to discuss about Active Steps or any aspect of the evaluation?

Mention to the participant what happens next (transcribing, analysis, and summarising findings to help evaluation) and if they have any further questions about the evaluation in the future to contact the research team.

Appendix 3

Interview topic guide for BLF Personnel

Open Interview

Introduce yourself to the participant. Talk through the topic of conversation for the telephone interview and how long it may last.

Hello, my name is X and I am a Researcher at the University of Lincoln. The British Lung Foundation received funding from Sport England to develop and deliver a new service called Active Steps. They are required by Sport England to evaluate the impact of this project and would value your feedback and input. We (the University of Lincoln) are working with the British Lung Foundation to perform an evaluation of this service. The evaluation intends to assess the feasibility, acceptability and practicability of Active Steps both to patients and staff at the British Lung Foundation. Today I will ask you a series of questions to explore what you feel is working/has worked well or not well, and to gather your thoughts on the importance, value and potential impact of the Active Steps service. The interview should not take longer than 60 minutes.

Provide opportunity for questions about the interview, re-confirm that patients agree to take part:

Q. Do you have any questions before we start the interview? Can I confirm that you still agree to take part in this interview?

Note: Ask the questions that are relevant to each participant. Only ask the questions and use the prompts when required, e.g. do not repeat questions or prompts.

Active Steps importance and value

I am first going to ask you a few questions about the importance and value of Active Steps

Q. What is the importance of the Active Steps Service?

Prompts: What is the need for BLF to be delivering this service to people with lung conditions?

Q. What value can Active Steps add to existing BLF services?

Prompts: How does it complement the existing helpline? What gaps in the BLF portfolio does the service address?

Q. Tell me how you think Active Steps can fit within the wider healthcare pathway of managing people with lung conditions?

Prompts: How does it complement existing NHS treatments? What gaps in healthcare provided to people with lung conditions can Active Steps address?

Training

I am now going to ask you a few questions about the training you received for your involvement in Active Steps. Your role may be in signposting people to Active Steps, providing physical activity advice and/or delivery of health coaching.

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Q. Did you feel that your participation in the delivery of Active Steps required you to have some technical skills?

Prompts: What previous training did you have in supporting physical activity?

Q. What training did you receive to help your role in Active Steps?

Prompts: What is your opinion of the training you received? What impact did this training have on your skills?

Q. What other resources helped you prepare for your role in Active Steps?

Prompts: Did you have time to practice your skills?

Q. What recognition or feedback have you received on skills relevant to your role in Active Steps?

Prompts: Have you been recognised for giving advice on physical activity? Have you received feedback on your delivery of advice or health coaching?

VBA delivery

I am now going to ask you a few questions about your thoughts on bringing up and discussing physical activity with patients over the phone.

Q. How do you find listening out for triggers that may indicate physical activity could help patients?

Prompts: What has it been like to identify barriers and motivators for becoming active?

Q. How do you find asking patients about their current level of physical activity over the phone?

Prompts: What has it been like to identify the appropriate time to deliver this advice? How have the patients responded to this question?

Q. How do you find providing advice on physical activity over the phone?

Prompts: Have you always remembered to deliver advice? Have there been particular situations that have influenced the delivery of advice?

Q. What have been the responses of patients to an invitation to receive further support to be physically active over the phone?

Prompts: What do you think of the referral process? What do you think are the key reasons for patients to accept or decline the support?

Active Steps delivery

I will now ask you questions about the delivery of Active Steps service from your perspective i.e. your role/involvement in the project

Q. What, if anything, do you think is working well/worked well with the service?

Prompts: What have been the successes? What have you liked about the service?

Q. What, if anything, do you think is not working well/worked well with the service?

Prompts: What have been the challenges? What have you disliked about the

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service?

Q: How does Active Steps service fit in with your existing workload?

Prompts: How has the service integrated with your other responsibilities?

Q: Do you feel that Active Steps is meeting patient needs, and if so how?

Prompts: What is the feedback you have received from patients?

Capability, Opportunity and Motivation (Physical Activity)

I will now ask you questions about how your involvement in this project has affected your delivery of support for physical activity in people with lung conditions. I am interested in the factors that have affected your capability, opportunity and motivation to support patients to be physically active.

Q. How has Active Steps, if at all, affected your understanding of the impact of physical activity in people living with lung conditions?

Prompts: How has your knowledge of the benefits of physical activity been affected?

Q. How has Active Steps, if at all, affected your understanding of the physical activity guidelines for people living with lung conditions?

Prompts: How has your knowledge of the guidelines on physical activity been affected?

Q. How has Active Steps, if at all, affected your skills for assessment of physical activity?

Prompts: Have there been any prompts or tools that you have used?

Q. How has Active Steps, if at all, affected your skills to identify when it is appropriate to deliver physical activity advice?

Prompts: Do you feel confident in delivering advice? Have there been any prompts or tools that you have used?

Q. Tell me whether you feel supporting physical activity of people with lung conditions should be part of your remit?

Prompts: Do you believe that delivering advice on physical activity is part of your role?

Q. Do you think you have sufficient resources for your role in Active Steps?

Prompts: Do you have dedicated time for the role? Do you know how to signpost on to other colleagues?

Q. How have discussions of physical activity, if at all, become a routine in your interactions with patients?

Prompts: Has it become a habit to have conversations about physical activity?

Q. How has Active Steps, if at all, affected your motivation to be physically active?

Prompts: Do you enjoy being physically active? Is it something you generally intend to do/is it a priority for you?

Q. How has Active Steps, if at all, helped physical activity become a habit for you?

Prompts: Is it something you do without having to think about it? If no, what would be helpful in developing it into an everyday habit/routine?

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Q. Was there anything else (other than what we discussed) that you think has any impact on your approach to supporting people with lung conditions to be physically active levels?

Impact of Active Steps on physical and mental health

I will now ask you a series of further questions about the potential impact of Active Steps on physical and mental health of patients

Q. What impact, if any, do you think Active Steps can have on level of physical activity in patients?

Prompts: What activities do you think they can become active in?

Q. What impact, if any, do you think Active Steps can have on quality of life in patients?

Prompts: How may Active Steps achieve this?

Q. What impact, if any, do you think Active Steps can have on physical health of patients?

Prompts: How may Active Steps achieve this?

Q. What impact, if any, do you think Active Steps can have on mental health of patients?

Prompts: How may Active Steps achieve this?

Q. What impact, if any, do you think Active Steps can have on healthcare services?

Prompts: How may Active Steps achieve this?

Q. What impact, if any, do you think Active Steps can have on other BLF services?

Prompts: How may Active Steps achieve this?

Final comments

Q. How would you summarise your experience with this service?

Q. Is there anything else you want to tell us about Active Steps?

Prompts: How has the service met your expectations? Has this new service affected your own personal levels of physical activity?

Future plans

Q. What would be your thoughts if Active Steps became business as usual for BLF?

Prompts: What would need to be considered to support this transition?

Q. Do you feel that Active Steps could be improved, and if so how?

Prompts: What would you change in the delivery of the service?

Q. What other populations, beyond people with lung conditions, do you think could benefit from a similar approach to Active Steps?

Q. What other support, if any, would you like BLF to be offering for people with

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lung conditions who are inactive?

End interview

Q. Thank you for taking part in this telephone interview. Is there anything else you wish to discuss about Active Steps or any aspect of the evaluation? Mention to the participant what happens next (transcribing, analysis, and summarising findings to help evaluation) and if they have any further questions about the evaluation in the future to contact the research team.

Appendix 3

Interview topic guide for Active Steps patients

Open Interview

Introduce yourself to the participant. Talk through the topic of conversation for the telephone interview and how long it may last.

Hello, my name is X and I am a Researcher at the University of Lincoln. The British Lung Foundation received funding from Sport England to develop and deliver a new service called Active Steps. They are required by Sport England to evaluate the impact of this project and would value your feedback and input. We (the University of Lincoln) are working with the British Lung Foundation to perform an evaluation of this service. You have previously consented to taking part in a telephone interview. Thank you for this, your contribution will help towards supporting people with lung conditions become active. Today I will ask you a series of questions to explore your experiences of your invitation to take part in Active Steps, the support you have received through Active Steps and how you feel this has affected your health and current or future physical activity. The interview should not take longer than 60 minutes.

Provide opportunity for questions about the interview, re-confirm that patients agree to take part:

Q. Do you have any questions before we start the interview? Can I confirm that you still agree to take part in this interview?

Note: Ask the questions that are relevant to each patient. Only ask the questions and use the prompts when required, e.g. do not repeat questions or prompts.

Active Steps Invitation

I am first going to ask you a few questions about how you were approached to take part in Active Steps Service

Q. Tell me about the way you accessed Active Steps.

Prompts: *What did you like/dislike about this process? Could this be improved?*

Q. What was your initial reaction to receiving the offer to take part in Active Steps?

Prompts: *How did you feel about the service?*

Q. Tell me your reasons for deciding to join Active Steps.

Q. What were your expectations when you decided to join Active Steps? Were these expectations met?

Information Pack

I am now going to ask you a few questions about the Information Pack you received in the post when you joined the service. This included:

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- *Keep Active booklet*
- *Active Steps Plan (behaviour change tasks, including an activity diary)*
- *A3 wallchart*
- *Letter to give to their GP*
- *Stay active stay well DVD*

You may have also received an exercise handbook or pedometer.

Q. What did you think of the Keep Active Booklet

Prompts: Was/Is there anything you like or dislike about it? Do you still read/refer to the Booklet?

Q. What did you think of the Active Steps plan?

Prompts: Was/Is there anything you like or dislike about it? Do you still use the plan?

Q. What did you think of the Activity chart?

Prompts: Was/Is there anything you like or dislike about it? Do you still use the chart?

Q. What did you think of the GP letter?

Prompts: Was/Is there anything you like or dislike about it? Was it useful to have?

Q. What did you think of the Stay active, stay well DVD?

Prompts: Was/Is there anything you like or dislike about it? Was it useful to have?

Q. Have you received/Did you receive an Exercise Handbook/ Stay active, stay well DVD? What do you think of it?

Prompts: Do you use/have you used them? How easy are/were they to use? Was/Is there anything you like or dislike about them?

Q. Have you received/Did you receive a Pedometer? What do you think of it?

Prompts: Do you use/have you used it? How easy is/was it to use? Was/Is there anything you like or dislike about it? How does it compare any other step counters you have used before?

Health Coaching

I will now ask you questions about the telephone calls you have been receiving from the BLF team to support you to become and stay active

Q. Tell me what it has been like receiving regular support via telephone? What did you find most helpful or least helpful? How, if at all, has it met your needs?

Prompts: How did you find the frequency of calls frequent enough? How did you find the duration of calls? What did you think of the total duration of support available for you? Was it important that the service was being delivered by BLF?

Q. What have/are the key reasons for you continuing to receive these calls?

Prompts: What has helped you to remain engaged with Active Steps?

Q. What did you think of information given about the schedule of calls?

Prompts: Were time/dates provided clearly/with enough notice? Was it clear what would be discussed in next call/conversation?

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Q: How has having access to this support, if at all, affected your levels of independence?

Prompts: Have you relied less on help from carers/family/friends?

Q: Tell me about your relationship with your health coach

Prompts: Did the coach invite/encourage you to talk about your current physical activity/ levels changing physical activity? Was the coach open to talking about other issues? Did the coach recognise your strengths?

Q: What did you think of the conversations you had about physical activity?

Prompts: Who do you feel was in control of the conversations? Did/Do you think that you had/have the opportunity to present your own ideas to change your physical activity? Do you feel that your ideas/preferences were listened to? Did the coach show interest in your situation/perspective?

Q. What did you think of the way that information was delivered to you during these calls?

Prompts: Did the coach check your interest in receiving information before providing it to you? Was the coach sensitive to your concerns/understanding when providing information?

Q. Describe your experience of making plans with the coach over the telephone?

Prompts: Did you feel that you were ready to make a plan to change your physical activity? Was setting goals helpful for you to make plans? Did you prefer to set short-term or long-term goals?

Q. What successes or challenges have/did you experience with your health coach?

Prompts: Did you always achieve your goals? Were your achievements acknowledged? How did you deal with overcoming any barriers to achieve your goals? When goals were not met or changes in your outcomes were not positive, how have you been/were you made to feel?

Capability, Opportunity and Motivation (Physical Activity)

I will now ask you questions about the factors that may impact your physical activity. I am interested in the factors that may affect your capability, opportunity and motivation to be physically active.

Q. How has Active Steps, if at all, affected your level of physical activity?

Prompts: What activities have you become active in?

Q. How has Active Steps, if at all, affected your physical condition/capability to be active?

Prompts: Are there any physical symptoms that make physical activity more difficult? How do you work around/take control of these symptoms?

Q. How has Active Steps, if at all, affected your understanding of the benefits of being physically active?

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Prompts: How important is physical activity to you/your family? How do you think physical activity can impact on your condition?

Q. How has Active Steps, if at all, affected your understanding of what is available for you in your local community or at home to be physically active?

Prompts: What facilities / services do you access to be active? Does this change throughout the year? Are there any resources/equipment which help you to be active?

Q. How has Active Steps, if at all, made you aware of the social support you can receive to be physically active?

Prompts: Do you have the opportunity to be active with others/friends/family? Who encourages you to be active?

Q. How has Active Steps, if at all, affected the time you have to be physically active?

Prompts: Do you have a dedicated time to being active? What interferes with your time to be active?

Q. How has Active Steps, if at all, affected your confidence in taking part in physical activity?

Prompts: Do you have any positive or negative beliefs about physical activity? What activities do you feel are right for you? Are there any past experiences that influences your view?

Q. How has Active Steps, if at all, affected your motivation to be physically active?

Prompts: Do you enjoy being physically active? Is it something you generally intend to do/is it a priority for you?

Q. How has Active Steps, if at all, helped physical activity become a habit for you?

Prompts: Is it something you do without having to think about it? If no, what would be helpful in developing it into an everyday habit/routine?

Q. Was there anything else (other than what we discussed) that you think has any impact on your physical activity levels?

Impact of Active Steps on physical and mental health

I will now ask you a series of further questions about how you think Active Steps has, if at all, impacted on your physical and mental health

Q. How has Active Steps, if at all, affected your mobility and day-to-day activities?

Prompts: Have you noticed any difference in your mental and/or physical well-being? If so, could you tell me about these differences?

Q. Has Active Steps had an impact on your quality of life, and if so how?

Prompts: Have you noticed any difference in your mental and/or physical well-being? If so, could you tell me about these differences?

Q. Has Active Steps had any impact on the control of your condition, and if so how?

Prompts: Have you noticed any difference in your ability to self-manage? If so, could you tell me about these differences?

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Q. Has Active Steps had any impact on your physical symptoms, and if so how?

Prompts: Have you noticed any difference in symptoms such as shortness of breath, pain, tiredness? If so, could you tell me about these differences?

Q. Has Active Steps had any impact on your mental health, and if so how?

Prompts: Have you noticed any difference in levels of anxiety or depression? If so, could you tell me about these differences?

Q. Has Active Steps had any impact on your use of healthcare services, and if so how?

Prompts: Have you noticed whether you are now in contact with more or less healthcare professionals? Could you explain why?

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Email and text message communications

I will now ask you questions about other BLF level communications. You may have received emails and/or text messages.

Q. Have you received/Did you receive the newsletters via email?

Prompts: What did you think of the stories of others with a lung condition? Was/Is there anything you like or dislike about them

Q. What do/did you think of the general communications from BLF?

Prompts: Was/Is there anything you like or dislike about the way you are contacted? Was/Is it useful to have email/text message reminders for the Active Steps Service?

Final comments

Q. How would you summarise your experience?

Q. Is there anything else you want to tell us about your experiences of Active Steps?

Prompts: How could Active Steps be improved in the future to help people become and stay active? What would you say to other people with a lung condition who are thinking about becoming more active

Future plans

Q. Do you have any plans to keep active, and if so how?

Q. What support, if any, would you like to be/remain active?

End interview

Q. Thank you for taking part in this telephone interview. Is there anything else you wish to discuss about Active Steps or any aspect of the evaluation?

Mention to the participant what happens next (transcribing, analysis, and summarising findings to help evaluation) and if they have any further questions about the evaluation in the future to contact the research team.

Appendix 4

Primary Care & Social Services	Unit Cost (£)	Source	Basis
Active Steps Intervention Cost	152.86	Active Steps Trial Team	
<i>Primary Care</i>			
Nurse or GP prescribe additional medication (steroids and/or antibiotics)	30.90	PSSRU 2019 [5]	Prescription costs per consultation (actual cost)
GP consultation face-to-face (including out of hours GP consultations in hospital)	39.00	PSSRU 2019 [5]	Per surgery consultation lasting 9.22 minutes
GP Consultation over phone	15.32	PSSRU 2019 [5]	(£15.32 per telephone triage)
GP Consultation by text	37.60	PSSRU 2019 [5]	Per e-consultation
GP Consultation by email	37.60	PSSRU 2019 [5]	Per e-consultation
GP Home visit	86.00	PSSRU 2019 [5]	(£4.30 per minute, assume 20 min - travel excluded)
GP Consultation (other)	39.00	PSSRU 2019 [5]	Per surgery consultation lasting 9.22 minutes
GP Nurse consultation face-to-face	8.40	PSSRU 2019 [5]	(£42 per hour, 12mins)
GP Nurse Consultation over phone	7.80	PSSRU 2019 [5]	(£7.80 per telephone triage)
GP Nurse Home Visit	28.00	PSSRU 2019 [5]	(£42 per hour, 40mins)
GP Nurse Consultation by text	4.20	PSSRU 2019 [5]	(£42 per hour, 6mins)
GP Nurse Consultation by email	4.20	PSSRU 2019 [5]	(£42 per hour, 6mins)
GP Nurse Consultation (other)	8.40	PSSRU 2019 [5]	(£42 per hour, 12mins)
District nurse	56.00	PSSRU 2019 [5]	Band 6 (£84 per hour, 40 mins)
Community Matron (Home Visit)	74.67	PSSRU 2019 [5]	Band 7 (£112 per hour, 40 mins)
Specialist nurse (Home Visit)	56.00	PSSRU 2019 [5]	Band 6 (£84 per hour, 40 mins)
Physiotherapist or occupational therapist	54.00	PSSRU 2019 [5]	COMMUNITY SERVICES, average cost per group session (one-to-one)
Mental Health/Respiratory Nurse	56.00	PSSRU 2019 [5]	Band 6 (£84 per hour, 40 mins)
One You	10.00	Personal communication	Contacted the organisation to enquire about the unit cost 2nd Nov 2020
Hospice	70.00	PSSRU 2019 [5]	Outpatient non-medical specialist palliative care attendance
Crisis team (community adult)	287.00	National Schedule 2018-19	Community adults
Crisis team (phone)	8.40	PSSRU 2019 [5]	(£42 per hour, 12mins)
Social Worker	51.00	PSSRU 2019 [5]	Assume 1 hour
Lymphedema nurse	42.00	PSSRU 2019 [5]	Band 6 (£84 per hour, based on 30 min consultation)
Optician (home visit)	40.10	PSSRU 2015 [5]	25min home consultation inflated using PSSRU 2019 NHS Cost Inflation Index
Hospice Visitor (Aromatherapy sessions)	70.00	PSSRU 2019 [5]	Outpatient non-medical specialist palliative care attendance
Long Term Oxygen per year	1206.80	Hertel et al [8]	Inflated using PSSRU 2019 NHS Cost Inflation Index

Appendix 4

Primary Care & Social Services	Unit Cost(£)	Source	Basis
Ambulance (See, treat, refer)	209.38	National Schedule 2018-19	HRG currency code ASS01
Urology Nurse	28.00	PSSRU 2019 [5]	Band 6 (£84 per hour, based on 20 min consultation)
Dietician	90.00	National Schedule 2018-19	CHS Dietician
Covid-19 Test	38.00	National Schedule 2018-19	Proxied by a directly accessed respiratory nurse DZ49Z (directly accessed diagnostic services)
Podiatrist	43.00	National Schedule 2018-19	A09A Podiatrist, Tier 1, General Podiatry
Flu Jab	9.80	NHS England Vaccination and Immunisation list 2018-19	
Osteopath	50.00	https://www.nhs.uk/conditions/osteopathy/ (approximation based on NHS information)	
Counselling Services	70.00	https://www.nhs.uk/conditions/counselling/ (approximation based on NHS information)	
<i>Accident & Emergency</i>			
A & E	166.00	National Schedule 2018-19	Composite cost
Ambulance (See, treat, convey)	257.34	National Schedule 2018-19	HRG currency code ASS02
<i>Imaging</i>			
X ray	26.00	National Tariff non mandatory prices 2019-20	Direct access plain film X-ray
Angiogram	112.00	National Schedule 2018-19	RD30Z: Contrast Fluoroscopy Procedures with duration of less than 20 minutes; Direct Access from GP, 20 minute procedure according to https://www.meht.nhs.uk/services/a-z-of-clinical-services/c-services/cardiac-centre-cardiology-services/welcome-to-the-angio-suite/angiogram-information
Magnetic Resonance Imaging Scan	121.00	National Schedule 2018-19	RD01A Direct Access
Computerised Tomography Scan	78.00	National Schedule 2018-19	RD20A Direct Access
Heart Scan	245.00	National Schedule 2018-19	RD60Z Direct Access
<i>Outpatient</i>			
Unspecified Outpatient	127.00	National Schedule 2018-19	General cost for OP visits
Unspecified Consultant	144.00	National Schedule 2018-19	General cost of a consultant for OP visits
Trauma & Orthopaedics	120.00	National Schedule 2018-19	Service code 110
ENT	107.00	National Schedule 2018-19	Service code 120
Ophthalmologist	98.00	National Schedule 2018-19	Service code 130
Oral Surgery	126.00	National Schedule 2018-19	Service code 140
Endocrinology	161.00	National Schedule 2018-19	Service code 302
Pain Management	157.00	National Schedule 2018-19	Service code 191
Gastroenterology	141.00	National Schedule 2018-19	Service code 301
Clinical Immunology and Allergy Service	192.00	National Schedule 2018-19	Service code 313

Appendix 4

Primary Care & Social Services	Unit Cost (£)	Source	Basis
Cardiology	139.00	National Schedule 2018-19	Service code 320
Sports and Exercise Medicine	145.00	National Schedule 2018-19	Service code 325
Respiratory Medicine	157.00	National Schedule 2018-19	Service code 340
Respiratory Physiology	120.00	National Schedule 2018-19	Service code 341
Neurology	177.00	National Schedule 2018-19	Service code 400
Rheumatology	147.00	National Schedule 2018-19	Service code 410
Clinical Psychology	199.00	National Schedule 2018-19	Service code 656
Audiology	108.00	National Schedule 2018-19	Service code 840
Urology	108.00	National Schedule 2018-19	Service codes 101
Breast Surgery	147.00	National Schedule 2018-19	Service codes 103
Medical Oncology	187.00	National Schedule 2018-19	Service codes 370
Physiotherapy	58.00	National Schedule 2018-19	Service codes 650
Dentistry	126.00	National Schedule 2018-19	WF01B NCL
Pulmonary Rehabilitation	79.00	National Schedule 2018-19	VC40Z Rehabilitation for Respiratory Disorders
Diabetic Medicine	142.00	National Schedule 2018-19	Service code 307
Hospital Stay (COPD)			
Emergency Longer hospital stay (>3days)	2026.28	National Schedule 2018-19	DZ65 composite
Emergency overnight stay	446.69	National Schedule 2018-19	DZ65 composite
Day case	520.29	National Schedule 2018-19	DZ65 composite
Elective	2319.11	National Schedule 2018-19	DZ65 composite
Hospital Stay (Asthma)			
Emergency Longer hospital stay (>3days)	1641.71	National Schedule 2018-19	DZ15 Composite
Emergency overnight stay	409.74	National Schedule 2018-19	DZ15 Composite
Day case	282.14	National Schedule 2018-19	DZ15 Composite
Elective	2224.86	National Schedule 2018-19	DZ15 Composite
Hospital Stay (Bronchiectasis)			
Emergency Longer hospital stay (>3days)	2604.23	National Schedule 2018-19	DZ12 Composite
Emergency overnight stay	486.60	National Schedule 2018-19	DZ12 Composite
Day case	463.27	National Schedule 2018-19	DZ12 Composite
Elective	3229.57	National Schedule 2018-19	DZ12 Composite
Hospital Stay (Tuberculosis)			
Emergency Longer hospital stay (>3days)	4203.68	National Schedule 2018-19	DZ14 Composite

Appendix 4

Primary Care & Social Services	Unit Cost (£)	Source	Basis
Emergency overnight stay	621.19	National Schedule 2018-19	DZ14 Composite
Day case	364.24	National Schedule 2018-19	DZ14 Composite
Elective	4124.06	National Schedule 2018-19	DZ14 Composite
<i>Hospital Stay (Pulmonary Fibrosis)</i>			
Emergency Longer hospital stay (>3days)	2514.47	National Schedule 2018-19	DZ25 composite
Emergency overnight stay	474.14	National Schedule 2018-19	DZ25 composite
Day case	470.97	National Schedule 2018-19	DZ25 composite
Elective	2545.37	National Schedule 2018-19	DZ25 composite
<i>Hospital Stay (other cause)</i>			
Emergency Longer hospital stay (>3days)	1656.88	National Schedule 2018-19	DZ19 composite
Emergency overnight stay	360.05	National Schedule 2018-19	DZ19 composite
Day case	488.84	National Schedule 2018-19	DZ19 composite
Elective	1684.54	National Schedule 2018-19	DZ19 composite
ICU Stay	1504.47	National Schedule 2018-19	Non-specific, general adult critical care composite (XC01Z to XC07Z)

Appendix 5

Comparison of the Short Active Lives Survey and ActiGraph GT3X to estimate weekly minutes of moderate to vigorous physical activity in adults with lung conditions

Background

The common tool used to measure physical activity in Sport England projects is the Short Active Lives Survey. Self-reported measures such as the Short Active Lives Survey can be prone to bias (1). As such, during evaluation of services, benefits may be exaggerated due to over-reporting of physical activity or downplayed due to underreporting of physical activity. There is also a lack of research reporting the typical short-term and long-term changes in physical activity (measured by the Short Active Lives Survey) in people with chronic lung conditions who are not receiving support to become active (i.e. usual care, control groups). Accelerometers are small lightweight activity monitors that can be worn on the waist. These monitors are known to provide accurate and reliable objective assessment of physical activity in people with lung conditions (2-5).

A cohort of inactive people with lung conditions was recruited to determine the agreement between physical activity measured by the Short Active Lives Survey and one of the most valid accelerometers used in people with lung conditions (ActiGraph GT3X).

Methods

Sample size

The sample size was based on the required number of participants in a comparator/control group for the evaluation of the British Lung Foundation Active Steps service (page 16 of full report). This sample size was also in accordance with typical sample sizes used in reliability and validity studies of Short Active Lives Survey (e.g. (6) in the general population and other self-reported tools of physical activity in people with lung conditions (e.g. 2).

Recruitment

The recruitment of the participants is detailed in the full report (page 15).

Study Procedures

Baseline characteristics

Following verbal consent for study, the baseline visit of the study was arranged at the place of preference for the participant (e.g. Home, local community hall, University). At this visit the research team first asked the participant to provide written informed consent for the study. Following written consent, information was collected via a General Health Questionnaire including demographics (age, ethnicity, gender), degree of breathlessness (mMRC), other comorbid chronic diseases and oxygen use.

ActiGraph

Participants were then fitted with a triaxial accelerometer (ActiGraph wGT3X-BT) on their waist in accordance with our previous research (7). The accelerometers were initialised to sample in 10 second epochs at 30 hertz frequency. Participants wore the accelerometer on a continuous basis (i.e. over 24 hours) for 8 days except for when bathing or showering. Participant's baseline visit took place at a range of different times, the duration of 8 days was to help ensure we collected 7 full days of ActiGraph data for each participant i.e. the half days at either of end data collection was cleaned during analysis. Participants were provided with a pre-paid envelope to return the accelerometer via post or the research team collected the accelerometer from the participant.

The accelerometer data were downloaded using the ActiLife6 software (ActiGraph corporation, FL, USA). The data were cleaned for periods when the monitor was not worn, defined as 60 minutes or more of zero accelerometer counts, with up to two 1-minute epochs of up to 100cpm (8). All valid data were classified into four intensity categories based on recorded counts per minute (CPM): sedentary (≤ 499 CPM), light (500-2019 CPM), moderate (2020-5999 CPM) or vigorous intensity activity (≥ 6000 CPM), in accordance with recommended cut-points for adults (9) and a similar study

Appendix 5

comparing Short Active Lives survey to accelerometer data in inactive adults (6). These data were used to calculate total accelerometer wear time per day and time in moderate to vigorous physical activity.

We approached the accelerometry analysis in two ways in accordance with a previous study (6). Our primary analysis was to include moderate to vigorous minutes only if they occurred in a bout of at least 10 minutes, allowing up to 20% of the bout time to drop below the moderate intensity threshold (2020 counts per minute). The bout approach attempts to exclude incidental short bouts, which may be overlooked when considering responses to self-report tools. Walking was anticipated to be the main form of activity in our study population. The walking component of the Short Active Lives Survey specifies that it must have been a continuous walk for at least 10 minutes. Secondly, we also considered all activity, which was classified as being of moderate to vigorous intensity, regardless of bout duration.

Short Active Lives Survey

Following the end of the ActiGraph data collection (i.e 1 week later), participants were asked to complete the Short Active Lives Survey over the telephone with the research team. The research team asked questions to the participant and recorded their answers electronically on the University of Lincoln GDPR compliant software (Qualtrics). The Short Active Lives Survey was slightly modified for the purposes of this study. Breathlessness is the key symptom for most people living with a lung condition. On the Short Active Lives Survey, if a respondent indicates that they have performed a continuous walk (lasting at least ten minutes); cycling; or sport, fitness activity or dance during the previous 7 days they are asked if the effort placed into that activity was enough to increase their breathing rate. Given the symptoms anticipated in the study population, such questions were adapted as follows:

Was the effort you put into walking usually enough to raise your breathing rate, **above any usual breathlessness you experience?**

Was the effort you put into cycling usually enough to raise your breathing rate, **above any usual breathlessness you experience?**

Was the effort you put into doing sport, fitness activity, or dance usually enough to raise your breathing rate, **above any usual breathlessness you experience?**

Statistical analysis

The Active Steps service had a primary aim of supporting people with lung conditions to become and stay physically active. British Lung Foundation had a specific interest in using the Short Active Lives Survey as a tool to identify people with lung conditions who are inactive or active. The classification of active was based on completing 30 minutes or more of moderate to vigorous physical activity per week. The accelerometer data were used to classify participants as 'inactive' or 'active', based on this threshold. Percent agreement and κ statistic were used to determine the level of agreement between the Short Active Lives Survey and accelerometry data in 10 minute bouts or all physical activity. Sensitivity and specificity analyses were used to explore the extent to which the Short Active Lives allocated participants to the same physical activity category as the accelerometry derived measures. Similar to a previous study (10), sensitivity was referred to the ability of the Short Active Lives to correctly identify those who were inactive and specificity referred to the ability of the comparison tools to correctly identify those who were active. In these analyses, the score on the ActiGraph was taken to be the 'true' measure given its validity as a measure of physical activity in people with lung conditions. Pearson's bivariate correlation was used to assess associations between self-reported time spent in moderate to vigorous physical activity on the Short Active Lives Survey and that derived from all physical activity or physical activity in at least 10 minute bouts measured by the ActiGraph accelerometer. Bland and Altman 95% Limits of Agreement were used to calculate the level of agreement between the self-report and device data.

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Results

A total of 80 participants agreed to take part in the study. The baseline characteristics are provided in table 1. Of the total sample of 80 participants, one participant did not complete the SALS, one participant declined to wear the accelerometer and another participant died during the week of physical activity monitoring. All remaining 77 participants, met the wear-time criteria for the accelerometer (at least eight hours per day on seven days) and completed the Short Active Lives Survey.

Table 1: Baseline characteristics of study participants.

Gender, n (%)	
Female	41 (54)
Male	36 (46)
Age, mean± SD	
	70 ± 10
Ethnicity, n (%)	
White	75 (95)
Asian or Asian British	1 (1)
Black or Black British	0 (0)
Mixed	1 (1)
Index of Multiple Deprivation Decile, n (%)	
1 (most deprived)	11(14)
2	8 (10)
3	10 (13)
4	6 (8)
5	4 (5)
6	10 (13)
7	10 (13)
8	3 (4)
9	10 (13)
10 (least deprived)	5 (6)
Lung Condition, n (%)	
COPD	57 (72)
Asthma	26 (33)
Bronchiectasis	12(15)
Interstitial lung disease	6 (8)
Lung cancer	1 (1)
Other	1 (1)
MRC Dyspnoea Scale, mean± SD	
	3 ± 1
Oxygen Use, n (%)	
None	71 (90)
Long-term oxygen	4 (5)
Ambulatory oxygen	2 (3)
Comorbidities, n (%)	
Arthritis or ongoing back/joints problem	36 (46)
Other long-term condition or disability	19 (24)
Mental health condition	15 (19)
High blood pressure	30 (38)
Heart condition	24 (30)
Diabetes	17 (22)
Cancer diagnosis/treatment (last 5 years)	6 (8)
Kidney or liver disease	6 (8)
Blindness or partial sight	6 (8)
Neurological condition	1 (1)
Learning disability	1 (1)
Stroke which affects your day-to-day life	6 (8)
Dementia	2 (3)

Appendix 5

Summary measures of moderate-to-vigorous physical activity captured via the Short Active Lives Survey or via accelerometry using all minutes of activity or only activity accumulated in at least 10 minute bouts, is shown in Table 2.

Table 2: Descriptive statistics of moderate to vigorous physical activity measured by the Short Active Lives Survey and the ActiGraph.

Measure of minutes of moderate to vigorous physical activity	Minimum	Maximum	Mean ± Standard Deviation
Short Active Lives Survey	0	280	22 ± 59
ActiGraph 10 minute bouts	0	334	15 ± 51
ActiGraph all activity	0	362	83 ± 85

The mean minutes of moderate to vigorous physical activity per week were relatively similar between the Short Active Lives Survey and accelerometer using activity accumulated in at least 10 minute bouts. The mean difference (standard deviation) between the minutes of moderate to vigorous physical activity was 11 (60) and the 95% limits of agreement were -117 to 133 minutes (Figure 1). Pearson’s correlation between the two measures was 0.332, which was statistically significant (p=0.003). The Bland and Altman 95% Limits of Agreement were large.

The mean minutes of moderate to vigorous physical activity per week were almost four fold higher with all minutes of physical activity derived from the accelerometer compared to Short Active Lives Survey. The mean difference (standard deviation) between the minutes of moderate to vigorous physical activity was 65 (100), which was statistically significant in (p< 0.001) and hence a Bland Altman Plot was not produced. Pearson’s correlation between the two measures was 0.092, which was not statistically significant (p = 0.427).

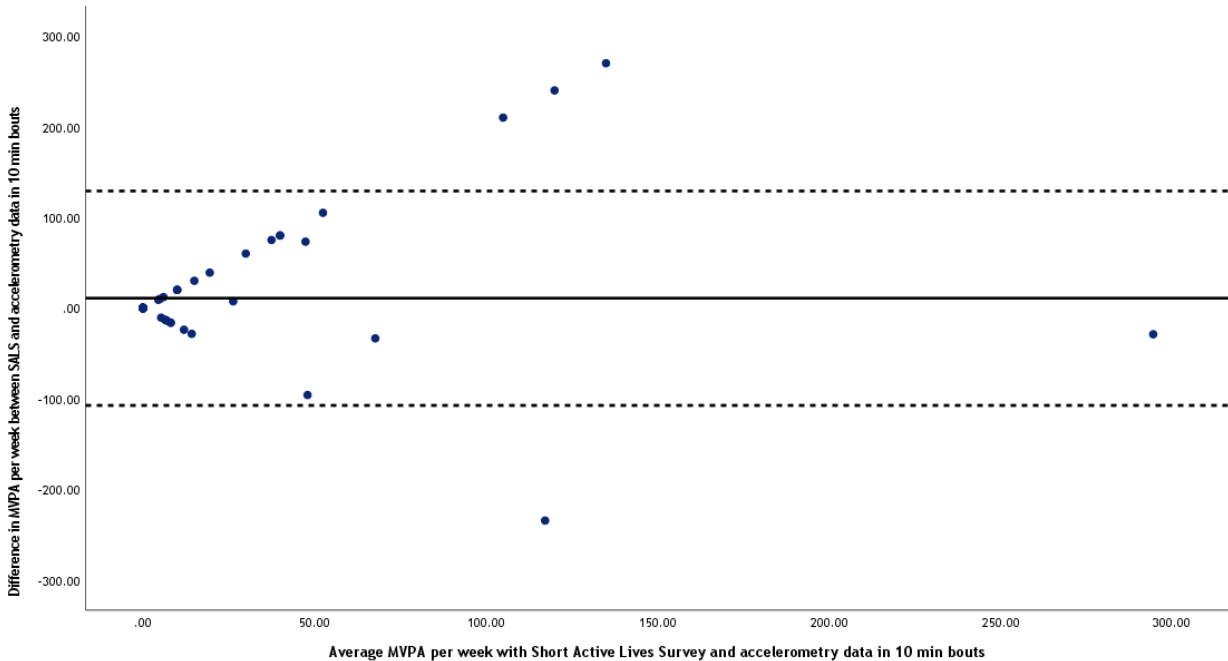


Figure 1. Limits of Agreement between the minutes per week of moderate to vigorous physical activity measured by the Short Active Lives Survey and accelerometry, including only activity accumulated in bouts of ≥ 10 minutes, n=77

Appendix 5

The classification of the participants into ‘inactive’ or ‘active’ using the measures (Short Active Lives Survey, accelerometer data including all minutes of activity or only activity accumulated in at least 10 minute bouts) is shown in Table 3.

Table 3. Classification of participants as ‘inactive’, ‘or ‘active’ from accelerometry and the Short Active Lives Survey

Measures	Inactive (< 30 min of moderate to vigorous physical activity per week) n (%)	Active (≥ 30 min of moderate to vigorous physical activity per week) n (%)
	Short Active Lives Survey	63 (82)
Accelerometry- 10 min bouts	73 (95)	4 (5)
Accelerometry - all minutes	22 (29)	55 (71)

When including physical activity undertaken in 10 minute bouts or more (Table 3), the Short Active Lives Survey correctly identified 50% of the 4 participants who were classified as active via accelerometry and 84% of the 73 participants identified as inactive by accelerometry. Overall agreement between the two tools was 82% and Kohen’s Kappa showed a slight measure of agreement between the two tools (0.154).

When including physical activity undertaken in 10 minute bouts or more (Table 17), the Short Active Lives Survey correctly identified 18% of the 55 participants who were classified as active via accelerometry and 86% of the 22 participants identified as inactive by accelerometry. Overall agreement between the two tools was 39% and Kohen’s Kappa showed a slight measure of agreement between the two tools (0.041)

The evaluation intended to collect device measured moderate to vigorous physical activity (via the accelerometer Actigraph wGT3X-BT) and Short Active Lives Survey at 12 months (see page 18). Collection of accelerometer-derived measures of physical activity from all participants was not feasible at 12 months. Due to the COVID-19 pandemic, there were significant delays in delivery and return of post in England and a large proportion of the participants were clinically extremely vulnerable people to COVID-19 (required to shield). Only 19% (n=15) of the 80 participants were able to receive the accelerometer at 12 months. The above approach was repeated to determine agreement between the tools in classifying participants as ‘active’ or ‘inactive’ at this timepoint.

The classification of the participants into ‘inactive’ or ‘active’ using the measures (Short Active Lives Survey, accelerometer data including all minutes of activity or only activity accumulated in at least 10 minute bouts) at 12 months is shown in Table 4.

Table 4. Classification of participants as ‘inactive’, ‘or ‘active’ from accelerometry and the Short Active Lives Survey at 12 months

Measures	Inactive (< 30 min of moderate to vigorous physical activity per week) n (%)	Active (≥ 30 min of moderate to vigorous physical activity per week) n (%)
	Short Active Lives Survey	11 (73)
Accelerometry- 10 min bouts	13 (87)	2 (13)
Accelerometry - all minutes	5 (33)	10 (67)

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When including physical activity undertaken in 10 minute bouts or more (Table 17), the Short Active Lives Survey correctly identified none of the 2 participants who were classified as active via accelerometry and 60% of the 13 participants identified as inactive by accelerometry. Overall agreement between the two tools was 60% and Kohen's Kappa showed a fair measure of agreement between the two tools (0.216).

When including physical activity undertaken in 10 minute bouts or more (Table 17), the Short Active Lives Survey correctly identified 20% of the 10 participants who were classified as active via accelerometry and 40% of the 24 participants identified as inactive by accelerometry. Overall agreement between the two tools was 60% and Kohen's Kappa showed a fair measure of agreement between the two tools (0.224).

Appendix 5

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