

1 **A remote behaviour change service for increasing physical activity in**
2 **people with chronic lung conditions: intervention development using the**
3 **Behaviour Change Wheel**

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15 **Background**

16 Physical inactivity is rising in the UK adult population, particularly in those with a
17 long-term health condition.¹ People living with chronic lung conditions (e.g.
18 Chronic Obstructive Pulmonary Disease, Bronchiectasis, Pulmonary Fibrosis)
19 have lower daily physical activity levels compared to aged-matched healthy
20 populations.^{2,3}

21 Structured physical activity programmes, such as pulmonary rehabilitation, a
22 face-to-face 6-8 week intervention, are one of the key treatments for chronic lung
23 conditions.⁴ However, across the UK there are barriers preventing people with a
24 lung condition to attend these programmes including accessibility, under-referral
25 and long waiting times.⁵ Current evidence also suggests that completing short-
26 term structured programmes does not always translate to long-term behaviour
27 change (i.e. daily physical activity).⁶

28 Remote-based interventions, including web and telephone, can support change
29 in physical activity behaviour.⁷ These interventions, however, are not readily
30 available for people with a lung condition in the UK. Third sector organisations
31 such as the British Lung Foundation can support the availability of remote-based
32 interventions targeting physical inactivity in people with lung conditions.

33 **Service Development**

34 The importance for having a theoretical basis for intervention development is well
35 established.⁸ The Behaviour Change Wheel (BCW) is a theoretically driven
36 framework designed to enable the systematic development of interventions for
37 supporting behaviour change.⁹ At the centre of the framework, is the COM-B
38 model, which sets out the need for a change in an individual's capability,
39 opportunity or motivation for behaviour change to occur. We report the
40 development of a new British Lung Foundation service for physical activity, to be
41 delivered remotely, according to the key stages of the BCW:

42 *Stage 1 (Understanding the behaviour)*

43 The first step in using the BCW required defining and specifying the target
44 behaviour. National surveys of physical activity in the UK define inactive
45 populations as those completing fewer than 30 minutes of moderate-intensity
46 equivalent physical activity per week.¹ The biggest gains in public health and the
47 best value for public investment is in supporting the people who are least active.¹
48 As such, increasing the proportion of people with lung conditions who complete
49 more than 30 minutes of physical activity per week was chosen as the focus of
50 this service.

51 Having specified the target behaviour, the next step was to identify what needed
52 to change ('behavioural diagnosis') to achieve the desired behaviour change.
53 This required a full understanding of the barriers and facilitators to physical
54 activity in people with lung conditions.

55 We performed a review of the literature (using PubMed) to support a behavioural
56 diagnosis. The search strategy was structured around free text terms for the
57 population (e.g. "COPD") and behaviour (e.g. "physical activity"). The search
58 retrieved 250 articles, of which 5 were identified as relevant to intervention
59 development. We held a workshop with health care professionals (n=3) and
60 people with lung conditions (n=3) to further explore the beliefs of key exercise
61 videos and optional pedometer s. The barriers and facilitators to physical activity
62 were finalised and mapped to the COM-B model (Table 1).

63 *Stage 2 (Identifying intervention options)*

64 The next step of the BCW considers nine potential intervention functions that can
65 bring about change in an individual's capability, opportunity and motivation, and
66 seven policy categories that support the delivery of the intervention functions. An
67 additional review of the literature was conducted to identify the available evidence
68 on remote interventions. PubMed was searched for population terms (as in Stage
69 1) alongside free text terms for remote interventions (e.g. "digital", "text", "phone",

70 “web”, “app”). The search returned 1,566 results, of which 14 were deemed
71 relevant for further review.

72 The articles were reviewed for intervention functions, policy categories and
73 behaviour change techniques (BCT) according to the Behaviour Change
74 Technique Taxonomy (BCTTv1)¹⁰. We again consulted our stakeholder group to
75 provide their perspectives. Decision making on intervention functions and policies
76 was an iterative process and informed by the APEASE (affordability,
77 practicability, effectiveness, acceptability, side effects and safety, equity) criteria.
78 The intervention functions of ‘incentivisation’, ‘restriction’ and ‘coercion’ were
79 excluded for not meeting the APEASE criteria. The majority of studies with
80 positive outcomes in physical activity in the existing literature utilised the
81 intervention functions of ‘enablement’ and ‘education’. The functions of ‘training’,
82 ‘environmental restructuring’, ‘modelling’ and ‘persuasion’ were also deemed to
83 be appropriate for addressing what needs to change (Table 1). In terms of
84 delivery of these intervention functions, many policy categories were not deemed
85 practicable or acceptable including fiscal measures, regulation, legislation and
86 environmental/social planning. Intervention functions delivered through service
87 provision, supported by communications/marketing and use of existing physical
88 activity guidelines were deemed most appropriate.

89 *Stage 3 (Identifying intervention content and implementation)*

90 The final steps were to consider the relevant BCT and delivery mode of the
91 intervention functions. The most frequently used BCT linked to these intervention
92 functions in the extant literature were 'goal setting (behaviour)', 'self-monitoring
93 of behaviour', 'social support (unspecified)', 'information about social and
94 environmental consequences' and 'adding objects to the environment'. Further
95 review of the BCTTv1¹⁰ and stakeholder discussions identified another 23 BCT
96 that met the APEASE criteria (Table 1). A 12 month telephone (health coaching)
97 intervention for each individual, supported by printed (information pack including
98 an activity diary and wallchart) and digital resources (email newsletters, exercise
99 videos and an optional pedometer), were agreed to be modes of delivery that met
100 the APEASE criteria for people with lung conditions. The implementation of each
101 BCT and the final design of the intervention content are provided in Table 1.

102 **Potential impact and implications**

103 The BCW enabled the systematic development of a telephone service for inactive
104 people with lung conditions. The importance of physical activity in management
105 of lung conditions is well recognised. Increased physical activity is associated
106 with improved symptoms, quality of life and reduced health care use in people
107 with lung conditions. An assessment of the feasibility and potential impact of this

108 new British Lung Foundation service is currently being undertaken in England,
109 with the evaluation framework due to be reported in a subsequent paper. The
110 findings of this evaluation will inform the potential scalability and transferability of
111 this intervention for achieving wider public health impact.

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149 **Table 1. Outline of the final design of the intervention, guided by the Behaviour Change Wheel. Behaviour Change Techniques, delivered by a remote service, have been identified as ways to address the intervention**
 150 **functions that are linked to barriers and facilitators of physical activity in people with lung conditions.**

COM-B Component	Barrier	Facilitator	Related BCW ¹ Intervention Function	Intervention components			Behaviour Change Techniques including the BCTTv1 ² code ³
				Phone support	Information pack (sent to all participants 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	Knowledge of the importance of being active Error! Bookmark not defined.	Education	<p>Provide information about the health benefits of physical activity and how it may alleviate symptoms of their condition</p> <p>Encourage participants to speak to their family/peers about the importance of being active with their condition</p> <p>Promote use of BLF's existing patient forum (Health Unlocked) to share experiences</p>	<p>Written health information about health consequences and social/environmental benefits – references to encourage participants to share this information with their friends and family</p> <p>Includes exercise video which has educational information from a clinician and a patient</p>	Month 1 themed around the benefits of being active	<p>5.1 Information about health consequences</p> <p>5.3 Information about social and environmental consequences</p> <p>6.3 Information about others' approval</p> <p>9.1 Credible source</p> <p>12.5 Adding objects to the environment</p>
			Enablement	<p>Help participants to find activities that they enjoy</p> <p>Support participants to set short, medium- and long-term goals for physical activity and outcomes important to them. Identify rewards and positive achievements</p> <p>Encourage participants to make plans to be physically active at a particular time on certain days of the week</p> <p>Support participants to identify specific personal triggers for physical inactivity and develop strategies to address these</p> <p>Review the patient's goals with the patient and how behaviour corresponds to agreed goals. Consider modifying goal accordingly</p>	<p>Includes guidance on getting started</p> <p>Includes guidance for goal setting</p> <p>Includes task on tracking progress which includes goal setting</p> <p>Includes activity diary for goal setting, action planning, self-monitoring, self-reward and goal review. Also prompts assessment of feelings after being active.</p> <p>Includes problem solving task for overcoming barriers</p> <p>Includes task to consider advantages and disadvantages of becoming active</p>	<p>Month 1 and 2 include references and tips on how to get started</p> <p>Month 6 themed around goal setting and tracking progress</p>	<p>1.1 Goal setting (behaviour)</p> <p>1.2 Problem solving</p> <p>1.3 Goal setting (outcome)</p> <p>1.4 Action planning</p> <p>1.5 Review behaviour goal(s)</p> <p>1.7 Review outcome goal(s)</p> <p>2.3 Self-monitoring of behaviour</p> <p>5.4 Monitoring of emotional consequences</p> <p>8.3 Habit formation</p> <p>9.2 Pros and cons</p> <p>10.9 Self reward</p>
Physical opportunity		Access to resources, equipment and opportunities	Enablement	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	Month 9 themed around different ways to be active	<p>1.1 Goal setting (behaviour)</p> <p>2.2 Feedback on behaviour</p>

				<p>Help participants to find activities in their local community or ways to be active at home</p> <p>Give practical information on local physical activity opportunities and transport links. This may include access to specialist services for individuals who require professional support</p> <p>Suggest mobile applications or activity websites</p>	<p>daily living, pulmonary rehabilitation and other activities</p> <p>Includes task about identifying different activities to try and space to record information</p> <p>Includes task to reduce sedentary time</p> <p>Includes exercise video which provides resource to do exercise at home</p> <p>Provide pedometers to those interested in walking or step-based goals (optional)</p>		<p>3.1 Social support (unspecified)</p> <p>8.1 Behavioural practice/rehearsal</p> <p>8.2 Behaviour substitution</p> <p>12.5 Adding objects to the environment</p>
Social opportunity	No one to be active with Lack of encouragement.		Enablement	<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>Includes resources to support participants to be active, e.g. activity diary and A3 activity wallchart and prompts to be active with others</p>	<p>All include references to being active with family and friends</p>	<p>1.4 Action planning</p> <p>3.1 Social support (unspecified)</p> <p>7.1 Prompts and cues</p>
			Modelling	<p>Promote use of BLF's existing patient forum (Health Unlocked) as a source of sharing positive achievements</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>Month 3 includes case studies to reinforce facilitators and reduce barriers</p>	<p>4.1 Instruction on how to perform a behaviour</p> <p>6.1 Demonstration of behaviour</p> <p>12.5 Adding objects to the environment</p>
			Environmental restructuring	<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 exercise to identify difficult situations, sources of social support and social cues that will facilitate physical activity</p>	<p>Includes top tips to encourage environmental restructuring, e.g. placing trainers by the front door</p>	<p>7.1 Prompts/cues</p> <p>12.1 Restructuring the physical environment</p> <p>12.2 Restructuring the social environment</p>

Reflective motivation	Psychological distress of COPD including fear, embarrassment frustration & disappointment. Error! Bookmark not defined. Perception of low importance of physical activity Error! Bookmark not defined.		Education	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 Reframe negative cognitions related to being active and create more positive beliefs about physical activity. Provide participants with information/evaluative feedback based on their self-monitoring (also <i>Persuasion</i>)	Includes health information on the importance of physical activity Includes a task on how might life be different by becoming active and identifying advantages and disadvantages of change Provide pedometer to those interested in step-based goals (optional) and encourage use alongside monitoring in activity chart/diary	Month 1 themed around the benefits of being active Month 2 themed around managing breathlessness and associated emotions	2.2 Feedback on behaviour 5.1 Information about health consequences 5.3 Information about social and environmental consequences 9.2 Pros and cons 9.3 Comparative imagining of future outcomes 12.5 Adding objects to the environment
			Persuasion	Provide encouragement Increase self-efficacy to be active through motivational interviewing Help participants to develop a positive perception of being active. Reframe negative past experiences Inform the patient of how their patient reported outcome measures have changed since baseline at follow up intervals (also <i>Education</i>)	Includes health information on the importance of physical activity	Case studies included in each newsletter to aim to change perceptions of being active with a lung condition	3,1 Social support (unspecified) 2.7 Feedback on outcome of behaviour 5.1 Information about health consequences 5.3 Information about social and environmental consequences 13.2 Framing/reframing
Automatic motivation		Physical activity becoming a habit Error! Bookmark not defined.	<i>The intervention has been designed to facilitate physical activity becoming a habit, and thus automatic motivation is incorporated throughout the intervention as an outcome of the intervention functions described above.</i>				
			Training	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 Encourage the patient to record their weekly physical activity	A3 activity wallchart and activity diary to record activity and encourage habit creation Provide pedometers (or signpost to step counting apps to use on their phone) to those who are interested in step-based goals (optional) Includes exercise videos	Month 12 themed around habit creation	2.3 Self-monitoring of behaviour 8.1 Behavioural practice/rehearsal 8.3 Habit formation 12.5 Adding objects to the environment

151 ¹Behaviour Change Wheel

152 ²Behaviour Change Technique Taxonomy Version 1

153 ³BCT '9.1 Credible source' applies throughout the intervention as the intervention is delivered by the British Lung Foundation