Pulmonary rehabilitation delivered in low resource settings for people with chronic respiratory disease: protocol for the 3-arm assessor-blind randomised implementation trial (PuRe) {SPIRIT item 1a}

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For the PuRe trial group (see acknowledgements for full list)

Abstract

Background: Pulmonary rehabilitation (PR) is a comprehensive, multidisciplinary, individually-tailored intervention that overcomes the deconditioning induced by chronic respiratory diseases (CRDs). In Low- and Middle-Income Counties, CRDs may be poorly differentiated, and PR inaccessible and under-resourced. The PuRe trial aims to test the clinical/cost effectiveness, sustainability, acceptability and implementability of PR delivered in low-resource setting for people with CRDs compared to usual care.

Methods: Our 3-arm individually-randomised, assessor-blind 6-month hybrid-1 implementation trial with health economic and process evaluations, will recruit 465 adults with symptomatic CRD (modified Medical Research Council (MRC) Dyspnoea Score ≥2) from four centres (Bangladesh, India x2, Malaysia).

Interventions: We will test two approaches to delivering a personalised exercise/education PR programme: Centre-PR (centre-based sessions) and Home-PR (one centre-based session followed by remotely-supervised sessions) both twice weekly for 8 weeks. The Usual-Care group will receive the locally available healthcare.

Randomisation: Participants will be allocated randomly (1:1:1) by the Edinburgh Clinical Trials Unit, using variable block sizes, stratified by centre.

Outcomes: The primary outcome is the Endurance Shuttle Walking Test (ESWT) and the key secondary outcome is health-related quality-of-life measured with the St George's Respiratory Questionnaire (SGRQ). Other outcomes include the modified MRC Dyspnoea Score; Hospital Anxiety and Depression Score; smoking status; activities of daily living; physical activity; adverse events; use of healthcare resources.

Data collection: Assessments will be made at baseline (pre-randomisation) and blinded assessments post-PR (10-12 weeks) and 6-months post-randomisation.

Analysis: ESWT will be analysed using a normal linear model, with treatment allocation, baseline ESWT and centre included as fixed effects.

Health economics: We will undertake a cost-consequence analysis of health care costs, out of pocket expenses and impact on work productivity.

Process evaluation: We will use mixed methods to assess fidelity/adaptation, mechanisms of action, acceptability, implementability and sustainability.

Discussion: Evidence of clinical and cost effectiveness will inform local/national decisions about investing limited resources to develop PR services, and the process evaluation will provide practical insights into sustainable implementation applicable to low resource settings.

Trial registration: ISRCTN 65701828

Keywords: Pulmonary rehabilitation, chronic respiratory disease, low- and middle-income countries, randomised controlled trial, hybrid-1 implementation trial, health economic evaluation, process evaluation.

Structured summary {1b}

Item	Description
Primary registry and trial identifying number {4}	ISRCTN – The UK's Clinical Study Registry. ISRCTN 65701828 https://www.isrctn.com/ISRCTN65701828 Date registered: 11th April 2024
Secondary identifying numbers	Clinical Trials Registry – India. CTRI/2024/10/075277 https://ctri.nic.in/Clinicaltrials/pmaindet2.php?EncHid=MTE2Mjc5&Enc=&userName= Date registered: 15th October 2024
Source of monetary or material support	Medical Research Council, Applied Global Health Research Board. MR/Y004809/1
Primary Sponsor and contact information {3b}	The Academic and Clinical Central Office for Research and Development (ACCORD) Usher Building, 5-7 Little France Road, Edinburgh BioQuarter, Edinburgh EH16 4UX enquiries@accord.scot ACCORD reference: AC24052
Role of sponsor and funder {3c}	The sponsor and funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.
Contact for public queries	Dr Vicky Hammersley, PR-PuRetrial@ed.ac.uk https://gtr.ukri.org/projects?ref=MR%2FY004809%2F1
Contact for scientific queries	Professor Hilary Pinnock Usher Building, 5-7 Little France Road, Edinburgh BioQuarter, Edinburgh EH16 4UX hilary.pinnock@ed.ac.uk
Public title	The PuRe trial Pulmonary rehabilitation delivered in low resource settings for people with chronic respiratory disease
Scientific title	Pulmonary rehabilitation delivered in low resource settings for people with chronic respiratory disease: a 3-arm assessor-blind implementation trial
Countries of recruitment	Bangladesh, India, Malaysia
Health condition or problem studied	Chronic Respiratory Disease
Interventions	• Centre-PR: Centre-based PR sessions twice weekly for 8 weeks • Home-PR: Remotely supervised sessions at home twice weekly for 8 weeks • Usual care group: Locally available healthcare
Key inclusion and exclusion criteria	Inclusion criteria 1. Adults ³18 years old. No upper age limit 2. Assessed by referring physician as having persistent and functionally-limiting respiratory symptoms (mMRC ≥2) after optimisation of pharmacological therapy 3. Resident locally and willing to engage with either Centre-PR or Home-PR schedules if randomised to these groups 4. Willing and able to provide written informed consent Exclusion criteria 1. People with non-respiratory causes for the symptoms (stable co-morbidity may be included if clinically appropriate) 2. Active tuberculosis infection 3. Any condition that would increase risk (e.g. uncontrolled cardiac disease) interfere with PR (e.g. neurological disorders, severe arthritis, dementia), or be inappropriate (very severe frailty, end-of-

	life) 4. On-going, or completed PR (including other exercise programme) within the previous 18 months 5. Living in the same house as another participant 6. Unwilling or unable to provide informed consent
Study type	Hybrid-1 randomised controlled implementation trial Randomisation, managed by the Edinburgh Clinical Trials Unit, via permuted blocks, using randomly varying block sizes, and stratified by centre Allocation 1:1:1 Assessor blinded
Date of first enrolment	29th May 2025
Sample size	465
Primary outcome	Functional exercise capacity, measured by the Endurance Shuttle Walking Test (ESWT) post- PR.
Key secondary outcome	Health-related quality-of-life measured with the St George's Respiratory Questionnaire (SGRQ) post-PR
Other secondary outcomes	Endurance Shuttle Walking Test (ESWT) at 6-months St George's Respiratory Questionnaire (SGRQ) at 6-months Modified MRC Dyspnoea Score (mMRC) Hospital Anxiety and Depression Score (HADS) London Chest Activities of Daily Living (LCADL) International Physical Activity Questionnaire (IPAQ) Smoking status Health care resource use, out of pocket expenses, work productivity and income.
Ethics review	Edinburgh Medical School Research Ethics Committee: Ref: 24-EMREC-039. Approved 01/07/2024 and Bangladesh Medical Research Council (BMRC) Ref: BMRC/NREC/2025-2027/96. Approved11/03/2025. Institutional Review Board (IRB), CMC Vellore. Ref: IRB Min. No. 2407111. Approved 20/08/2024. KEM Hospital Research Centre Ethics Committee, Pune. Ref: KEMHRC/RVM/EC/420. Approved 12/05/2025. Medical Research Ethics Committee (MREC), Universiti Malaya Medical Centre (UMMC). Ref: MREC ID NO: 2024713-13912 Approved 18/11/2024.
Individual trial participant data sharing statement	Quantitative trial data. Trial participants will be given the option to opt in/out of their data being shared during the consent process. A data sharing pack for secondary research will be prepared once all analyses outlined in the Statistical Analysis Plan have been completed and the final analysis report has been produced. This will be made available 12 months after first publication of study findings for sharing with approved researchers via Edinburgh DataShare https://www.ed.ac.uk/information-services/research-support/research-data-service/after/data-repository The Edinburgh DataShare repository has an openly searchable index. Meta-data will be available for potential new users to identify whether the data could be suitable for their objectives. A link to the data sharing policy will be included in the published study findings. Process evaluation/qualitative data Interview transcripts will be transcribed and analysed in the local language and will not be translated to English. The full interview transcripts will be archived in DataVault, a University of Edinburgh data repository https://library.ed.ac.uk/research-support/research-data-service/after/datavault. An associated Pure record (www.pure.ed.ac.uk) with searchable metadata and a DOI will be created so that the dataset is findable and can be made available to researchers who meet the criteria for access to confidential data.

Introduction

Background and rationale {9a}

More than half the 545 million people globally with chronic respiratory disease (CRD)[1] live in low- and middle-income countries (LMICs).[2,3] Conditions such as Chronic Obstructive Pulmonary Disease (COPD), post-tuberculosis (post-TB), asthma, bronchiectasis and interstitial lung disease (ILD)[4] are associated with breathlessness, fatigue and muscle dysfunction which reduce exercise capacity and physical activity.[5] Increasing disability, frequent exacerbations, anxiety and fear associated with breathlessness,[6] reduced productivity, and co-morbid depression[7] result in social isolation and economic hardship,[8] adversely affecting health-related quality-of-life (HRQoL).[9]

Pulmonary rehabilitation (PR) is a comprehensive, multidisciplinary, individually-tailored intervention designed to overcome the deconditioning induced by CRDs,[10] and contribute to improved HRQoL.[11] Components include tailored exercise, education, support for self-management and lifestyle change.[10,12] Evidence of effectiveness is particularly strong for COPD,[13] but PR also improves exercise capacity and HRQoL in other CRDs such as bronchiectasis, ILD and asthma,[14-16] and (in COPD) has been shown to be cost effective as the need for emergency care is reduced.[17] However, most of the evidence is generated in high-income countries and is disease specific (commonly COPD), whereas in LMICs CRD is often poorly differentiated. Also, PR services developed in high income settings may not be deliverable in LMICs because of the substantial differences in resources, awareness, culture, healthcare configuration and disease profile.[18-19] The potential gains to individuals and healthcare economies, however, are large given the burden of CRD in LMICs.[20]

Summary of systematic review evidence

Our systematic review (13 studies; 11 at high risk-of-bias) assessed the impact of PR on exercise capacity and HRQoL when delivered in low-resource settings for people with CRD.[21] PR improved exercise capacity in 10 studies, HRQoL in 12, but one of the two studies at moderate risk-of-bias showed no benefit. The programmes employed low-cost strategies adapted to their setting. All included exercise training; most provided education and breathing exercises. Travel and time involved in attending a course of PR is a recognised barrier to uptake and completion.[22] A systematic review in 2016 concluded that home/community-based PR (the review did not distinguish these settings) may be as effective as centre-based PR,[23] and a recent Cochrane review confirmed the effectiveness of telerehabilitation (unlikely to be feasible in our LMIC contexts).[24] Our recent systematic review (N=16 trials) concluded that Home-PR using a range of remote supervision strategies, was comparable to Centre-PR, though the three studies from LMICs were small ($n \leq 40$) and at high risk-of-bias.[25]

Feasibility studies

Our feasibility studies, conducted within the National Institute for Health and Care Research Global Health Research Unit (RESPIRE)[26] demonstrated that PR programmes can be adapted for low resource settings and provided insights for intervention development.[27-32]

Explanation for the choice of comparator {9b}

The Usual-Care group will receive the standard care available within the healthcare services of the respective centres. Each centre operates in a different context, so for clarity we have summarised the care typically available to people with CRD. (Table 1) PR is either not recommended in local guidelines, rarely available or inaccessible in Bangladesh,[33] India,[29] and Malaysia,[34] so is not 'usual care' in these contexts.

Table 1. Description of the usual care typically available in each of the centres

	Khulna (BPCRS)	CMC Vellore (RUHSA)	KEM Pune (Vadu)	Kuala Lumpur (UM)
Diagnostics	Due to out-of-pocket costs, most patients undergo only CXR and spirometry, but HRCT is available. Total lung capacity and DLCO are only available at tertiary centres so are not routine diagnostic practice.	Blood tests, CXR, spirometry are available at RUHSA. CT scans are only available at Vellore (25-35 km away). Concessional rates are available for those who cannot afford them.	CXR, blood tests and USS are available and affordable, from private and government health facilities. Patients need to visit tertiary care hospitals for spirometry and CT/MRI.	CXR, HRCT, spirometry and MRI are available and free for pensioners; most others need to pay out of pocket. The cost of investigations in UM is higher than other government hospitals.
Respiratory medication	Most recommended drugs for CRDs are available. Affordable options, allow patients to purchase small quantities at a time	Inhalers (SABA, ICS, ICS/LABA, LAMA) spacers and oral medications (antibiotics, corticosteroids) are available at RUHSA.	Medicines are free from government health facilities. Drugs not available from village stores are ordered from city pharmacies.	SABA, ICS, LAMA and LABA are available. Pensioners and government staff get most medications free; others need to purchase
Oxygen (LTOT)	Not commonly used, but a few patients use home oxygen concentrators as advised by tertiary care.	LTOT and ambulatory oxygen are provided in tertiary care centres. Oxygen cylinders and concentrators are purchased or rented from private vendors or CMC.	LTOT is available at tertiary and district hospitals, with standard charges. Access to ambulatory oxygen depends on institutional resources and patient financial capacity.	Respiratory specialists prescribe LTOT. Financial assistance may be available via medical social worker. Government sponsors LTOT for pensioners.
Airway clearance	Provided by hospitals for excessive secretions e.g. following chest/cardiac surgery.	Patients can (rarely) be admitted for postural drainage, otherwise referred to tertiary care centres for further care.	Bronchial hygiene is not routinely available but can be provided on a case-by-case basis.	Chest physiotherapy is available e.g. for people with bronchiectasis, and includes some education and exercise sessions.
Post admission	Post admission, a follow-up outpatient appointment is scheduled; however, patient attendance is often poor.	Post-admission patients are followed up after 1 week to 1 month based on doctor's recommendation. Usual outpatient follow up is at 3 months intervals.	Comprehensive post discharge follow-up at hospital to monitor progress, measure lung function, review medication and reinforce lifestyle modifications, adherence.	Follow-up at one month post-discharge includes a full assessment and development of a management plan.
Smoking cessation	Smoking status assessed and guidance offered (engaging support of family/friends). Pharmacotherapy is rarely available.	Advise and refer to counselling centre for support. NRT is not available in CMC but can be bought outside.	Assessment and counselling on risks of smoking and benefits of quitting. If needed, psychologist support is available.	Primary care provides smoking cessation counselling. Pharmacotherapy is not available but can be bought privately.
Mental health	May be offered counselling, prescribed medication. Mental health services are not widely available.	Patients may be referred to counselling centre, or further care from a psychiatrist.	Volunteer-counselling and free helplines. PHCs are initial contact but resources and skills are limited. Specialist care in Pune.	First-line is primary care physician. Referral for counselling can be made to medical social work or psychologist
Healthcare system	Dual healthcare system with unstructured referral processes and gaps in care. Most healthcare expenses are paid by patients, placing financial burden on individuals.	CMC is a private health system but highly subsidised to make care affordable for the patients with low socio-economic status.	Specialist care is available at the secondary or tertiary level hospitals, but most people go to private facilities, incurring out of pocket expenditure.	Malaysia provides universal healthcare for all citizens. The Government heavily subsidises the cost of treatment through public facilities, so patients' fees are small.

Abbreviations: CEI: community engagement and involvement; CMC: Christian Medical College; CRD: chronic respiratory disease; CT scan: computed tomography scan; CXR: chest X-ray; DLCO: diffusing capacity for carbon monoxide; HRCT: high resolution computed tomography; ICS: inhaled corticosteroid; LABA: long-acting beta-agonist; LAMA: long-acting muscarinic; LTOT: long term oxygen therapy; MRI: Magnetic Resonance Imaging; NIMH: National Institute of Mental Health and Hospital; NRT: nicotine replacement therapy; PEFR: peak expiratory flow rate; PHCs: Primary healthcare centres; PPI: patient and public involvement; RUHSA: Rural Unit for Health and Social Affairs; SABA: short-acting beta-agonist; USS: ultrasound scan.

Aims and objectives {10}

We aim to test the clinical effectiveness and sustainability at 6-months, cost impact, acceptability and implementability of Centre- or Home-PR delivered in low-resource settings for people with (potentially undifferentiated) CRDs compared to usual care. Reflecting outcomes that matter to people with CRD, our interest is in both functional exercise capacity and quality-of-life.[30,31]

Primary objectives

In people with CRD:

1. Compared to Usual-Care, does Centre-PR or Home-PR improve functional exercise capacity (primary outcome) and quality-of-life (key secondary outcome) when delivered in LMICs?
2. Does supervised Home-PR achieve outcomes that are non-inferior to Centre-PR?

Secondary objectives:

In people with CRD:

3. Is the impact of Centre-PR and/or Home PR sustained at 6-months?
4. Does Centre-PR or Home-PR lead to changes in Health Care Resource Use (HCRU), associated cost, Out-of-Pocket (OOP) expense, work productivity, and income over 6 months? What are the associated healthcare, patient and societal costs?
5. Are Centre-PR or Home-PR programmes acceptable, feasible and implementable?

Methods

Stakeholder engagement {11}

Aligned with the RESPIRE Stakeholder Engagement guidance,[35] we will collaborate with local communities and harness the patient voice.[36] We will engage with individuals and communities in equitable, gender/culturally sensitive ways such as facilitating community meetings, listening to and acting on community members' feedback, and securing the support of influential community, religious, or political leaders and primary healthcare providers. We will use local media to raise awareness of respiratory health and PR; co-producing resources with community members. Local end-of-trial workshops will disseminate results to community members and facilitate discussion.

Patient colleagues

Two patients (from Bangladesh and Malaysia) contributed to proposal-development, commented on feasibility/acceptability of the PR programme; outcomes that matter to people with CRD; recruitment strategies; use of technology for Home-PR. As grant-holders they are members of the Trial Management Committee and are authors on this paper (JB, KK).

Policy stakeholders

Building on our prior PR stakeholder work,[33,34] we will engage those with interest and power to effect change such as regional healthcare services, regional and national policymakers, non-governmental organizations and the World Health Organization.[37]

Trial design and trial setting {12}{13}

PuRe is a 3-arm individually-randomised, assessor-blind, 6-month hybrid-1 implementation trial[38] evaluating two approaches to delivering PR (Centre-PR or Home-PR) compared to Usual-Care for people with CRD in low-resource settings.

The trial will be conducted in the four centres who undertook the feasibility studies. Their diverse low-resource settings and the characteristics of the patients they expect to recruit are in Table 2.

Table 2: Features of the four centres and characteristics of the people we expect to recruit

Centre (World Bank status)	Khulna, Bangladesh (LMIC)	CMC, Vellore, India (LMIC)	KEM, Pune, India (LMIC)	Kuala Lumpur, Malaysia (UMIC)
Features of the four centres				
Setting	Community based respiratory outpatient care with PR facility	Rural Unit for Health and Social Affairs In/outpatient facility	Rural Health Program (Vadu). In/outpatient facility	Tertiary hospital, urban setting. In/outpatient facility
Staff	Primary care physician, medical assistant, physiotherapists	Physicians, physiotherapists, psychologist, nutritionalists, occupational therapist	Respiratory physicians, physiotherapists, psychologist	Rehabilitation physicians, physiotherapists, occupational therapist, dietitian
Characteristics of people we would expect to include from these centres				
Source of population data	Community Respiratory Centre clinical records, other local practitioners	Record of Respiratory Wellness Clinic which provides care for CRD patients (since 2021).	Vadu HDSS database n=220,660; 22 villages and respiratory screening camps	Observation of respiratory OPD and acute admissions
Age	Median: 58 yrs Range: 18 to 89yrs	Mean: 55yrs (SD16.7) Range 16 to 91yrs	Mean: 55yrs (SD16.6) Range 16 to 97yrs.	Typically older age group; majority > 70 years old
Sex Gender	M/F: 60/40% (Gender: NA)	M/F: 60/40% (Gender: NA)	M/F: 46/53% (Gender: NA)	M/F 57/43% (Gender: NA)
Race, ethnicity and ancestry	South Asian (Bangladeshi)	Asian - Indian	Asian - Indian	Malaysia is multi-ethnic: Malay (58%), Chinese (22%), Indian (7%) in 2025.
Socioeconomic status	Predominantly low- and middle-income	Predominantly middle- and lower- income;	Predominantly low and middle income.	Most are not currently employed. Government servants and pensioners have concessions on fees.
Geographic location	Urban/peri-urban/rural	Rural. Majority in agriculture.	Rural, agricultural work, homemakers, company activities	Urban
Disease profile	Predominantly COPD, others include asthma, ACO, post-TB, and ILD	COPD (52%), Asthma (40%), post TB (4%), ILD (2%), Bronchiectasis (2%)	66% report respiratory symptoms without a confirmed diagnosis. Asthma (20%), COPD (4%) overlap (3%), post-TB (1.04%),	Predominantly ILD. Multi-morbidity is common.
Education/literacy		Low literacy especially among elderly.	Primary widely available; higher secondary and tertiary education limited.	

Abbreviations: M: male, F: Female, NA: Not available, COPD: chronic obstructive pulmonary disease, ACO: asthma/COPD overlap, TB: post-tuberculosis, ILD: interstitial lung disease. HDSS: Health and Demographic Surveillance System.

Eligibility criteria for participants {14a}

Inclusion criteria

- Adults ≥18years old. No upper age limit.
- Assessed by referring physician as having persistent and functionally limiting respiratory symptoms (modified MRC Dyspnoea Scale (mMRC ≥2) after optimisation of pharmacological therapy.
- Resident locally and willing to engage with either Centre-PR or Home-PR schedules if randomised to either of these groups.
- Willing and able to provide written informed consent

Exclusion criteria

- People with non-respiratory causes for the symptoms (stable co-morbidity may be included).
- Active TB infection.
- Any condition that would increase risk (e.g. uncontrolled cardiac disease) interfere with PR (e.g. neurological disorders, severe arthritis, dementia),[10] or be inappropriate (very severe frailty, end-of-life).
- On-going, or completed PR (including other exercise programme) within previous 18 months.
- Living in the same house as another participant.
- Unwilling or unable to provide informed consent.

Eligibility criteria for sites and those delivering interventions {14b}

The four sites are the centres who developed PR initiatives within the RESPIRE Global Health Unit, tested feasibility, are partners in adapting the PR for the trial, and are grant holders in the PuRe trial. At each centre, the exercise is delivered by physiotherapists trained (by RR and MH) to deliver PR with a hybrid programme of on-line training and an in-person workshop (Vellore, October 2024). Education components, standardised in a detailed intervention manual and adapted locally for language, culture and context, are delivered by physicians, psychologists, dieticians, physicians, and occupational therapists according to workforce availability.

Informed consent {32a}

Trial information will be provided by referring clinicians or included in invitations to potential participants on local registries. A researcher, trained to take informed consent, will provide information and answer questions to ensure the patient is fully informed about the trial before taking written consent. Participants will have at least 24-hours to consider participating in the PuRe trial and be encouraged to discuss with family/friends if they wish.

Some potential participants may have literacy problems: researchers will provide sensitive support (reading out information, checking understanding, encouraging (culturally appropriate) family support. Participants unable to sign their name/initials may indicate consent with a thumbmark observed by an impartial witness (who will also sign/date the consent form).

Consent provisions for collection and use of participant data and biological specimens {32b}

Participants will be asked to consent to the use of their de-identified data in future studies. No biological specimens will be collected.

Intervention and comparator {15a}

The PuRe trial will investigate two approaches to delivering PR for people with CRD:

- Centre-based PR: in which patients attend PR sessions twice weekly for 8 weeks at a PR centre.
- Home-based PR: in which patients are supported remotely twice weekly for 8 weeks to undertake the PR sessions at home.
- The Usual Care group will receive the routine care available within their local healthcare service.

The core content of the intervention is summarised in Table 3 using the TIDieR checklist.[39]

Table 3: PuRe Trial intervention described according to TIDieR categories

TIDieR	Description	
Brief names	The two approaches to delivering PR are: 1) Centre-PR and 2) Home-PR.	
Why?	The rationale for the intervention is described in the Introduction	
What? What tailoring?	We have adapted international standards for delivering exercise components of PR[10,12] in low-resource settings (e.g. 10-metre tracks, steps for endurance; improvised weights, resistance bands for strength). Standardised educational resources (e.g. written information, presentations, video-clips) and basic psychological support[65] are locally adapted to ensure cultural and contextual relevance. Behaviour change techniques will optimise sustainability of effect.[66]	
Who provides?	Sessions will be led by PR-trained physiotherapists, with some content (e.g. psychological support, inhaler technique training, smoking cessation) delivered by other professionals according to local skill-mix. We will provide training for PR staff (hybrid: on-line and three days at CMC Vellore, India) with on-going oversight and support from PR experts (RR and MH).	
How?	All assessments (baseline and follow-up) in all groups will be conducted in the Centre. A centre-based session will initiate the prescribed exercise and education programme for participants allocated to Centre- or Home-PR with subsequent session delivered according to allocation. A paper-based PuRe pack, tailored to the individual's disease, severity and prescribed exercise, will be given to participants.[67] Other video/audio/paper resources about CRD, PR, exercise demonstrations will support the tailored educational content.	
	• Centre-PR sessions last up to two hours and include exercise components and education. In three centres these will be rolling programmes so that participants are recruited continuously and can be allocated to a session within 2-weeks of being randomised. CMC Vellore, India, will recruit participants in cohorts who will be randomised and attend a PR programme as a group.	• Home-PR will include the same components as Centre-PR but (after the initial introductory centre-based session), supervision will be delivered remotely. Ideally, we will provide supervision and education via video-links, but availability of technology varies, and we will offer a range of options: e.g., audio calls to supervise exercises and provide motivation and individual education.[68]
Where?	• Centre-PR will be in a hospital, community clinic or satellite venue: the key criterion is that the patients attend a group session with at least basic equipment and supervised in person by a healthcare professional.	• Home-PR will normally be undertaken at home: the key criterion is that the patient is by themselves (or with a family member) supervised remotely by a healthcare professional.
When? How much?	Both Centre-PR and Home-PR will provide sessions twice a week for 8 weeks	
How well?	Guided by international standards,[10,12] and informed by local feasibility studies,[27-32] and stakeholder engagement,[33,34] we have defined the core components of PR to which fidelity is expected. Practical adaptation to local context is encouraged to enable delivery of the required content (e.g. in Bangladesh single sex groups are culturally appropriate). Fidelity and adaptation are considered at two levels: 1. Professional fidelity to the manualised PR service. Fidelity will be monitored, and local adaptations recorded. Process data collected will include: therapists' detailed logs of the exercise and education components delivered to individual patients; qualitative interviews with patients and PR staff. 2. Patient fidelity to the Centre-/Home-PR. We will use the detailed PR service records and explore adherence in qualitative interviews.	

Abbreviations: PR: pulmonary rehabilitation; CMC: Christian Medical College;

Criteria for discontinuing or modifying allocated intervention/comparator {15b}

PR may be discontinued for clinical reasons (e.g., developing a contraindication to PR.[40]) Whilst core components are defined in the PuRe manual, PR is intended to be tailored to the individual clinical status, educational needs, personal preferences and home/family context. This tailoring will be recorded in the PR logs, explored in the process evaluation and reported with trial outcomes.

Strategies to improve adherence to intervention/comparator {15c}

We have strategies to enhance adherence at two levels:

Professional adherence to delivery of core components of PR.

- Involvement in designing the adapted PR intervention and writing the PuRe manual, and flexibility for local adaptation increases the practicability of delivering the intervention.
- On-line and in-person training ensures physiotherapists have both theoretical understanding of PR and the practical skills required to deliver the tailored intervention.
- Weekly team meetings include a regular item on intervention delivery which reinforces the manualised protocol and provides opportunities to discuss queries with PR experts (RR and MH) and share practical problems and solutions.
- Quality assessment visits (by HP and VH) after approximately 30 patients had been recruited at each site enabled observation of trial processes, review of the detailed PR log and discussion with the local team.

Participant adherence to allocated PR.

- Not all participants will engage with the full PR course,[41] and uptake, engagement and completion will be monitored and reasons (if provided) collected to inform delivery.
- Flexible arrangements, motivational approaches by PR staff, and group encouragement may improve adherence to the 8-week programme, but this is a real-world study and the aim is to minimise non-adherence using practical approaches that could be implemented and maintained in future routine service provision.

Concomitant care permitted or prohibited during the trial {15d}

Trial participation places no restrictions on concomitant care and management of any co-morbid conditions which will be provided by the patients' usual medical advisor or arranged via usual local healthcare channels.

Ancillary and post-trial care {34}

PR is a defined course of treatment so no follow-on arrangements are required. The participants remained under the care of their usual healthcare provider for all concomitant care and that will continue post-trial. Participants in the Usual-Care group will be offered their choice of Centre-PR or Home-PR at the end of the trial (6-months post randomisation). The PuRe trial has indemnity to cover care/compensation to those who suffer harm from trial participation. The risks, however, are small as PR is a guideline-recommended treatment for CRD, with an excellent safety record in the high-income countries in which it has been tested.[13-16]

Outcomes {16}

Core Outcome Measures in Effectiveness Trials (COMET) identifies outcomes for PR as 'exercise capacity', HRQoL and 'symptom control'.[42,43]

Primary outcome

Exercise capacity measured by the Endurance Shuttle Walking Test (ESWT),[44] is an adjunct to the Incremental Shuttle Walking Test (ISWT) enabling assessment of both functional and endurance exercise capacity using the same 10-metre shuttle course. The ESWT is reproducible and responsive to change after PR in COPD and other CRD.[45] The minimum clinically important difference (MCID) is 174 seconds.[45] USB drives with patient instructions and timed 'beeps' are available to standardise delivery of the test.

Key secondary outcome

The 50-item St George's Respiratory Questionnaire (SGRQ) measures HRQoL (symptoms,

activities, impact (scale: 0 (well) -100 (impaired)) and is responsive to change.[46] MCID is 4.[47] It is validated in all common respiratory conditions and takes 8-15 minutes to complete. An on-line app calculates the weighted scoring.[48] Translations are available in Bengali, Tamil, Marathi, Hindi, Malay and Mandarin.

Secondary outcomes

Breathlessness and the impact of CRD on mental health, activities of daily living and physical activity will be measured with validated questionnaires.

- Breathlessness. The modified MRC Dyspnoea Scale (mMRC),[49] assesses breathlessness in the context of activity. The scoring for the mMRC ranges from 0 to 4.
- Anxiety and depression will be assessed with the Hospital Anxiety and Depression Score (HADS).[50]
- The impact of breathlessness on activities of daily living will be assessed with the London Chest Activities of Daily Living (LCADL).[51]
- International Physical Activity Questionnaire (IPAQ) has been used in >50 countries (including Bangladesh, India, Malaysia[52]) to assess physical activity in the domains of work, leisure, and travel.[53]
- Smoking status will be categorised as ‘current smoker’; ‘vaper’; ‘ex-smoker’ (> 3 month since quitting); ‘never smoked’. Pack-years will be calculated using an on-line tool that accommodates bidis and other locally used tobacco products.[54]
- HCRU, associated cost, OOP expenses and impact on work productivity and income.

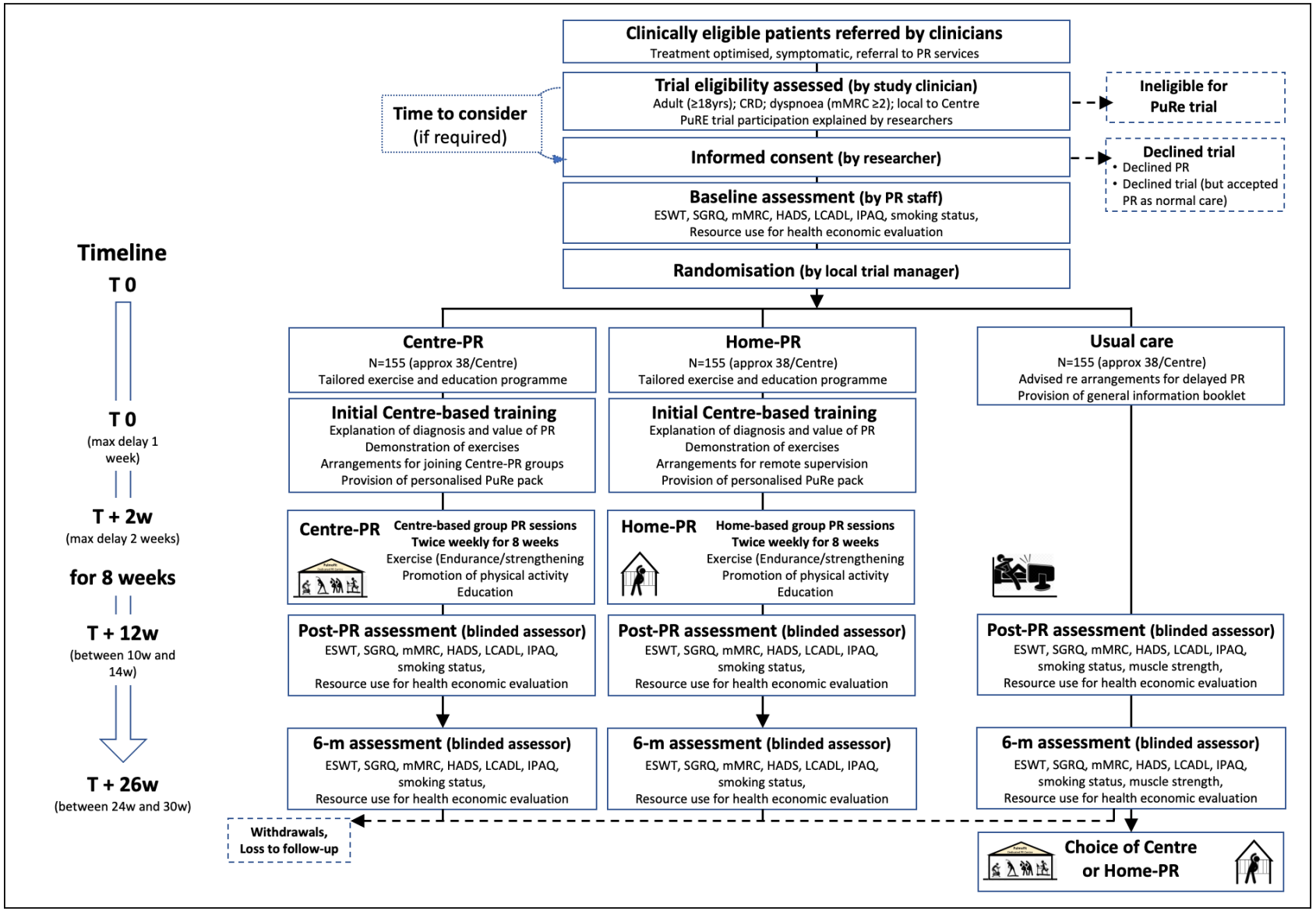
Harms {17}

Serious adverse events identified during routine checks or reported to PR staff/researchers will be recorded. The local Investigator will review documentation related to the event (e.g. hospital notes, laboratory and diagnostic reports) and in discussion with the Principal Investigator (and/or co-Principal Investigators) determine seriousness, causality, severity and expectedness. As this trial involves procedures and interventions that are well established, recommended by guidelines,[10,12] with well understood risks, only Serious Adverse Reactions and Suspected Unexpected Serious Adverse Reactions related to the intervention, will be onward reported to the Sponsor.

Participant timeline {18}

The Schedule of enrollment, interventions, and assessments is in Figure 1.

Figure 1. Schedule of enrolment, interventions and assessments



Abbreviations: CRD: Chronic Respiratory Disease; ESWT: Endurance Shuttle Walking Test; IPAQ: International Physical Activity Questionnaire; HADS: Hospital Anxiety and Depression score; LCADL: London Chest Activities of Daily Living; mMRC: modified MRC Dyspnoea Score; PR: pulmonary rehabilitation; SGRQ: St George's Respiratory Questionnaire; w: weeks

Sample size {19}

We allowed for 30% attrition based on a 22% loss in the feasibility study in Bangladesh[27] and even greater in Malaysia[31] (though pandemic-related restriction orders will have inflated these figures). A 2.5% one-sided significance level will be used throughout, with hierarchical hypothesis testing to control strongly the type-I error (see trial analysis).

ESWT (superiority testing of Centre-PR or Home-PR vs Usual-Care)

ESWT (in seconds) has a standard deviation (SD) of 156 seconds under control conditions; MCID 174 seconds.[44] The within-participant SD in ESWT measured one week apart under usual-care was 72s.[55] The correlation between two measurements under Usual-Care is 0.893 (Higgins 2020[56]). In PuRe, ESWT will be repeated at 10-12 weeks so lower correlation (0.6) is assumed. Analysing by analysis of covariance an overall sample size of 465 will give >99% power.

ESWT (non-inferiority testing of Home-PR vs Centre-PR)

Assuming a non-inferiority margin of 87seconds [Singh S: personal communication]; expected mean difference of 0; analysis by two sample t-test; we will have 98% power to show non-inferiority.

SGRQ

In a Cochrane review,[13] the within-group change from baseline in total SGRQ score ranged from 9.4 to 16.1. The correlation between two assessments measured 2-weeks apart under usual care is 0.92.[46] The correlation between measures 10-12 weeks apart will be lower, say 0.6. Analysing by analysis of covariance and assuming: MCID 4 points;[47] SD 11.3; 90% power will require a total sample size of 465 across the three randomised groups.

Recruitment {20}

Source of referrals will vary according to the local healthcare context: for example: self-referral to a community-based centre, referral from local clinicians, contact via a local Health and Demographic Surveillance System, identified by community health workers, outreach activities, health 'camps', attending respiratory wellness clinics, hospital clinics, discharge arrangements for inpatients.

Randomisation {21a}{21b}{22}{23}

Sequence generation will be provided by a programmer at Edinburgh Clinical Trials Unit (ECTU). Participants will be randomised to Centre-PR, Home-PR or Usual Care in the ratio 1:1:1. Permuted block randomisation will use randomly varying block sizes, stratified by centre. The allocation sequence will be stored on a secure server visible only to permitted personnel. It will be created by a member of ECTU staff not involved in the analysis or management of the PuRe trial data. The Centre trial managers (or a nominated deputy) will assign participants to groups, they will not have access to the random allocation sequence.

Blinding {24a}{24b}{24c}

Trial participants, PR staff and local research staff cannot be blinded as they will be participating in PR, delivering PR, or organising trial processes. The assessors (post-PR; 6-months) will be blind to allocation and will not be aware of the baseline assessment. The trial statistician will be blind to allocation throughout the trial. The statistical analysis plan will be developed without knowledge of the treatment allocations and will be signed off prior to database lock. The ECTU statistician will be blind to allocation until preparation for the first Data Monitoring Committee report.
Outcome assessments (post-PR; 6-months) will be undertaken by assessors unconnected with the trial team or intervention delivery. Participants will be asked not to divulge allocation during the

outcome assessment; local teams are aware of the need for blind assessment and will avoid conversations/contexts that could inadvertently disclose allocation. We will record if blinding was breached and ask assessors to indicate their opinion of allocation after the assessment.

A procedure for unblinding is not required as participants, PR therapists and local researchers are all aware of allocation.

Data collection and management {25a}

Trial outcomes

- The trial baseline assessment (prior to randomisation) will be undertaken by PR staff/researchers. The measures contribute to the clinical pre-PR assessment on which the tailored exercise programmes will be based.
- Effectiveness (objectives 1 and 2) will be undertaken by a blinded assessor at a post-PR assessment arranged as soon as possible after PR completion (typically 10-12 weeks post-randomisation; latest data collection 14-weeks).
- Sustainability (objective 3) will be assessed at 6-months post-randomisation by a blinded assessor.
- Master copies of all data collection forms in all relevant languages are available on a shared drive maintained by the University of Edinburgh.

Health economic data

- Health economic data will be collected by the researcher at the same three timepoints as the trial outcome data.

Process evaluation[57]

- Quantitative data will be collected from the researcher logs and therapist logs of PR delivery.
- Qualitative data will be generated by in-depth interviews with patients, professionals and other stakeholders. A key aim is to gain insights into the barriers and enablers of implementing PR as a routine clinical service, so topics covered will include views on the PuRe intervention and the practicalities of participating/delivering the service. Recruitment will continue until data saturation is achieved (estimated up to 20 patients and 15 professional interviews at each Centre). Interviews will be undertaken, audio-recorded and transcribed verbatim in the preferred language of the participant.

Plans to promote participant retention and complete follow-up {25b}

Reducing attrition

The importance of attending assessments will be emphasised to participants from the outset and we will schedule convenient appointments, flexibly and well in advance. Travel and out-of-pocket expenses will be reimbursed. Patients in the Home-PR or Centre-PR groups who stop attending the PR sessions (out of choice, or a change in clinical situation) will be encouraged to remain in the trial and attend follow-up assessment visits.

Withdrawal of study participants

Participants may withdraw from the trial at any point and the primary reason for withdrawal will be documented in the participant's case report form (if available).

Data management {26}

Quantitative data: A REDCap database [Research Electronic Data Capture. www.projectredcap.org]

has been developed and is held centrally in ECTU. Clinical data will be entered at sites by delegated members of the study team into an electronic case report form (eCRF) accessed via a unique username and password.

Qualitative data: Interviews will be conducted by qualitative researchers, digitally-recorded on password-protected encrypted devices and securely deleted when the transcription has been checked.

Data quality and standards

Data queries, data field behaviour will be defined as part of the initial eCRF specification and validated by the Trial Manager (or designee) before release on the live system. Database training and the use of a training database will be provided remotely to each Centre. Quality checks will be performed by the ECTU Data Management team in accordance with ECTU Standard Operating Procedures.[58] Query reports, generated by ECTU, will be sent to each Centre monthly.

Quality Assurance visits

The quality assessment visits (by HP and VH after recruitment of first 30 patients) will include a check of a random sample of REDCap data entries against the source data. Any systematic errors will be discussed and duplicate data entry arranged for those fields.

Confidentiality {33}

We will adhere to UK and local confidentiality legislation. Data-sharing agreements will be in place with access control at every stage. Audit trails and documentation will be maintained for all access and changes in data.

Personal information will be securely stored locally at the local Centres for three years after the trial is ended. All trial data will be coded and de-identified and no personally identifiable information will be shared outside the study sites. All mention of people/place names (and anything potentially identifiable) in interview data will be redacted from the transcripts of the qualitative interviews.

Statistical methods {27a}

Statistical analysis plans {5}

Formal statistical and health economic analysis plans will be developed without knowledge of the treatment allocations and will be finalised and signed prior to database lock. The plans will be added to the trial registration entry (ISRCTN 65701828). The process evaluation protocol has been submitted for publication.

Trial analysis (Questions 1,2, and 3)

Analyses will test hypotheses in a hierarchical manner, using a serial gatekeeping approach to strongly control overall type I error at 5%. In three stages, we will test:

1. Superiority of each of Centre-PR and Home-PR to Usual-Care;
2. Superiority of Centre-PR to Home-PR; Non-inferiority of Home-PR to Centre PR;
3. Superiority of Home-PR to Centre-PR.

Testing will only progress to the next stage if there is a significant result on the relevant hypothesis test in the previous stage.

The primary outcome (ESWT post-PR) will be analysed using a normal linear model, with treatment allocation, baseline ESWT and Centre included as fixed effect covariates. Intervention effects will be

the least squares mean difference for each pairwise contrast in the design (Centre-PR or Home-PR minus UC; Home-PR minus UC; Centre-PR minus Home-PR) and its 95% confidence interval. (See below for how we handle missing data).

Other continuous outcomes (secondary and at 6-months) will be analysed in the same manner as the primary outcome.

Intention to treat analysis {27b}

For trial analyses, the population will be all randomised participants, analysed according the group to which they were assigned.

Handling missing data {27c}

Multiple imputation implementing a missing-at-random assumption (with relevant sensitivity analyses) will enable an intention-to-treat (treatment policy) estimand. Further details will be in the statistical analysis plan.

Additional analyses (e.g. subgroup analyses) {27d}

The overall high statistical power for the trial primary outcome facilitates informative subgroup analyses. Pre-specified subgroup analyses will be: centre; age (<60yrs; ≥60yrs); gender; disease (COPD, asthma, bronchiectasis, post-TB and 'other CRD'); severity (mMRC=2; ≥3); educational status (primary; secondary and above). Each subgroup variable in turn will be included in the normal linear model of the primary outcome, as well as a term for its interaction with randomised treatment. Subgroup outcomes will be presented in a forest plot with the p-value for the subgroup by treatment interaction.

Interim analyses {28b}

We do not plan interim analyses. Summaries of recruitment, baseline characteristics and safety data will be reviewed at regular intervals by the independent data monitoring committee.

Health economic evaluation (Question 4)

Results will be presented cost-consequence style[59] alongside the main trial clinical outcomes to enable potential decision makers to select outcomes most pertinent to their circumstances. Primary analysis will present HCRU, associated cost, OOP expenses, lost productivity and income for each country using only its own data, with secondary analysis allowing for pooling between countries where common services exist. Full details of these analyses will be pre-specified and signed off in a comprehensive Health Economic Analysis Plan.

Process evaluation (Question 5)

Informed by a logic model (see process evaluation protocol[57]), analysis of the mixed methods process data will focus on understanding the process of PR delivery in the trial, the local/national context surrounding delivery, the mechanisms of PR's impact, and future potential for sustainable implementation in routine practice.

1. *Quantitative analysis* will describe the process of delivering the Centre-PR and Home-PR interventions including uptake, adherence and completion, and the components of PR delivered.
2. *Qualitative analysis* will be thematic and conducted initially within centres. A qualitative meta-synthesis of the themes emerging from the four centres will derive high-level themes applicable more widely in similar settings.
3. The qualitative/quantitative findings will be combined for triangulation and complementarity.[60]

Oversight and monitoring

Coordinating centre {3d}

The PuRe team, including the central co-ordinating team, co-investigators, researchers and therapists from the four centres, meet weekly to monitor progress, answer any queries that have arisen, share any problems and solutions.

- The central co-ordinating team is led by the Principal Investigator (UK), two co-Principal Investigators (UK; Malaysia) and an experienced trial manager (UK) with combined expertise in development/evaluation of complex interventions, PR and global health service research. ECTU are hosting the trial and provide randomisation, database, quality assurance, health economics, trial methodology input, statistical analysis and reporting. A senior health service researcher (UK) will support local teams undertaking the process evaluation.
- Co-investigators from the partner centres bring a broad range of clinical specialities (PR, rehabilitation, respiratory, generalist), allied healthcare disciplines (physiotherapy, occupational therapy, psychology), healthcare settings (primary, secondary, tertiary), academic expertise (medical sociology, education/training, data management) and health economics.
- Each centre has recruited a team of therapists to provide the PR intervention, and researchers to deliver the trial including the process evaluation.

Trial steering committee {3d}

The Independent Trial Steering Committee (ITSC) will meet at least annually to oversee progress and monitor governance and ethical issues. The independent members include respiratory, global health, PR and statistical expertise. Rapporteurs from each centre will gather lay perspectives from their communities and report to the ITSC.

Data monitoring committee, its role and reporting structure {28a}

The independent members of the Data Monitoring Committee (DMC) are two pulmonologists (UK; Malaysia) and a statistician (UK). They will safeguard the interests of the participants and review the trial data (including unblinded data if needed) and advise the ITSC of any potential concern.

Frequency and plans for auditing trial conduct {29}

The Sponsor will determine if an independent risk assessment and audit of study management by ACCORD Quality Assurance is required and, if so, at what frequency.

Protocol amendments {31}

Amendments will be reviewed by the sponsor before being submitted to UK and local ethics committees for approval prior to enrolling participants into an amended protocol.

Dissemination policy {8}

We will:

- Publish our trial, health economic and process evaluation findings in high impact journals.
- Encourage partners to publish locally relevant findings in their national journals to enhance reach.
- Arrange end-of project events to disseminate our findings within the local communities and engage with state/national level stakeholders to inform policy.
- Provide lay summaries for participants and reports for key professionals in the communities.

- Use innovative social media channels to communicate messages.
- Present at local, national and international respiratory and global health conferences.
- Optimise informal communication via professional societies.
- Contribute to education for healthcare professionals, therapists, community health workers to embed findings in local healthcare practice.

Discussion

PR is an established intervention in the management of specific CRDs in high income contexts. The PuRe trial aims to establish whether similar benefits can be achieved in low resource settings where access to diagnostics and optimal therapy may be limited. Whilst non-respiratory causes of breathlessness must be excluded, requiring a definitive respiratory diagnosis or optimisation of therapy prior to commencing PR can be a barrier if either are unavailable, unaffordable or inaccessible. Our broad eligibility criteria reflect the aim of testing PR in people with (potentially undifferentiated) CRD who have been offered the (locally available) pharmacological management.

The need for this trial emerged from work undertaken with the RESPIRE Global Health Unit,[26] initially in the Centre in Khulna, Bangladesh,[27,28,33] and later in rural health services in Pune and Vellore, India,[29,30] and an urban setting in Kuala Lumpur, Malaysia.[31,32,34] The intervention being tested in PuRe was adapted by local investigators from global guidelines,[10] based on their practical experience of setting up a PR service, and initiatives in similar low resource settings.[61-63] As a Hybrid-1 implementation trial, our approach is pragmatic expecting fidelity to the defined core components whilst allowing (indeed encouraging) the Centres to adapt delivery to their diverse local contexts.

Evidence of clinical and cost impacts will inform local/national decisions about investing limited resources to enable sustainable implementation. RESPIRE is supporting three additional feasibility studies (in Bhutan, Pakistan, refugee camps in Cox's Bazar[64]) which have adapted the PuRe PR protocol and are exploring acceptability, implementation processes and sustainability in their settings. We will use all these insights to draw conclusions applicable to a broad range of low resource settings.

Trial status

Recruitment began on 29th May 2025 and is scheduled to complete in August 2026.

Abbreviations

ACCORD	Academic and Clinical Central Office for Research & Development
COPD	Chronic Obstructive Pulmonary Disease
CRD	Chronic Respiratory Disease
eCRF	electronic Case Report Form
ECTU	Edinburgh Clinical Trials Unit
ESWT	Endurance Shuttle Walking Test
IPAQ	International Physical Activity Questionnaire
ISRCTN	International Standard Randomised Controlled Trial Number
HADS	Hospital Anxiety and Depression Score
HRQoL	Health-Related Quality-of-Life
ITSC	Independent Trial Steering Committee
LCADL	London Chest Activities of Daily Living
LMICs	Low- and middle-income countries
MCID	Minimum clinically important difference
mMRC	modified Medical Research Council Dyspnoea Scale
post-TB	Post-tuberculosis
REDCap	Research Electronic Data Capture
RESPIRE	NIHR Global Health Research Unit on Respiratory Health
PR	Pulmonary rehabilitation (as in Centre-PR and Home-PR)
SD	Standard Deviation
SGRQ	St George's Respiratory Questionnaire

Declarations

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The University of Edinburgh, UK: Tracy Jackson, Ruth McQuillan, Imad Adamestam, Michael Main.

International Primary Care Respiratory Group: Sian Williams, Genevie Fernandez.

Authors' contributions {3a}

HP is the Principal Investigator; with co-Principal Investigators EMK and RR she conceived the study, led the

proposal and protocol development, oversees the conduct of the trial. Local Principal Investigators MH, BP, DA, JE with SCC contributed to study design, development of the proposal and are overseeing trial delivery in their respective centres. CW is the trial statistician with NA; AS is the health economist; PA is the process evaluation lead; DB provides a link with RESPIRE. JB and KK are the Community Engagement and Involvement colleagues. VH is the Trial Manager who leads the running of the trial with local Trial Managers NU, DD, PJ, MR. All authors read and approved the final manuscript.

Sources of funding and other support {7a}

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SCC is supported by a PhD studentship from the University of Edinburgh

Availability of data and materials {6}

Quantitative trial data.

Trial participants will be given the option to opt in/out of their data being shared during the consent process. A data sharing pack for secondary research will be prepared once all analysis outlined in the Statistical Analysis Plan has been completed and the final analysis report has been produced. This will be made available 12 months after first publication of study findings for sharing with approved researchers via Edinburgh DataShare https://www.ed.ac.uk/information-services/research-support/research-data-service/after/data-repository. The Edinburgh DataShare repository has an openly searchable index. Meta-data will be available for potential new users to identify whether the data could be suitable for their objectives. A link to the data sharing policy will be included in the published study findings.

Process evaluation/Qualitative data

Interview transcripts will be transcribed and analysed in the local language and will not be translated to English. The full interview transcripts will be archived in DataVault, a University of Edinburgh data repository https://library.ed.ac.uk/research-support/research-data-service/after/datavault. An associated Pure record (www.pure.ed.ac.uk) with searchable metadata and a DOI will be created so that the dataset is findable and can be made available to researchers who meet the criteria for access to confidential data.

Ethics approval and consent to participate *{30}*

UK ethics: Edinburgh Medical School Research Ethics Committee: Ref: 24-EMREC-039.
AND
Bangladesh Medical Research Council (BMRC)
Institutional Review Board (IRB), CMC Vellore
KEM Hospital Research Centre Ethics Committee, Pune
Medical Research Ethics Committee (MREC), Universiti Malaya Medical centre (UMMC)
Written, informed consent to participate will be obtained from all participants.

Competing interests {7b}

HP chairs the Education Council of the European Respiratory Society.

EMK reports personal fees from AstraZeneca, and is Board of Director of the International Primary Care Respiratory Group; the President of the Primary Care Respiratory Group Malaysia.

MH owns a community-based PR clinic in Khulna.

JB and KK are colleagues with lived experience of CRD.

NA, RR, MR, DD, DA, AS, PA, NU, VH, CW, JE, DB, BP, PJ, SCC declare no competing interests.

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