Position statement and considerations for remotely delivered pulmonary rehabilitation services

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Keywords | Pulmonary rehabilitation, telerehabilitation, remote delivery, chronic respiratory disease.

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Abstract

Statement and methods of development

The challenge of access to pulmonary rehabilitation (PR) and meeting associated service demand is certainly not new. However, the COVID-19 pandemic set an unprecedented challenge evoking rapid adaptation of services. An inherent spotlight has been placed on remotely delivered services. As we look beyond the height of this pandemic, it is important to reflect and consider what has been learnt, and emerging perspectives on the future of PR service delivery.

This document updates the '*ACPRC statement and considerations for the remote delivery of pulmonary rehabilitation services during the COVID-19 pandemic*' (1) and seeks to provide pragmatic practical guidance for remotely delivered models of PR for healthcare professionals that should be used alongside local guidance.

The recommendations provided are for guidance only, and may be updated in response to further national guidelines and new evidence.

An online survey of PR healthcare professionals (*ACPRC pulmonary rehabilitation provision during COVID-19 and beyond!*) was conducted in the development of this document to scope current practice in PR services across the U.K. Informed by queries received by the ACPRC, the survey was first conducted in 2020 and repeated in July 2021 with the aim of capturing a snapshot of practice, one-year post onset of the COVID-19 pandemic. The survey was publicised and disseminated via Twitter using the @theACPRC handle, with request that one team member completed on behalf of their service. A summary of the 21 responses can be found in Appendix 1 which served to inform the content of this document.

A literature review was undertaken to identify and integrate relevant published trials since the 2021 Cochrane review of telerehabilitation for people with chronic respiratory disease (2). Details of the search strategy can be found in Appendix 2 and summary of study characteristics and outcomes in Appendix 3.

Anonymous feedback from four PR services was collated and analysed to identify common themes in experiences of remotely delivered PR services. A summary of this process and collated feedback can be found in Appendix 4.

Key terms

- **Remotely delivered models** – the delivery of pulmonary rehabilitation services at a distance; the interaction between healthcare professional and participant using communication and information technologies, that may take place in real-time (synchronously) or asynchronously (1). It may be delivered by a virtual platform, an online web application or programme, or referred to as telerehabilitation (note: this terminology is used where studies have reported it).
- **Field walking tests** are commonly employed to evaluate exercise capacity, prescribe exercise, and evaluate treatment response in chronic respiratory diseases (3). The most valid, reliable and responsive ones are the six-minute walk test (6MWT), incremental (ISWT) and endurance walk test (ESWT).
- **NACAP** – the National Asthma and COPD Audit Programme is commissioned by the Healthcare Quality Improvement Partnership (HQIP), as part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP), and currently covers England and Wales. The programme is led by the Royal College of Physicians (RCP) and includes a pulmonary rehabilitation workstream.
- **PRSAS** – the Pulmonary Rehabilitation Services Accreditation Scheme was launched in April 2018, and is run by the Royal College of Physicians (RCP).

Introduction

The COVID-19 pandemic has had an overwhelming impact on people's lives, and healthcare delivery across the world. Prioritisation of NHS resource during the first U.K. national lockdown led to a temporary suspension of *non-essential* services. Conventional face-to-face pulmonary rehabilitation (PR) programmes were widely suspended to protect vulnerable groups, and many staff redeployed in order to support the care of those acutely unwell. Technology-enabled remote delivery of healthcare services has played a significant role in the resumption of non-urgent services in the NHS. In the emergence from the height of this pandemic, PR services have needed to employ an individualised approach to the resumption of services in keeping with local contextual factors. The challenges faced created an environment rich in innovation and allowed further development of remotely delivered models of PR. With consideration of evidence-informed guidelines and quality standards (4, 5), it is important to evaluate and reflect upon, what has been learned during these unprecedented circumstances that can contribute to delivery of quality PR that meets the needs of our population. Remotely delivered models of PR have the potential to contribute to meeting growing rehabilitation need, however inequalities arising from the so called *digital divide* must be considered as the longer-term role of telerehabilitation evolves (6). The NHS England National 5-Year PR Plan (7) recognises that in-person supervised PR is the gold standard and should be offered to patients, as well as the need for action to reduce health inequalities, and optimise the provision of personalised care.

The efficacy of PR in improving health related quality of life, and exercise capacity in chronic respiratory disease populations remains undisputed and the demand for PR services remains high (8–11). Remotely delivered service models such as delivery through video conferencing (for example, Hansen et al. (12)), telephone and/or website supported programmes (for example, Chaplin et al. (13), Nolan et al. (14)), use of a mobile application (for example, Bourne et al. (15)), *hub and spoke* model, with use of remote healthcare facilities (for example, Stickland et al. (16)) aim to increase access and/or improve uptake of PR.

A recent Cochrane review (2) identified 15 trials (1904 participants) evaluating the efficacy of remotely delivered PR for people with chronic respiratory disease. Interventions were required to include exercise training with at least 50% of the intervention delivered remotely. Compared to no rehabilitation remotely delivered PR may improve exercise capacity (measured by 6MWT distance (mean difference (*MD*) 22.17 metres (m), 95% confidence interval (CI) -38.89 m to 83.23 m; 94 participants; two studies; low-certainty evidence) and also when delivered as maintenance rehabilitation (*MD* 78.1 m, 95% *CI* 49.6 m to 106.6 m; 209 participants; two studies; low-certainty evidence). No adverse events beyond any reported for in-person PR or no PR were reported. The authors concluded that there is likely little or no difference in exercise capacity (measured by 6MWT distance) between remotely delivered and in-person rehabilitation (*MD* 0.06 m, 95% *CI* -10.82 m to 10.94 m; 556 participants; four studies; moderate-certainty evidence). Similarly, little or no difference in quality of

life (QoL) (measured with the St George's Respiratory Questionnaire total score) (MD -1.26, 95% *CI* -3.97 to 1.45; 274 participants; two studies; low-certainty evidence). Participants undertaking telerehabilitation were more likely to complete their programme with a 93% completion rate (95% *CI* 90% to 96%) compared to 70% for in-person PR. The certainty of this evidence is limited by the small number of studies with relatively few participants, variance in delivery models, underperformance of the control group (in-person PR groups not achieving the minimally clinically important difference in core outcomes), and a large number of people who declined to take part in these trials leading to lack of equipoise.

A literature review was conducted in July 2022 (a summary of the search strategy can be found in Appendix 2) to identify published trials of remotely delivered PR for people living with chronic respiratory disease following the searches of this Cochrane review (2). Four relevant trials were identified: three comparing remotely delivered to standard in-person PR and/or no rehabilitation control (17–19), and one trial evaluating a remotely delivered maintenance programme (20). A summary of study characteristics and outcomes can be found in Appendix 3.

In summary, face-to-face supervised PR for people living with chronic respiratory disease remains the gold standard. Where it is not possible to deliver a face-to-face programme, a remotely delivered programme could be considered a safe and feasible alternative that may deliver clinically meaningful outcomes. Further research is required to confirm the efficacy and role of remotely delivered PR. The reported trials have depended upon reliable internet access (as well as the provision of equipment); it is essential to identify and address service-related inequity. Building comprehensive service models to progressively achieve equitable access to quality PR is a key priority in improving the quality of life of people living with chronic respiratory disease (6).

Governance

Risk assessment and mitigation

Prior to starting a new remote service or the delivery of any components of the service remotely, a standard operating procedure (SOP) needs to be written. Data protection and health inequalities impact assessments are recommended with the respective purposes of identifying and minimising data protection risks, and supporting identification of approaches to reduce discrimination and improve access. The SOP needs to include a comprehensive risk assessment in-line with local policy and procedures which should be reviewed regularly, for example, every 12 months for any pre-existing remotely delivered components and every six months for new services. Many PR services are offering different modes of remotely delivered care. Identification and mitigation of potential hazards associated with each type and model of remote service delivery offered must be considered in the context of the local service, as recommended by the British Thoracic Society (21). Pragmatic clinical guidance on the remote delivery of PR services is detailed in Appendix 5.

The BTS developed a checklist of safety precautions for remotely supervised interventions (21). Important considerations in mitigating risk associated with the delivery of remotely supervised PR include:

- Individual participant risk assessment; Table 1 details recommended inclusion and exclusion criteria.
- Obtain informed consent (verbal or written) to remotely supervised PR ensuring the participant has a clear understanding of the intervention and associated risks and benefits. An example consent form for remotely supervised PR can be found in Appendix 6.
- Ensure the participant has a clear understanding and awareness of potential adverse events. The procedure for a medical emergency during remotely supervised contact should be included within your SOPs. This should include appropriate review during and after the session to ensure the participant's well-being in the case of observed adverse events or sudden unexpected video disconnection.
- Ensure to provide the participant with clear information and instructions regarding the use of the video-conferencing/other digital platform.
- Where possible, providing the participant with an opportunity to do a *test run* prior to commencing their programme is advisable. Ensure to familiarise the participant with the *speaker view* function of the video-conferencing tool to facilitate optimal visualisation of the instructing clinician. Familiarisation with *live captioning* functionality may also be useful for some.
- In accordance with local privacy and data protection policy, ensure to advise participants against recording their group session as doing so in the absence of explicit consent from all members of the group would be considered a breach of confidentiality (22).
- Consider the use of a participant self-assessment checklist to prompt review of symptoms, preparation of equipment and environment, and access to support, prior to starting a session. An example checklist of this can be found in Appendix 6.
- Where remote monitoring is being used, participants should be provided with equipment that has been appropriately maintained and checked, as well as quarantined/cleaned inline with local infection control policy. Participants should be provided with the relevant guidance and instructions and technique checked prior to commencing their programme to ensure safe and effective use.
- Risk assessment of available workspace and equipment to be used for the delivery of remotely supervised interventions is essential.
- Consideration must be given to the screen size of the device to be used by the clinician (for example, laptop, desktop) in assessing staff to participant ratio requirement for group interventions. Dependent on individual participant risk assessment, a ratio of 1:4 may be appropriate when using a laptop, whereas 2:8 may be optimal in using a large TV screen, enabling one member of staff to focus on monitoring.
- The use of headsets may be beneficial in optimising audio quality.

- Consideration must be given to the background environment seen and heard by participants to ensure privacy and professionalism, avoid unwanted distractions, and optimise instructive interaction with participants. Avoid windows/mirrors being in view and take appropriate action to minimise any significant background noise. The volume of any music used in exercise sessions must be assessed to ensure the instructing clinician can be heard clearly by all, with consideration for any participants with any hearing impairment.
- Training needs of staff expected to use video-conferencing (and/or other digital platforms) must be assessed and appropriate support provided. Workforce training resources can be found within Appendix 7.
- Consideration of individual risk assessment is essential in grouping participants for exercise interventions based on monitoring requirements.
- In instances where the ability to meet service demand is significantly impacted due to imposed restrictions resulting in breach of maximum waiting times (5), this must be logged on the local trust's risk register inline with local policy and procedure.

Recommended inclusion and exclusion criteria for remotely supervised exercise testing and exercise component of PR (1):

Table 1: Recommended inclusion and exclusion criteria for remotely supervised exercise testing and exercise component of PR.

Inclusion
• Access to device capable of supporting the video-conferencing platform and reliable internet connection.
• Adequate digital literacy and competence to use video-conferencing and email, or reliable support of digitally competent family member/carer.
• Able to safely follow instructions in English or be supported by family/carer or remote interpreting service.
• Safe environment within home to perform exercise test/exercise programme.
• Able to mobilise and use any home exercise equipment safely and independently.
• Consents to participate in remote exercise testing/virtual PR programme.
• Able to provide informed consent and report adverse events.

Exclusion

- Significant unstable cardiac or other disease, that would make exercise unsafe or prevent programme participation.
- Cognitive impairment with inability to follow instructions safely.
- Significant sight or hearing impairment (individual risk assessment where indicated).
- Impaired balance with risk of falls without supervision.
- Identified as high risk of exertional desaturation <90% (for example, resting SpO_2 ≤92% or home oxygen user, pulmonary fibrosis, post-acute exacerbation) and unable to remotely monitor pulse oximetry.

Please note that this is intended as a guide only; individual risk assessment as per usual protocols is required.

Information governance

The legal framework for offering remote treatment services is governed by the *NHS Act 2006*, the *Health and Social Care Act 2012*, the *Data Protection Act 2018* and the *Human Rights Act 1998*. The aim is to allow the sharing of personal data between individuals involved in providing care whilst maintaining participant confidentiality when personal data is used for secondary purposes. Further information and support materials that can be useful when setting up a remote service can be found on the NHS England website.

Your local organisation will have their own specific information governance (IG) policy that will detail the requirements for the protection of participant sensitive data within your organisation. It is essential that you refer to these documents when implementing any remote programme. Important practical IG considerations in the delivery of remote services are appended (Appendix 8).

Workforce

The NHS response to COVID-19 has demonstrated how rapidly and effectively staff can adapt to meet the needs of patients. A continued focus on upskilling is needed to strengthen the workforce, expand capabilities, create more flexibility, support career progression, and importantly boost morale (23). Services offering any remotely delivered components of PR, must ensure staff are suitably digitally literate and competent with digital platforms used by the trust. Appropriate training and support need to be provided. Supporting staff to develop motivational interviewing skills can ensure teams are supporting the Making Every Contact Count (MECC) agenda (24), and increased uptake of PR.

Workforce training and support resources can be found in Appendix 7. Local trust well-being services should be made accessible and signposted to all staff.

Health and digital inequalities

The pandemic has seen a rapid shift to remote consultation in primary and secondary care, with the aim of reducing unnecessary face-to-face attendances; serving to accelerate work associated with the wide-spread implementation of technology-enabled care (25). As the healthcare landscape evolves from rapid innovation to continuation of service restoration and *business as usual* models, the NHS has been tasked to 'use what we have learnt through the pandemic to rapidly and consistency adopt new models of care that exploit the full potential of digital technologies' (26, p.5). Clinicians have a duty of care to their participants to ensure these new technologies are not worsening the digital divide, and worsening outcomes for those in lower socioeconomic groups or those in underserved populations.

This section introduces health and digital inequalities and highlights considerations relevant to remotely delivered PR. Some examples of practical strategies aiming to reduce and prevent inequalities are provided.

Health inequalities in pulmonary rehabilitation

The *NHS Long-Term Plan* (11) called for stronger action to reduce systematic, avoidable, and unjust differences in health and wellbeing, between different groups of people (27).

Evidence continues to highlight inequalities in the prevalence and impact of chronic respiratory disease, and data demonstrate that people living with COPD in more socioeconomically deprived areas are less likely to complete PR than those in the least deprived areas (6, 28). To reduce health inequalities, factors influencing fair access and personal agency to engage in PR need to be identified and targeted. There is a lack of research on addressing health inequalities in PR in the U.K.

Remotely delivered services have the potential to play a role in improving access and uptake of PR for some people; for example those who may not be able to attend during working hours, have caring commitments, be unable to travel to rehabilitation site or consider group exercise to be culturally inappropriate. However, acceptability may be limited (29) and the reliance of some models on having a digital device and/or stable internet connection and an adequately-sized private space may limit the ability to engage.

Principles of understanding the needs of our local population, comprehensive good quality data collection, and individual and organisational reflexivity, have been proposed to effectively work toward health equity in PR (6). To help services address this, the Health Equity Assessment Tool (HEAT) (27) supports professionals to systematically identify and address health inequalities, and equity related to a service or programme of work (see Appendix 7 for further resources).

Health literacy

Health literacy is defined as 'personal characteristics and social resources needed for individuals and communities to access, understand, appraise and use information and services

to make decisions about health' (30, p.12). Research shows that people with low health literacy are more likely to have a long-term condition; older people in England with low health literacy have higher mortality and lower literacy and lower educational levels are linked with unhealthy lifestyles (31). In the U.K. 7.1 million adults read and write at or below the level of a nine-year-old (32). In England between 43% and 61% of English working age adults routinely do not understand health information (32). This number increases to 65% if numbers are included within the text.

Strategies to improve health literacy are important empowerment tools, with potential to reduce health inequalities.

Examples of strategies to improve health literacy:

- Work with health individuals and communities.
- Ensure information and services offered are designed to be accessed by everyone.
- Understand the Accessible Information Standard (33), and how to implement into practice.
- Use the Health Education England Health Literacy e-learning resource.
- Use and provide plain English approved material.

NHS organisations must fulfil their legal duty and meet the Accessible Information Standard (33) by providing participant information in accessible formats such as Easy Read and British Sign Language.

Many people with low literacy skills can conceal their deficit and are often quite articulate when speaking. There are certain *red flags* that may indicate low health literacy skills (34); for example, when asked to complete or read forms, patients may make excuses and may demonstrate one or more of the following behaviours:

- Lifting text closer to their eyes.
- Missing appointments and/or making errors with medication.
- May tick items as 'no' to avoid follow up questions.
- Show signs of nervousness, confusion, frustration.
- Give incorrect answers when questioned about what they have read.

Level of education is not always a good indicator of health literacy (35); more targeted questions can be used with patients, such as:

- Do you ever get help from others with filling out forms, reading prescription labels?
- How much time do you spend reading each day? What do you like to read?
- Do you have problems with reading and remembering information?
- How do you prefer to learn something new? Do you prefer learning by watching TV, listening to the radio, talking with people?

People with low health literacy often have problems understanding information given verbally; research has demonstrated that patients only retain and understand about half of what the clinician tells them, and often won't ask for the information to be repeated or clarified (36). Recommended strategies to improve understanding and retention of information include (36, 37):

- Speak slowly and limit the amount of advice given.
- *Use of plain language* – writing designed to be easy-to-read and understand.
- *Keep it short* – instructions should be specific, concrete and vivid.
- *Structure the message* – organise information logically focusing on 3–5 most important *need to know* points.
- *Effective teaching methods* – using simple language, talk about what's important first, and breaking down complex information into understandable chunks, and reinforce key messages.
- *Use of visual aids* – videos, images or infographics that are culturally sensitive, linguistically appropriate, clearly labelled and support the message being told, use of participant decision aids.
- *Recommend and use technology* – participant portals, telemedicine, mobile apps.

Any information provided can be checked for the reading age using the website www.thefirstword.co.uk readability test, or in Microsoft Word by choosing:

- Home > Editor > Document stats (a dialogue box will appear letting you know that Word is calculating your document stats) > choose OK (Word will open a window that shows you information about the statistics and reading level of your document).

Digital literacy

Digital literacy has been defined by Health Education England (HEE) as 'the capabilities that fit someone for living, learning, working, participating and thriving in a digital society' (38). The numbers of adults in the U.K. who have never used the internet (or have not used in the preceding 3 months) has nearly halved since 2011; however 5.3 million adults (10% of the adult population) were still described as *internet non-users* in 2018 (39). Five years-worth of progress in digital engagement is reported to have been made in one year during the height of the pandemic by the 2021 U.K. Consumer Digital Index (40). Whilst increased engagement across the breadth of the population was seen with 1.5 million people starting to use the internet, 2.6 million remain offline (40). Notable regional differences are reported (for example, Wales highest proportion of those offline at 13%), and over a third of benefit claimants have very low digital engagement (40).

In an increasingly digital world, this has the potential to impact people's ability to maintain social interactions, access to healthcare and use of new systems or equipment which are being increasingly accepted such as remote long-term condition monitoring. Furthermore, older people, people with disabilities and those from lower socioeconomic backgrounds,

are less likely to be engaged or have the skills to use digital devices; it is these groups who are more likely to suffer from social isolation, and be more disproportionately affected by ill-health (41). Of note, it has been observed in a U.K.-based cohort of PR service-users, that improved digital literacy does not necessarily translate to acceptability of web-based interventions (29).

Digital literacy cannot be viewed in isolation due to interdependencies with many other aspects of health, including significant overlap with health literacy (41). Therefore when implementing any virtual or digital solutions, services must be focused on whether these solutions are widening the inequalities gaps. Online resources (38, 42–44) provide the following strategies to improve digital accessibility:

- Co-production of resources to include those at risk of socioeconomic/geographic/age-related disadvantages for both participants and health professionals.
- Clear, concise information at an appropriate reading age. National recommendations are to aim for a reading age of 7 years old.
- Training for health care professionals/third party organisations delivering/teaching use of digital platforms.
- Specific interventions designed to improve use/understanding and critical assessment digital health literacy, for example gamification, artificial intelligence.
- Consideration of alternative systems such as paper-based, face-to-face options, for those who remain low levels of digital literacy or loaning of equipment.
- Initiating working relationships with external organisations.
- Consideration of easy-read information.

The spectrum of digital literacy of healthcare professionals expected to use potentially unfamiliar digital tools, and technology in the delivery of PR must also be acknowledged. The HEE Digital Capabilities Framework (38) can be used to identify and support the development of digital capabilities of healthcare staff. It can be used:

- For self-assessment.
- To help identify learning and developmental needs.
- To inform personal and professional development plans.
- To guide formal, informal, directed and self-directed learning.
- For reflection and goal setting.
- For evaluation of progress and performance.
- To support innovative digital literacy training initiatives, interventions and resources.

Further health and digital literacy resources, can be found within Appendix 7.

Audit and evaluation

Audit

The National Asthma and COPD Audit Programme (NACAP) Pulmonary Rehabilitation (PR) workstream (45) includes a continuous clinical audit (of people living with COPD in the U.K. referred to PR), a snapshot organisational and resourcing audit, and an accreditation scheme (England and Wales). Participation in local and national audit programmes is a requirement for accreditation (46).

When inputting data into the NACAP PR clinical audit, there is a choice to select centre-based or home-based programmes. Included within the home-based programme option are options to select *other digital communication* for email, or app-based programmes and *phone calls* when using a PR manual, such as SPACE for COPD and MyCOPD apps. The number of sessions supervised and received need to be completed.

Evaluation

Local audit and service evaluation play an important role in assessing clinical efficacy and informing quality improvement (47). Some examples of audits and evaluations relevant to remotely delivered models of PR include:

- Participant satisfaction survey.
- Participant feedback survey.
- Audit of education sessions content and delivery in remote models.
- Waiting list evaluation.
- Uptake and completion of remotely delivery services.
- Objective outcome measure improvement in remote delivery models compared to face-to-face group model, for example walking distance, speed and strength assessment.

Guidance on getting started with quality improvement can be accessed on the British Thoracic Society website.

Accreditation

PR is nationally recognised as a key component of the *NHS Long-Term Plan* (11) that is based on the extensive evidence. The consequences of the pandemic made it necessary to develop innovative delivery of PR to address waiting lists and offer some form of PR to participants. Despite the innovation increasing capacity in remotely delivered models, these are not necessarily recommended in the quality standards.

In alignment with NACAP, the Pulmonary Rehabilitation Services Accreditation Scheme (PRSAS) run by the Royal College of Physicians is designed to support PR services to measure and improve the quality and outcomes of care provided (46). The PRSAS standards (47) (based on the BTS quality standards (5)) can be accessed on the PRSAS website.

The accreditation assessment requires services to be able to demonstrate both face-to-face pre/post assessments (including use of validated field walking tests for exercise prescription), as well as classes at the site visit to achieve accreditation.

For the most up-to-date information on accreditation assessment, please visit the PRSAS website.

Participant and staff experience

Person-centred care is pertinent to high-quality PR; confidential feedback from participants, supporters, and staff involved in the service is essential in facilitating this (47). A summary of feedback from 69 participants of remotely delivered PR from four services across England and Wales between November 2020 and April 2022 can be found in Appendix 4. Overall reported experience of completers was positive though notably most of those who had attended PR previously expressed a preference for face-to-face.

Inskip et al. (48) conducted focus groups with people living with chronic respiratory disease, and healthcare professionals (HCPs) involved in PR to identify critical elements of face-to-face PR, and how they can be supported remotely using technology. Four main themes of social aspects, communicating with healthcare professionals, measuring bioparameters, and evolving support were identified. In addition to group exercise sessions at home, group video chat with peers, interactive video games, and buddy system were suggested as ways to recreate the social aspect. Though HCPs reported concerned about the potential frequency of technology-enabled communication; specific check-in time windows were suggested to manage this. Of note, individuals who had either attended face-to-face PR, or did not attend due to distance limitations were purposefully selected to participate in this study; potentially limiting the breadth of ideas and generalisability.

Knox et al. (49) conducted focus groups with standard outpatient PR attendees (*hub* site), those participating remotely (in rural Wales *spoke* site) through video-conferencing link (*virtual PR*), and the staff involved in delivering the service. All spoke-site attendees reported that they would not have attended the hub site due to the distance. Staff identified *increased training needs* and the *importance of good administration* as essential to the success of virtual PR delivery. Workforce training resources can be found within Appendix 7.

Despite indicators of improved digital access and confidence in a single centre survey of PR service users (2021 cohort compared to 2020 cohort), no difference in acceptability for PR was reported (29). Technical difficulties are highlighted as being the most cited reason for poor uptake, and acceptance of telehealth interventions. With consideration of previous literature (home-based rehabilitation trials and qualitative studies), the authors deliberate the likelihood that many patients may just prefer face-to-face PR (29). See the health and digital inequalities section for further relevant considerations.

Acknowledgements

The contribution of authors and contributors of the ACPRC '*Statement and considerations for the remote delivery of pulmonary rehabilitation services during the COVID-19 pandemic*' is gratefully acknowledged: Anna Alderslade, Frances Butler, Laura Graham, Theresa Harvey-Dunstan, Karen Ingram, Agnieszka Lewko, Claire Nolan, Helen Owen, Sam Pilsworth, Helen Stewart, Ema Swingwood, Kelly Wainwright, Christine Wright.

The contributions of Powys Teaching Health Board, Worcestershire COPD Team, Barts Health Adult Respiratory Care and Harefield Pulmonary Rehabilitation teams, are gratefully acknowledged.

Funding declaration

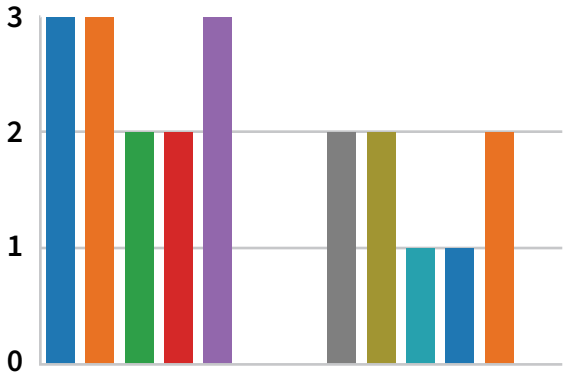
Lucy Gardiner is undertaking a Welcome Trust funded doctoral fellowship.

Appendices

Appendix 1 – 'ACPRC pulmonary rehabilitation provision during COVID-19 and beyond! round 2' – summary of survey responses

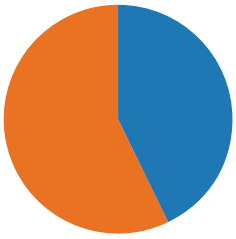
1 Which region do you work in?

East England	3
East Midlands	3
London	2
North East	2
North West	3
Scotland	0
South Central	0
South East	2
South West	2
Wales	1
West Midlands	1
Yorkshire and Humber	2
Northern Ireland	0



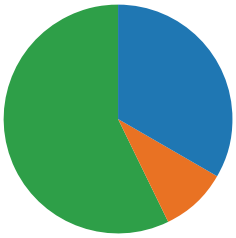
2 Have you or any members of your pulmonary rehabilitation team been redeployed at any point since the outbreak of COVID-19?

Yes	9
No	12



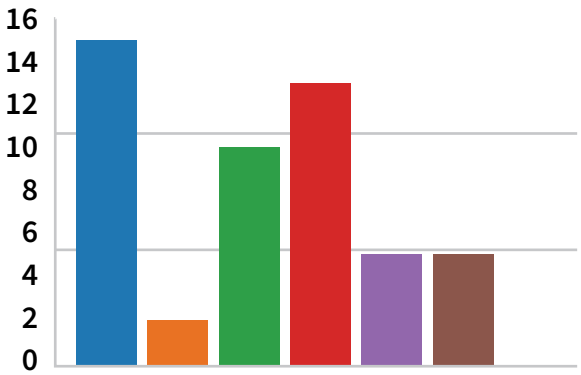
3 If you answered Yes to Q2, has your staffing provision now returned to pre-COVID-19/'usual' levels?

Yes	7
No	2
Not applicable	12



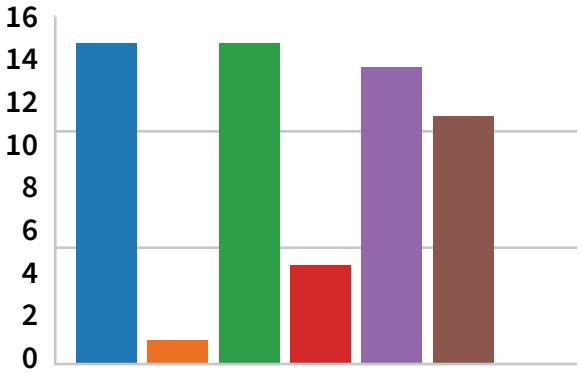
4 What form(s) of PR delivery is your service currently offering for exercise?

Face-to-face: non home-based	15
Face-to-face: home-based	2
Virtual (live sessions using video	10
Unsupervised programme with	13
Unsupervised programme	5
Other	5



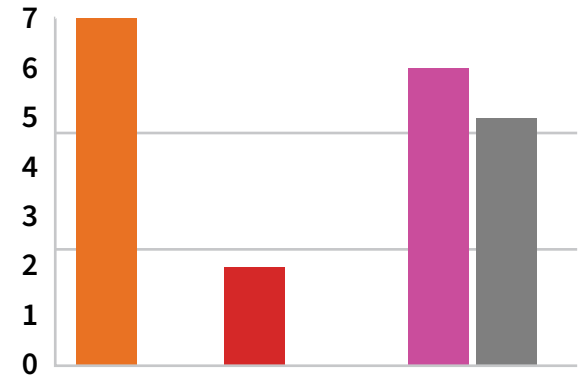
5 What form(s) of PR delivery is your service currently offering for education?

Face-to-face: non home-based	15
Face-to-face: home-based	2
Virtual (live sessions using video	10
Unsupervised programme with	13
Unsupervised programme	5
Other	5



6 If you're providing a 'virtual' rehab service, which video-conferencing platform are you using?

Zoom	0
Teams	7
Skype	0
AttendAnywhere	2
Webex	0
Google Hangouts	0
Not applicable	7
Other	7



7 *If you're providing a 'virtual' rehab service, what challenges have you experienced in delivering this? (for example, upskilling staff, limited resources, poor uptake, and so on). (Please move on to Q8 if you're not currently providing a 'virtual' service).*

13
responses

Latest responses

'Building staff confidence. Decision making around inclusion on programme…'

'Poor uptake from patients'

8 respondents (**62%**) answered **patients** for this question.

patient max lack
patient and staff
uptake from patients
Limited resources
patients
staff
many patients
Poor uptake
technology
not all patients
patients ability
issues
patients who have difficulty
Labour intensive
Access to resources – patients

8 *If you answered Yes to Q8, has your service been provided with any form of additional resources to support this? (for example, staffing, equipment). (If you answered No to Q8, please move on to Q10).*

13
responses

Latest responses

'Worked within existing resources but more staffing needed to supervise on…'

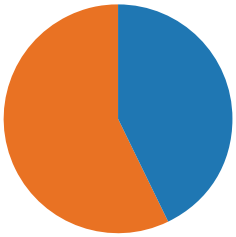
'No'

2 respondents (**15%**) answered **patients for access** for this question

moving forwards
number of devices
mobile phones
virtual than face
extra equipment
copd app
copd cohort
PR packs
limited number
education leaflets
patients for access
face to face
pulse oximeters
staff
access to classes
Extra iPads
use of volunteers
leaflets and exercises
form patients
staffing

9 *Is your service currently responsible for the provision of any form of post-COVID-19 rehabilitation? (not associated with 'business as usual' participants).*

Yes	9
No	12



10 *Are there any changes to your service) that have occurred as a result of COVID-19) that you think will either remain in place or continue to evolve long-term?*

19
responses

Latest responses

'Offering choice of virtual and face to face rehab. Increased staff: patient rat…'

'We will continue virtual PR classes alongside face to face classes'

'Phone initial assessment will remain. Option for virtual rehab for those who…'

12 respondents (**63%**) answered **virtual** for this question

virtual rehab

remote **virtual** Patient

initial assessment virtual PR face to face

Appendix 2 – literature search strategy

An electronic literature search was conducted through AMED, CINAHL, Cochrane Library, EMBASE, MEDLINE, and PsycINFO for studies of remotely delivered pulmonary rehabilitation (PR), published since December 2020 (following the Cochrane review '*Telerehabilitation for chronic respiratory disease*' (2). Key terms used included medical subject headings related to remote delivery, rehabilitation and chronic lung disease (full search strategy below). Searches were restricted to English language. Reference lists of identified studies were checked for additional references.

Search strategy:

- Remote* OR Distance* OR Telemedicine OR Telehealth OR Telecommunication* OR Telerehab* OR Videoconferenc* OR Virtual* OR App* OR Telephone OR Web*.

AND

- Pulmonary OR (Chronic Obstructive Pulmonary Disease) OR COPD OR (Obstructive Lung Disease) OR Asthma OR Bronchiectasis OR (Interstitial Lung Disease) OR (Pulmonary Fibrosis).

AND

- (Rehab* OR Exercise* OR Therap*).

In accordance with methods used by Cox et al. (2), randomised or controlled clinical trials of remotely delivered PR in people living with chronic respiratory disease were included. The rehabilitation intervention needed to include exercise, that could be group-based or individual, and at least 50% needed to be delivered remotely. Trials that compared remotely delivered models of PR to conventional, or no PR were included. Trials of maintenance rehabilitation (for example, aiming to maintain health benefits following a primary programme of PR) were included. Outcomes of interest included: exercise capacity, health-related quality of life, and adherence.

The lead author conducted the literature search in July 2022, and screened at abstract/title and full-text level as indicated. Following removal of duplicates and appropriate exclusions, four studies were identified for review (17–20).

Appendix 3 – study characteristics and outcomes

	Methods	Participants	Interventions	Outcomes	Notes
Cerdan-de-las-Heras et al. (17)	Single-centre, non-inferiority randomised study comparing 'telerehabilitation' versus standard programme.	54 people living with COPD in Denmark.	Standard rehabilitation: twice weekly 1-hour group training sessions and 6 hours of COPD education for 8 weeks. Telerehabilitation: delivered through a 'virtual autonomous physiotherapist agent' (VAPA) comprising software, that serves as a platform for the HCP to create individualised telerehabilitation programme, the exercise session with the VAPA was 10–20 minutes, 3–5 times per week, with individually prescribed training aids (for example, weights, fitness step).	No significant between-group difference in 6MWT; trend for greater improvement in the telerehabilitation group (47 m, $p = 0.14$). Telerehabilitation was non-inferior to standard rehabilitation for 6MWT (margin 35 m) post 8-week rehab and after 3 and 6 months of follow-up. No differences in 7-day pedometry and QoL between groups. Telerehabilitation adherence was reported to be 82% (% training time performed) and participant satisfaction 4.27 ± 0.77 (465 responses) using the 5-point Likert scale.	Reported to facilitate the 'highest workout intensity' however no further detail regarding exercise prescription is provided. No comparative data for the standard rehab participants for adherence and satisfaction.

Cerdan-de-las-Heras et al. (18)	Single-centre randomised pilot trial comparing a 'telerehabilitation' programme to usual care ('no rehabilitation').	15 people living with idiopathic pulmonary fibrosis in Denmark.	12-week telerehabilitation programme delivered through 'VAPA' (as detailed in Cerdan-de-las-Heras et al. (17)) plus usual care versus usual care only (no defining characteristics detailed).	Statistically significant differences between groups in 6MWD favouring the telerehabilitation group at 3 months (+39.5 m, $p = 0.03$) and 6 months (+34.3 m, $p = 0.02$) post telerehabilitation, but not at 9 months (+40.0 m, $p = 0.15$). No significant differences between groups in 7-day pedometry and QoL. Telerehabilitation adherence (% training time performed) was reported to be 64% in 15 participants at 0–3 months, and 110% in 3 participants at 6–9 months (not accounting for drop-out) and participant satisfaction 3.8 ± 0.5 (168 responses) on the Likert satisfaction score (1–5).	No defining characteristics of 'usual care' detailed. The telerehabilitation group had less severe disease at baseline (significantly lower forced vital capacity % predicted) (mean difference-14.1%, $p = 0.03$) which could have led to greater improvements in 6MWD post rehabilitation.

Cox et al. (19)	Multi-centre assessor-blinded randomised controlled trial of centre-based PR versus 'telerehabilitation'.	142 participants living with chronic respiratory disease in Australia.	8-week twice-weekly programme. Participants randomised to telerehabilitation received equipment for the duration of their programme including a step-through exercise bike, tablet with mobile data with a stand for video-conferencing, and a pulse oximeter. Initial assessment was conducted in the participant's home.	No significant differences were reported between groups for any outcome at any time point and both groups achieved clinically significant improvements in dyspnoea and exercise capacity post rehabilitation. Equivalence of telerehabilitation for the primary outcome of dyspnoea (measured by the CRQ) could not be confirmed (mean difference (95% *CI*) -1 point (-3 to 1)) and inferiority could not be excluded. At end-rehabilitation, equivalence of telerehabilitation was demonstrated for 6MWD and the emotional and fatigue domains of the CRQ. Subgroup analysis of participants with COPD demonstrated a statistically significant difference in dyspnoea favouring the centre-based PR group at 12-month follow-up.	The authors conclude that telerehabilitation may not be equivalent to centre-based PR in all outcomes but is safe, confers clinically meaningful improvements, and may provide an alternative model when centre-based is not available.
Galdiz et al. (20)	Multi-centre parallel-group randomised trial to determine the efficacy of a maintenance 'telerehabilitation' programme (post in-person PR) in sustaining improvements in exercise capacity and QoL in comparison to usual care.	94 participants living with COPD in Spain. Exclusion criteria of note: 'COPD patients with a bronchodilator response, history of severe coronary artery disease'.	8-week in-person PR programme consisting of three training sessions per week and four educational sessions. Participants randomised to telerehabilitation were provided with an equipment kit for the 12-month follow-up period. The control group were advised to exercise regularly ('at least walking for 1 hour daily') and provided with educational materials as per usual care.	No statistically significant differences between groups were reported in any outcome. Analysis of dyspnoea (measured by CRQ) demonstrated a significant interaction between baseline score and intervention group; participants with lower baseline scores faring better in the control group in comparison to those with higher scores ($p = 0.023$).	With recognition of limitations resultant from a pragmatic approach, the authors conclude that whilst the telerehabilitation maintenance programme was feasible and safe, no clinically meaningful improvements were demonstrated.

Appendix 4 – Participant feedback summary

Anonymous feedback from four services identified by the authors was collated and analysed to identify common themes. The risk of bias associated with this pragmatic method is duly acknowledged and should be considered. The summary intends to provide an insight into a selection of *real-life* data.

The summary includes feedback from 69 participants of remotely delivered PR programmes (all through video-conferencing platforms) from four PR services across England and Wales between November 2020 and April 2022. Methods of feedback reporting were varied; Table 1 provides further details.

Table 1: Details of PR service feedback.

Service	Service location	Time period	*N*	Non completers included	Feedback method
1	Urban England	November 2020	9	Yes	• Telephone interview with patient experience team.
2	Rural Wales	November 2020–July 2021	18	No	• Anonymous questionnaire.
3	Rural Wales	November 21–April 2022	27	No	• Facilitated group discussion and individual interview.
4	Rural/ urban England	December 2020–August 2021	15	No	• Anonymous questionnaires and thank you cards received.

Overall satisfaction with remote PR

High levels of satisfaction with the remote PR experience were reported by all participants from service three, as evidenced by *good* or *very good* (highest) ratings for *the overall experience*. All 14 participants asked from service two agreed that they would recommend remote PR to other people living with lung disease. All participant feedback described benefits in one or more of the domains of symptom management, self-efficacy, exercise tolerance, mood and motivation. Nine remote PR participants who had previously completed a face-to-face PR programme (in urban England) reported the face-to-face to be preferable (50).

Social elements

The social aspects of in-person PR have been reported to increase participant motivation, accountability and sense of belonging (48). Feedback received from the Welsh remote PR services frequently described improved motivation, and a feeling of support from peers and staff delivering the programmes. This is encouraging, but remote support may need more facilitation than it would in a face-to-face setting, where there is greater opportunity for private and spontaneous conversations.

> 'It made me do the exercises I had been thinking about doing for months… it gave me the motivation to carry on and change my lazy ways!! I feel a lot better after doing the course'.

> 'I know that I am not alone. Tutors were friendly and understanding'.

> 'I was able to discuss and listen to people with the same problems'.

> 'Seeing others in the same position and sharing difficulties is comforting'.

> 'It would have been nice to talk to the other patients – a little bit of interaction'.

> 'I don't socialise very well but managed to talk to the people on the course'.

Communication

Video and audio communication between PR sites were identified as challenges in a study, in *hub and spoke* PR model in rural Wales, but this improved as more sessions were delivered (49). However, staff suggested that appropriate training with video-conferencing equipment could have prevented the difficulties arising (49). Experiences reported by service one also conferred initial technical difficulties with videoconferencing platforms and communication but the extent to which this impacted completion and outcomes is not known. Only four of 21 participants from service three reported technical concerns, all of which were resolved with all participants reporting *good* or *very good* audio and visual communication in their final feedback, and high levels of satisfaction with the service.

> 'Considering quality of (my) equipment results were surprisingly good'.

Access and inclusion

Remote rehabilitation can make access to PR possible for participants who may otherwise have been excluded due to travelling distances, time constraints, disability or psychological status. Feedback from service one suggested that people with greater physical disability, may feel less safe exercising remotely (50), and highlighted the need to ensure that the model of rehab offered inspires confidence, is effective and keeps participants safe.

> 'I don't socialise very well but managed to talk to the people on the course'.

> 'I found virtual sessions better for me as I didn't like going to the sports centre, because of the risk of infection'.

'I liked being able to do the course online, as I was able to do it in the comfort of home surroundings'.

'I like my solitude and I don't think I'd have done it face-to-face. I would not have made it (attended F2F), because of the weather and my lung condition'.

'I found face-to-face pulmonary rehab was better than virtual and with others in the room, I could push myself more'.

'Taking part virtually I was able to join in… without feeling awkward'.

Staff survey

The impact of delivering remote PR on staff workload and the technological competencies required have been identified as concerns by PR staff (48). In the same research, staff acknowledged that remote PR had potential to improve access to previously underserved populations, and could have positive effects on their job satisfaction. The ACPRC conducted a PR staff survey in 2021 (Appendix 1) and received feedback on the experience of delivering remote PR from 13 services. Most survey respondents identified that remote PR is labour intensive, and required more resources in terms of time and staffing than face-to-face PR. Courses may take more time to organise and deliver. Training and support with the technology are required for both staff and participants. Other areas of concern highlighted were reported poor uptake of remote PR, with two services reporting 20% and 25% of patients on waiting lists accepting remote delivery. Challenges with participant access to exercise equipment and concerns regarding achieving good clinical outcomes were also mentioned.

For participants who chose remote PR, staff reported uptake was better when support was provided, for example, posting or emailing literature guides. Additionally, a clear theme emerged regarding remote PR remaining in place to support personalised care through a '*menu of options*'.

Conclusions

- The overall experience of remote PR appears to be positive for people who have completed courses. When asked, most participants agreed that they would recommend remote PR to others, although those who had experienced both models of PR expressed a preference for face-to-face.
- Social support and enabling progression to independent self-management is an important component of the rehabilitation process, and often needs more facilitation during remote PR than in a face-to-face setting.
- Personal communication needs, access to appropriate equipment for communication and monitoring bioparameters, training and adequate internet speed all need to be considered when considering whether remote PR will be a positive experience for participants and staff.
- More information describing the participant and staff experience of remote PR could inform better service development. Anonymisation and inclusion of standardised patient

and staff experience measures could improve the validity of information gathered and ensure services develop to meet the needs of both participants and providers.
- Finally, more research needs to take place to establish how the experience and clinical outcomes compare to traditional face-to-face PR, so service providers and participants can make better informed choices about their rehabilitation options.

Appendix 5 – Remote delivery of pulmonary rehabilitation services

Whilst the delivery of a remote pulmonary programme may be different compared to face-to-face delivery, the desired outcomes should remain the same. This section will consider what we need to do differently in these remote programmes in comparison to face-to-face.

It is the responsibility of services to keep up-to-date with current clinical governance and guidelines, especially with regards to any future COVID-19 surges or pandemics.

Although this document includes practical guidance in what should be considered when offering remote PR, services must ensure they put suitable processes in place for risk mitigations that are appropriate for their local area, participant populations and inline with local policies and procedures. Special considerations need to be made when delivering remotely to ensure safety, efficacy and accessibility. The information below is considered best practice but not exhaustive.

Assessment

Some services may decide to conduct a pre-initial assessment phone call to check for suitability and interest whilst participants are on the waiting list. The following topics might be useful to address at this point:

- Whether a participant is digitally confident and capable with access to appropriate equipment, or has a willingness to be supported to use any loaned equipment.
- Any prehab/ground rules.
- Please ensure you check the most up to date NHS infection control guidance (51), to assist with clinic/home visits if the participant is assessed as requiring additional support.
- Screening of the referral for potential exclusion criteria or concerns, that may affect ability to participate in a remote programme such as:

    a Communication: visual, hearing or literacy issues.
    b Safety: balance, clinical frailty or physical mobility problems which may result in a falls risk or a history of falls.

Initial assessment: subjective

The participant may be invited to complete their subjective initial assessment in a variety of ways that may include telephone, virtual consultation or face-to-face in a clinic, or on a home visit, as it might be deemed appropriate to separate this from the objective assessment.

- Obtain a good quality medical, holistic history from participant, their supporters and/or other healthcare professional as required. Use existing clinical records where possible to verify information including whether there are outstanding medical investigations or treatments (52).
- Consider whether any other onward referrals and/or screening tools may be required at this point, such as *Nijmegen questionnaire for breathing pattern disorder*.
- If unable to complete physical observations, screening to identify red flags/onward referrals must include:
    - Headaches.
    - Diplopia.
    - Dizziness.
    - Blackouts.
    - Palpitations.
    - Chest pain.
    - Falls screening.

Objective assessment

The first part of an objective assessment should be screening for safety before proceeding to field exercise testing. A face-to-face objective assessment is the gold standard where circumstances permit. If this is not possible (rurality, isolation, for example), then consider the following:

- Consider the use of *Make Every Contact Count* (MECC) (24). For example, streamlining appointments. Can other staff members be utilised if they are visiting the participant to obtain baseline observations as part of their visit, rather than have multiple visits?
- Consider using the participant's own equipment to obtain readings, or the use of loaned equipment for this purpose.
- Consider looking at previous trends in physical health measurements on shared record systems.
- Complete a blood pressure and manual pulse check to assess cardiac status/rhythm, in the month prior to starting the programme if possible.
- If a participant has a home oxygen prescription, check oxygen usage pre-physical assessment/course commencement, using concordance data.
- Can you support the participant to risk assess their physical environment, or have you completed a risk assessment? The assessment may include questions on the following (see the section *Governance: Risk assessment and mitigation* for further details):
    - Is there space and the area free of clutter?
    - Suitable flooring and check for trip hazards, for example, loose rugs.
    - Does the patient have suitable clothing and footwear, for example, no flip flops.

- Pets put away to minimise trips or interruptions.
- Do they have appropriate exercise equipment including suitable seating to use during classes?
- What access arrangement are there in case of emergency, including next of kin/emergency contact details, especially for those exercising alone.

The *BTS PR Quality Standards* (5) list 3 outcome domains (to include as a minimum): exercise capacity, dyspnoea and health status.

Field exercise testing (exercise capacity)

Field exercise tests such as the six-minute walk test (6MWT), incremental (ISWT) and endurance walk test (ESWT) have multiple purposes (3):

1. To ascertain the physiological response to exercise.
2. Use as an outcome measure to assess participant's progress.
3. To provide a baseline for exercise prescription.

Completion of a face-to-face physical exercise test in accordance with technical standards (3) is the gold standard. If physical exercise testing cannot be completed face-to-face, then consider the following:

- Ability to monitor the participant:
  - Observing or listening for audible breathlessness (for example, use speakerphone on telephone consultations).
  - Where required, ensure the participant has someone available nearby in case of emergency.
  - Ensure the team and participant are clear of the emergency procedures, if an incident was to occur during appointment, including loss of communication.
- If no physical observations are available, clinical judgement should be used to determine if the test should go ahead, and the participant instructed to stop the test if they experience any adverse symptoms, for example dizziness, chest pain, intolerable breathlessness, pain, for example (participants will usually self-limit their activity level as required).
- Ensure participants on home oxygen are fully optimised with therapy prior to starting the programme.
- For participants not on home oxygen, good practice would be to obtain an oxygen saturation at baseline where possible.
  - If this is not possible use clinical judgement to determine whether it is safe to proceed with testing, or whether the participant would require onward referral for further assessment/investigation (53), (refer to local guidelines/pathways).

Functional outcome measures

In instances where it may not be possible to conduct a technically correct field walking test, (see *Technical Standards* (3)), clinicians may choose to conduct a functional outcome

measure. The 4-metre gait speed has been reported to have the highest correlation, with routine measures of exercise capacity, but standardisation in a remote assessment and ability to prescribe exercise may be limited (54). Commonly used as a measure of functional capacity, sit-to-stand (STS) tests (for example, one-minute STS) may be easier to standardise in a remote assessment. Evidence supports the validity, reliability and responsiveness of STS tests, as an alternative measure of exercise capacity in people living with COPD (55, 56).

Consider:

- Reference to instructions (for example, the *Primary Care Respiratory Society One-Minute STS Test Protocol*).
- Ensure the participant has been appropriately monitored, for recovery after test completion, returning to baseline parameters.
- Encourage active recovery in participants with increased cardiac risk (57).
- Ensure standardisation (for re-assessment purposes).

Measurement of dyspnoea and health status

Services will need to consider how participants can be supported to complete valid and reliable outcome measures, if completed remotely.

Consider:

- Selecting self-reported questionnaires wherever possible, for example CAT, PHQ-9/GAD-7, Clinical Frailty Scale and MRC Dyspnoea.
- Methods to support participants with learning and communication needs to ensure they can complete the questionnaire and the answers that are reflective of their personal perception of their condition (without undue influence on anyone helping to complete them).
- The delivery mode and method of return, for example, by post, by email, web-based or over the phone.

Exercise

Delivery of remote exercise and remote exercise prescription present specific communication, supervision and safety challenges for participants and staff. The following should be considered:

1 Emergency protocols

- Services must have an emergency protocol, to follow if a participant becomes unwell. This includes actions to take during in the event of chest pain, severe shortness of breath, sudden severe pain or any other medical emergency.
- Clear red flag symptoms should be identified as part of a participant information leaflet, to support self-escalation of concerns before, during or post exercise session as well as on completion of home programme.
- Services should consider how to mitigate increased risk of adverse cardiac event for

a certain period after the exercise class has ended if there are no further supervised activities planned, for example, a subsequent education session.
    - Therefore, services should be mindful to adapt programmes to include graduated cool-downs of at least 15 minutes, and working within an appropriate heart rate training zone, (no more than 80% maximum heart rate, or lower for very deconditioned individuals), plus use of the BORG scale to monitor perceived exertion (57).
- Services must have a plan for technology failures, and staff and participants must be aware of the protocols.
- A next of kin or emergency contact for the patient, should be documented in the patient's notes.
- Services must have up to date service details in an easily accessible format, to ensure participants are able to contact the service, if the service is unable to contact the participant.

2 *Staffing*

Ratios

- Staffing ratios should ensure that all participants can be seen on screen at the same time, if using video-group.
- Screen size may affect group size due to ability to safety supervise for example, using a laptop screen compared to a large TV screen.
- Participant peer supervision, may be limited in remote groups which may be less effective compared to face-to-face groups.
- There should be a minimum of 2 members of staff to run a group, and consideration must be made with regards to risk mitigation in larger groups. For example, the group can continue to run with 1 member of staff, and there should be capacity for 1:1 support for group members.
- Consideration of staff confidence to use the chosen platform, and ability to provide basic troubleshooting advice to participants.
- Consider reducing group sizes when inducting new staff.

Communication

- One staff member should be designated as lead for the duration of the session.
- Each staff member should be given a specific role/task(s) for the duration of the group, to ensure clear lines of responsibility and communication for example:

1 Demonstration of exercise.
2 Exercise progression, modification and technique/performance supervision.
3 1:1 participant support/communication, to include escalation/emergency responses.

- Agree private means of communication between staff members during sessions.
- Agree private means of communication with individual participants during sessions, if needed (please refer to the section *Governance: information governance for further information*).

- Patients should be provided with a contact number, for the staff in case of any issues that may arise during the session.

3 *Equipment*

- Participants and staff should be comfortable using their IT equipment, and the remote platform. The device should be positioned appropriately (see the section *Governance: placement of video equipment*).
- Participants must have the appropriate equipment to perform and progress their exercise programme. For example, chairs/free weights/resistance band, for example.
- As per individual assessment, if prescribed essential medical equipment such as reliever inhalers, GTN and oxygen, participants must ensure these are easily accessible.
- An alternative means of communication should be easily accessible, such as mobile phone/land line in case of emergency, or support for technical issues.
- Participants should ensure they have water nearby, for adequate hydration.
- Blood sugar monitoring kits – participants with diabetes who routinely monitor blood sugars should check their blood sugar levels, before starting exercise classes. If a diabetic participant who does not routinely check their blood sugars feels unwell, they should not exercise and contact their GP or Diabetic nurse for a review.
- Those who are diabetic should have their rescue diabetes kits available, in case of hypoglycaemic event.

4 *Environment*

General

- It is good practice to support participants to risk assess their environment and themselves at the beginning of each session (see Appendix 6 checklist, for example). In addition, participants are not to exercise after drinking alcohol and leave at least one hour after completing exercise before having any alcoholic drink.
- Physical environment assessment needs to be as per local risk assessment guidelines.

Temperature

- The American College of Sports Medicine (58) recommend a temperature of 68–72°F (20–22.2°C) in a gym environment (with consideration of appropriate humidity and air circulation levels).
- People exercising in their home environment may not monitor or consider this. Appropriate precautions and advice must be given, that includes considerations for clothing, hydration, exercise intensity and duration (including frequency of monitoring). This will help to maintain the expected physiological responses that would normally occur within the more ideal and recommended environmental parameters (57, 58).

5 *Programme content*

- All programmes require suitable exercises supported by an appropriate warm-up and cool down suitable for a remote platform.

- Consider how the service will offer individualised programmes to maintain motivation, and allow for participant progression. Some services may consider stratifying participants according to diagnosis/condition severity/exercise tolerance.
- If new participants are joining an existing a cohort programme or a rolling programme, consider an individual induction prior to attending the main group.

Education

The *BTS Quality Standards* (5) state PR programmes must include 'defined, structured education', that is typically included within the same session as the exercise component in a traditional face-to-face programme. The COVID-19 pandemic accelerated the focus of technology-enabled learning including in the context of PR. There is some evidence to suggest improved patient experience with technology-enabled learning for people with chronic respiratory disease, however the variability in approaches and methods of evaluation and barriers affecting access limit interpretation and generalisability (59).

Considerations for delivery of remote education

- Digital literacy and equipment access for both participants and staff including 'how to use guides' or providing technical support to participants who require help (please refer to the section *Health and digital inequalities*).
- Clinicians must have an appropriate workspace to deliver remote education for example, a shared office is not an appropriate space due to potential information governance breaches.
- Consideration must be given to staff providing remote services in terms of health and safety/DSE assessments.
- Inclusion of resources/ability for carers/families to ask questions and be supported.
- Consideration must be given to those who do not have remote access. They should not be disadvantaged because of lack of access.
- Consideration of sight or hearing difficulties that might be exacerbated by poor sound quality/small screens, dependant on device.
- Plan sufficient time for responding to participant questions when delivering remote education.
- Any new forms of educational material must be checked for readability, clarity, and appropriateness (see health inequalities section).
- Consideration of available material for participants who cannot speak English, or use sign language.

- Remote delivery gives opportunity for utilisation of extensive learning tools to encourage active participation, motivation, and peer support rather than didactic delivery methods.
    - Tools might include interactive quizzes, live voting, live whiteboards, polls, short video clips, gameshow quizzes/trivia, for example.

It is encouraged to consider different learning styles within a group to make learning more effective and efficient for the patient. There are many different learning theories and learning styles (60). Using *VARK* (61) as an example, a combination of different strategies can be used to enhance learning in PR classes:

- Visual: for example, pictures, videos, models, colour, shapes.
- Auditory: for example, video/podcasts, lectures, discussion.
- Reading/writing: for example, written information, looking at data, lists, rewriting ideas into own words.
- Kinaesthetic: for example, trial and error learning, task-based learning, case studies.

Studies do show that learners adapt their learning style dependent on the task, just as educators can adapt their teaching styles to become more holistic and facilitatory (62). By doing this and using a range of tools and other strategies, this allows for adaptability and a richer learning experience for patient and keeps education more interesting for staff:

- Reflection.
- Problem solving.
- Role play/simulations.
- Group discussions using different delivery methods.
- Coaching.
- Reinforcing key messages.

Resources to support the remote delivery of education can be found in Appendix 6.

Managing waitlists

It is acknowledged that variation in approaches in managing waiting lists during the height of the pandemic and beyond has been required due to factors such as:

- Staff redeployment (ACPRC survey Appendix 1) showed >70% services had some staff redeployment).
- Services shutting down completely and/or closed to new referrals for a period.
- Many services required to offer face-to-face PR upon resumption to those who completed a remotely delivered programme (and some services already have 12 month recalls as part of standard contracts).
- Some services held participants who declined, or were inappropriate for remotely delivered PR in a separate caseload, and some services discharged these participants.

- Some services had additional contract variations added such as post-COVID-19 related activity, with/without additional resource.
- Some services have multiple waiting lists according to suitability, preference or other factors now facing the challenge of how to prioritise or merge lists (if appropriate), as face-to-face services resume.

Possible solutions (identified by authors)

- Caseload cleansing activity (particularly if not using an electronic shared record system) – check for any participants who may be deceased or have moved out of area. Use admin/support staff where possible.
- Send out an opt in/activation letter: participant sent a letter, detailing service offerings and contacts service to provide preference. Discharged if no response. Requires admin support to receive and log calls and maintain waiting lists.
- Pre-calls: telephone call by support/admin staff member (ideally with some training in motivational interviewing/health coaching, and with an understanding of PR models, risks and benefits) to discuss PR and the offerings the service has available, encourage participant motivation for participation and ascertain model/offering preference.

For awareness: services need to consider how they might manage participant expectations about potential start dates. When a participant is initially contacted by a service, they often expect to receive an appointment shortly thereafter, or they may enquire about wait times and *hang on* to timescales provided. The timing of the calls should be considered, particularly where waiting lists are lengthy. For example, an opt in letter or pre-call on referral, will need greater consideration around how to deal with wait times as participants may have a longer wait, whereas the same activities carried out when the participant reaches the top of a waiting list, may mean that the participant can be immediately booked into an appointment slot on contact with the service; this may also help to reduce DNA's if the wait to appointment time is short, however it will likely not reduce waiting lists significantly, at the point of referral.

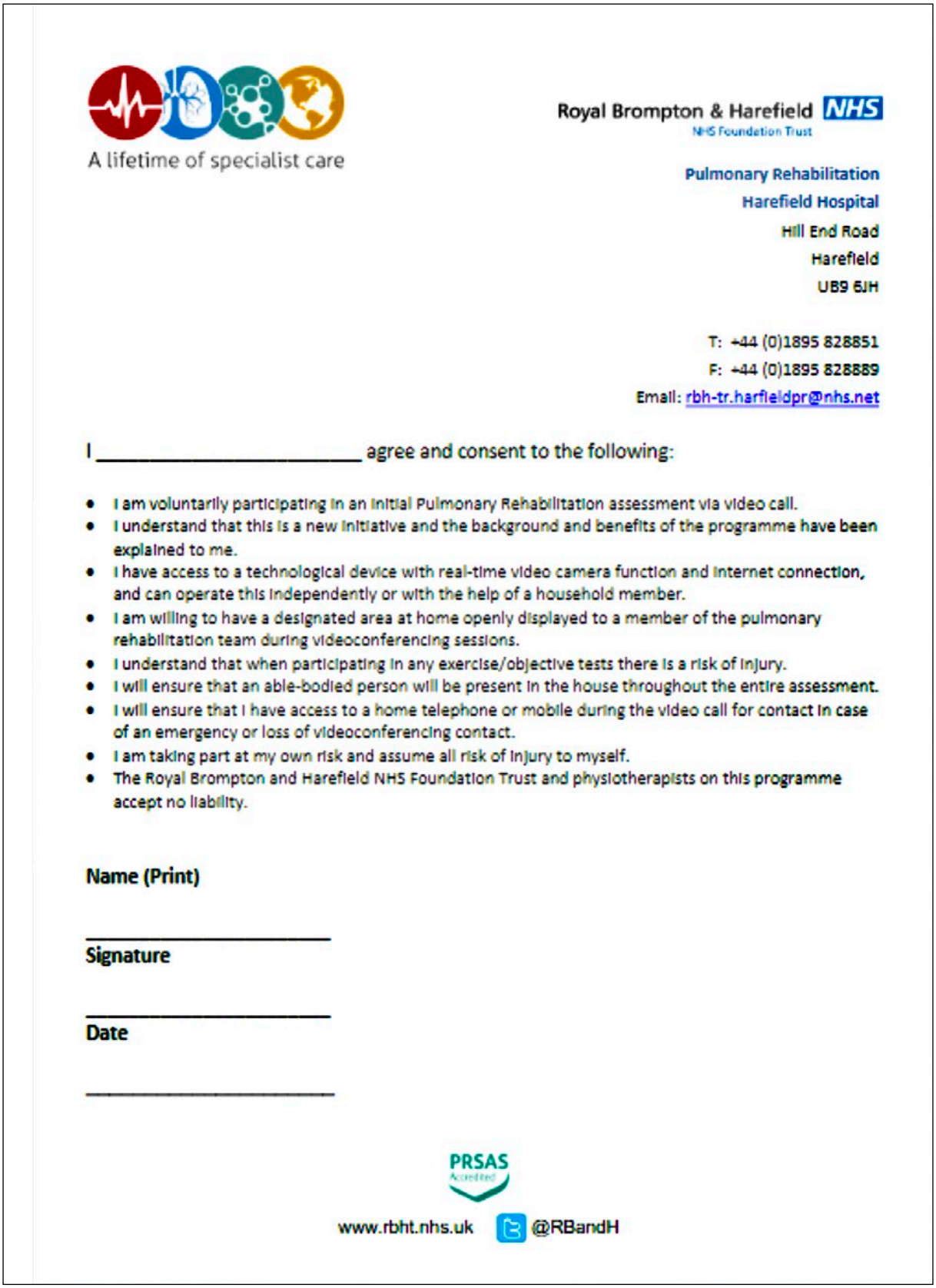
Considerations

- If sending an opt in letter, health literacy and identification of health inequalities need to be taken into account (see *Health and digital inequalities* section).
- Where referrals are longer than 3 months old, up-to-date medical information should be sought prior to assessment – this will vary per service as to how this is obtained. For example, request updated summary care record from primary care or review shared record if available, such as SystmOne or EMIS (if share agreement in place – consider adding consent to open share section to referral form, in areas where shared record systems are used).
- Consider case stratification to identify priorities for the waiting list, such as:
    - Post-admission for respiratory exacerbation (particularly in the last 4 weeks).
    - Post-respiratory exacerbation related A&E attendance, 999/111 call.

    - Referral following admission avoidance for respiratory exacerbation.
    - Recent respiratory exacerbation (managed at home).
    - Recurrent respiratory exacerbation.
    - Pre/post lung surgery.
    - ILD diagnosis.
    - Routine – 1st attendance.
    - Routine – repeater (>12 months since previous course).
- Consideration should be given to who is available to support and who has responsibility for waiting list caseload management. Does the service have sufficient administrative support?
- Where waiting lists are lengthy, and there is a requirement for updated medical information to be sought prior to the assessment appointment, clinicians need to be given appropriate time to review and potentially follow-up this new information for any changes to participant suitability in order to avoid wasted appointments.

Appendix 6 – example consent form and self-assessment checklist for remotely delivered pulmonary rehabilitation services

Example consent form



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Royal Brompton & Harefield NHS
NHS Foundation Trust

Pulmonary Rehabilitation
Harefield Hospital
Hill End Road
Harefield
UB9 6JH

T: +44 (0)1895 828851
F: +44 (0)1895 828889
Email: rbh-tr.harfieldpr@nhs.net

I _____ agree and consent to the following:

- I am voluntarily participating in an initial Pulmonary Rehabilitation assessment via video call.
- I understand that this is a new initiative and the background and benefits of the programme have been explained to me.
- I have access to a technological device with real-time video camera function and internet connection, and can operate this independently or with the help of a household member.
- I am willing to have a designated area at home openly displayed to a member of the pulmonary rehabilitation team during videoconferencing sessions.
- I understand that when participating in any exercise/objective tests there is a risk of injury.
- I will ensure that an able-bodied person will be present in the house throughout the entire assessment.
- I will ensure that I have access to a home telephone or mobile during the video call for contact in case of an emergency or loss of videoconferencing contact.
- I am taking part at my own risk and assume all risk of injury to myself.
- The Royal Brompton and Harefield NHS Foundation Trust and physiotherapists on this programme accept no liability.

Name (Print)

_____

Signature

_____

Date

_____

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Example self-assessment checklist

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Virtual Pulmonary Rehabilitation Self-Assessment Checklist

You must complete this checklist before each video pulmonary rehab class.

Equipment to have ready:

1. I have my reliever inhaler to hand	Yes _____	No _____	N/A _____
2. I have my GTN spray/tablets to hand	Yes _____	No _____	N/A _____
3. I have a glass of drinking water ready	Yes _____	No _____	
4. There is a sturdy chair against a wall	Yes _____	No _____	
5. My telephone/tablet/computer is charged and working	Yes _____	No _____	

Environment:

1. The room is a comfortable temperature	Yes _____	No _____
2. There is adequate lighting	Yes _____	No _____
3. Trip hazards e.g. rugs, pets, children have been moved	Yes _____	No _____

Other:

1. My able-bodied household member is within earshot	Yes_____	No_____
2. I have informed the team of any changes to my health	Yes_____	No_____
3. I have informed the team of any changes to my medications	Yes_____	No_____
4. I have had a recent light meal or snack	Yes_____	No_____
5. I am wearing appropriate clothing and flat shoes/trainers	Yes_____	No_____

Symptoms:

It is your responsibility to monitor your symptoms and only exercise if you feel well enough.

You must check your symptoms before **each** class. You must not join in the class if you have a temperature, feel ill or become suddenly unwell.

If you have increased breathlessness, worsening symptoms or new/worsening joint pain prior to exercising you should not join the class for that session but return when the symptoms have settled.

You must stop exercising immediately if you experience any of the following:

1. Chest Pain
2. Dizziness
3. Nausea
4. Extreme Breathlessness
5. Excessive Wheezing
6. Coughing up blood

If there is any other reason you feel you should not exercise today, you must let the team know. Please call us on 01895 828851 or email rbh-tr.harefieldpr@nhs.net if you wish to speak to someone before the class.

Now please enjoy your class!

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Appendix 7 – resources for remote delivery of pulmonary rehabilitation services

Video-conferencing platforms:

- Microsoft Teams.
- Attend Anywhere.
- Zoom.
- Webex.
- OneConsultation.
- AccuRx.

Workforce training and support

Training

- Health Education England: training and educating the workforce: https://www.hee.nhs.uk/our-work/population-health/training-educational-resources.
- https://www.e-lfh.org.uk/programmes/coronavirus/.
- https://learninghub.nhs.uk/.
- https://learninghub.leadershipacademy.nhs.uk/.
- https://transform.england.nhs.uk/covid-19-response/technology-nhs/web-based-platform-which-offers-video-calls-services/ (NHSE Transformation, 2022b).
- Digital Health Academy: foundation level modules freely available at orcha-academy.com, and on the Health Education England NHS Learning Hub (learninghub.nhs.uk) at learninghub.nhs.uk/Catalogue/ORCHA.
- https://www.hee.nhs.uk/our-work/digital-literacy.
- https://www.e-lfh.org.uk/programmes/digital-learning-solutions.
- https://www.vc.scot.nhs.uk.
- www.makingeverycontactcount.co.uk.
- https://www.personalisedcareinstitute.org.uk.

Well-being

- England: https://www.england.nhs.uk/supporting-our-nhs-people/support-now/staff-mental-health-and-wellbeing-hubs/.
- Northern Ireland: https://www.publichealth.hscni.net/covid-19-coronavirus/guidance-hsc-staff-healthcare-workers-and-care-providers/questions-and-answers.
- Scotland: https://wellbeinghub.scot, https://www.nhs24.scot/staff-information/staff-wellbeing/, https://www.nes.scot.nhs.uk/news/staff-wellbeing-resources/.
- Wales: https://heiw.nhs.wales/support/colleague-health-and-wellbeing/.
- NHS People Plan: https://www.england.nhs.uk/ournhspeople/.

Health and digital literacy

Health equity assessment

- Health Equity Assessment Tool (HEAT): https://www.gov.uk/government/publications/health-equity-assessment-tool-heat/health-equity-assessment-tool-heat-executive-summary.
- Training to use Health Equity Assessment Tool (HEAT): https://www.e-lfh.org.uk/programmes/health-equity-assessment-tool-heat/.
- Equality Impact Assessment toolkit for research: https://arc-em.nihr.ac.uk/clahrcs-store/equality-impact-assessment-eqia-toolkit, https://forequity.uk/.

Health literacy

- Public Health England: Improving health literacy to reduce health inequalities: https://www.gov.uk/government/publications/local-action-on-health-inequalities-improving-health-literacy.
- Health Education England: Improving health literacy: https://www.hee.nhs.uk/our-work/knowledge-library-services/improving-health-literacy.

Digital literacy

- Barclay's Digital Eagles.
- Vodafone's Buy One Give One commitment.
- Digital Poverty Alliance.
- National Literacy Trust.
- Department of Education – essential digital skills framework.
- Royal College of Nursing – improving digital literacy.
- The Good Things Foundation – learn my way, make it click.
- Department for Digital, Culture Media & Sport: Digital Skills and inclusions – given everyone access to the digital skills they need.

Delivery of education

- ACPRC: patient information leaflets https://www.acprc.org.uk/publications/patient-information-leaflets/.
- Asthma and Lung UK: www.blf.org.uk/support-for-you.
- Asthma and Lung UK: www.asthma.org.uk/advice/inhaler-videos.
- Stay Active and Stay Well (Asthma and Lung U.K.): www.blf.org.uk/support-for-you/keep-active/exercise-video.
- British Thoracic Society: PR resource pack: https://www.brit-thoracic.org.uk/covid-19/covid-19-information-for-the-respiratory-community/.
- European Lung Foundation (ELF): www.europeanlung.org/en/lung-disease-and-information/lung-diseases/.
- Lung Foundation Australia: https://pulmonaryrehab.com.au/importance-of-education/education-topics/.

- Supporting Someone with Breathlessness: https://supporting-breathlessness.org.uk/.
- Living well with COPD: https://www.livingwellwithcopd.com/.

Digital resources

- UCL Partners: Digital resources for Asthma and COPD.
- myCOPD app: NICE medical technologies guidance MTG68.
  - Related evidence: Bourne et al. (2017), Crooks et al. (2020), North et al. (2020), Platt & Jackson (2022).
- SPACE for COPD: Self-management Programme of Activity, Coping and Education for COPD – manual and online self-management programme.
  - Related evidence: Chaplin et al. (2017), Horton et al. (2018), Bourne et al. (2020), Houchen-Wolloff et al. (2021).

Other resources

- Example programme: https://www.uhdb.nhs.uk/pulmonary-rehabilitation-virtual-pulmonary-rehabilitation.
- Examples of PR standard operating procedures: https://www.respiratoryfutures.org.uk/resources/regional-and-local-resources/pulmonary-rehabilitation-standard-operating-procedures-sops/.
- Managing questionnaires online:
  - LimeSurvey: www.limesurvey.org/en/.
  - Microsoft Forms (requires purchase of Office 365): www.microsoft.com/en-gb/microsoft-365/online-surveys-polls-quizzes (can be used for surveys, polls, and quizzes).
  - REDCap: www.project-redcap.org (secure web application for building and managing online surveys and databases).
- Student placement guidance: https://www.csp.org.uk/professional-clinical/practice-based-learning.

Appendix 8 – practical information governance considerations

Data Protection Impact Assessment (DPIA)

Information and guidance on conducting DPIAs, can be found on the Information Commissioner's Office website: Data Protection Impact Assessments (DPIAs) | ICO.

General IG equipment

All devices require a minimum of password and or biometric protection. Other secure methods include a physical USB device, or external security card.

- Passwords should be unique and used only once. Use long passwords, a minimum or 12 characters are recommended, with a mixture of characters and punctuation marks. Phrases that incorporate characters and punctuation marks, are easier to remember.
- Use a secure password manager with two-factor authentication, to store passwords or store any written password in an offsite secure site.
- Do not save passwords in an unencrypted file, or on an unencrypted device.
- Ensure that any anti-viral and anti-malware is up-to-date, or preferably on automatic updates on all devices.
- Ideally all devices should be encrypted, this includes desktops, laptops, phones, tablets or any other mobile device.
- If any recording or transferring of personal data is to occur, then the device must be encrypted.
- Devices should be set to automatically time out if not accessed, however, this time needs to be extended when using for a remote session, to prevent lock-outs occurring during a remote session.
- It is advisable not to use your personal devices for remote sessions unless they meet the IG standards of your organisation. Check with your local IG policy documentation, if it is permissible to use your own personal device.
- Each user must have an individual account on each device. Accounts must not be shared between different individuals.

Placement of video equipment

Consider using a mains-powered laptop with either a built-in camera or an external USB camera (plugged into the laptop) that will provide greater freedom of camera placement. An external USB camera with a tripod offers the greatest flexibility.

- Consider the use of a hands-free headset and earphones, to reduce the likelihood of participants being overheard.
- Ensure that displays and video equipment are not visible to the public. The use of screens may be useful, if a closed room is not available.
- Ensure that video equipment is placed to prevent *photo bombing* opportunities.
- Place video equipment at a suitable distance to allow participants to see a full body view of the physiotherapist, if appropriate. Ensure that the field of view minimises the

recording of the external environment, to protect external individuals from being seen or participants being overseen.
- Ensure the area visible on screen presents a professional setting and role models a safe working and exercise environment.
- Advise participants to place their video equipment in order that carers, or relatives are unable to see other individuals on screen as much as is practical.
- It is difficult to guarantee that no other individual will be able to oversee or overhear a remote session, as participants often require additional support when accessing IT equipment at home, or do not have a separate area to access equipment.
- The fact that other participants or carers maybe able to see individuals must be discussed with all participants at the initial assessment, and practical advice on how to minimise this should be given.

Participant modesty

Advise participants on appropriate clothing and placement of cameras, to minimise the potential for embarrassing situations to arise.

- An additional staff member should be available to discontinue a remote session immediately, should inappropriate behaviour be noticed. A follow-up phone call, can then be made to correct the behaviour.
- Participants may be tempted to use blurring of their own backgrounds. If this is the case, then they must be reminded to stand closer to the camera to avoid being blurred out themselves.

Recording sessions

If a session is to be recorded, you must ensure that the local recording device is encrypted, and password protected.

- Consent must be sought from each individual and discussed before any such recording occurs.
- External recording must be discouraged by participants and will need to be discussed before commencing sessions. Most remote services will warn that an external recording has been started. In this instance the assistant or physiotherapist should immediately discontinue the remote session with the individual recording the event, and follow-up with an explanatory phone call.
- If a remote system is used that does not warn of external recordings occurring, then an alternative remote system must be used. Microsoft Teams has been validated as secure by the NHS, and should be used as the gold standard when comparing remote services.

Emergency access

- To reduce the effect of power failures an uninterrupted power supply (UPS) maybe used, in combination with a mains-powered laptop. In the event of a temporary power failure, the laptop will automatically switch to battery backup, and the UPS will allow power

to remain to the router device, thus allowing the remote session to continue. The UPS will provide power for a limited time dependent on the wattage of the router, however, this should be sufficient to allow for a seamless switch to another device, or for a temporary glitch in power to be corrected.

- If a remote session is interrupted, then a switch to an alternative remote device maybe indicated such as a phone or tablet device. However, this device must be encrypted and password or biometrically protected, if any recording of a session is to occur.
- Individuals must have access to an individual account, with an individualised password on the back-up device to prevent multiple users accessing sensitive material.
- Conversations on encrypted social media are only protected end-to-end, meaning that the conversations cannot be read whilst in transit. However, if either of the receiving devices are not encrypted then the entire conversation maybe read if access is gained to either of the devices. The device must be encrypted.
- Social media also allow access to be gained to messages through web access, that will be password protected. However, if any device that is used that is not encrypted, then access to those messages maybe possible. Examples are internet cafés or home computers, that allow guest user access. Do not use any device that allows for guest users and ensure that accounts are individually accessible through a secure password.
- Check your local IG policy documentation for permitted devices, as personal devices are often not allowed to be used within local organisations.

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