

Brief Report

Telerehabilitation Services Remain Increased Post-COVID-19 in Australia

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Running Head: Telerehabilitation Continues Post-COVID-19

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Abbreviations: ATS = American Thoracic Society; CBPR = Center-based pulmonary rehabilitation; COPD = Chronic obstructive pulmonary disease; IQR = interquartile range; PR = Pulmonary rehabilitation

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Introduction

Pulmonary rehabilitation (PR) is a highly effective, yet widely underused treatment for people with COPD as well as other chronic respiratory diseases.^{1,2} Typically, PR is an 8-12 week program delivered within a hospital or healthcare center.² However, patients may experience significant barriers to attending center-based PR (CBPR).² The opportunity to undertake PR at home via telerehabilitation may help overcome some patient-related barriers to attending CBPR, such as travel and transport issues, thereby supporting increased service access.²⁻⁴ Prior to the COVID-19 pandemic very few programs (just 4% in the Australian context) delivered home-based PR.⁵ Telerehabilitation use expanded during the pandemic. However, post-pandemic it is unclear how many services continue to deliver telerehabilitation, and how telerehabilitation delivery may have impacted CBPR programs, for people with COPD and other chronic respiratory diseases.

Telerehabilitation programs may use synchronous (e.g. telephone calls, video-conferencing) or asynchronous communication (e.g. email),³ and can be available across a variety of platforms. A recent Cochrane review has demonstrated that, for people with COPD, telerehabilitation achieves similar clinical outcomes to CBPR for exercise capacity, quality of life and breathlessness, although findings for other outcomes, such as hospitalization, remain limited by the certainty of available evidence.⁴ Telerehabilitation is, however, associated with greater program completion rates.⁴ International clinical practice guidelines recommend that people with chronic respiratory disease should be provided a choice of CBPR or telerehabilitation.² For telerehabilitation to be a clinically acceptable alternative to CBPR, program models should meet similar standards to those of CBPR in delivering the essential components of effective PR.⁶ Defined essential components include an initial pre-program center-based assessment, individually prescribed and progressed endurance and resistance training, and delivery of the program by healthcare professionals trained in the specific

telerehabilitation model.¹ The extent to which telerehabilitation models deliver the essential components of PR in clinical practice is unclear.

This study aimed to characterise PR service delivery, investigate the impact of the COVID-19 pandemic on PR services, and describe telerehabilitation and CBPR with reference to the essential components of PR in the Australian context.

Methods

An online, cross-sectional survey was undertaken between July 19 and August 28, 2023 (Qualtrics, Provo, UT, USA), with pilot testing and expert review prior to launch. Email invitations for completion of the voluntary anonymous survey were sent to all PR programs listed within the Lung Foundation Australia national database, the most comprehensive record of programs available. A preference was indicated for the PR coordinator of each service to complete the survey if possible. Only one survey could be completed for each PR site. Ethics approval was granted prospectively (Monash University (ID 39264)).

The survey comprised twenty-seven questions (Online supplemental table S1). Twenty-five questions were in closed categorical form (plus sub-questions as required), and two questions required open responses. The survey explored PR program availability, program structure, and satisfaction of the essential components of PR. Respondents were asked to describe PR program delivery i) at the time of survey completion, and ii) to recall program delivery practices prior to, and during (2020-2022) the COVID-19 pandemic. Demographic information relating to the role of the respondent, professional makeup of the PR team and PR service setting were also collected.

All responses received, including from incomplete surveys, were included in the data analysis (IBM SPSS Statistics V28.0 (IBM Corp., NY, USA)). Descriptive statistics were reported as

number (%) or median (interquartile range (IQR)). Open responses were coded thematically. Service availability at the time of survey completion was compared with availability pre-COVID-19 pandemic for CBPR, and during the pandemic (2020-22) for telerehabilitation (McNemar's test; significance $p < 0.05$).

Results

Survey invitations were sent to 295 PR programs with 117 responses received (40% response rate; $n=9$ (8%) incomplete). Respondents represented all Australian states and territories, were located across metropolitan, regional and rural areas, and provided services in a variety of clinical settings (Figure 1). 92% of respondents were the service PR coordinator. PR services included team members across a variety of occupations, most commonly physiotherapists (96%), allied health assistants (61%) and nurses (55%).

97% of respondents ($n=114/117$) reported delivery of CBPR at the time of survey completion (Figure 1), which was similar to recall of pre-pandemic CBPR availability (96%). CBPR was primarily delivered in a group setting ($n=109/110$, 99%), to median (IQR) 7 (6-8) participants/group. 39% of respondents ($n=42/109$) reported CBPR group size to be smaller than pre-pandemic. The most common CBPR training modalities were walking (90%), free/machine weights (78%), stationary cycling (68%) and resistance bands (53%).

Telerehabilitation was reported to be delivered by 43% of respondents ($n=50/116$) current at the time of survey completion (Figure 1). Availability of telerehabilitation at the time of survey completion was significantly reduced compared with recall of availability during the pandemic (74%, $n=85/114$; $p < 0.001$). The most cited reasons for telerehabilitation cessation were staffing limitations, patient preference for CBPR, and staff perception for greater ease/benefits of CBPR. All services except one delivered telerehabilitation in addition to

CBPR. Multiple telerehabilitation models were used, including telephone (94%), video-interaction (60%) and email (34%). Of synchronous (video) telerehabilitation programs (n=28), group video-conferencing (n=11/28, 39%; median (IQR) 3 (2-4) participants/session) was less commonly delivered than 1:1 video-calls (n=26/28, 93%; Figure 2). Reported Session durations for telephone (median (IQR) 30 min (20-30)) and video-interaction (median (IQR) 45 min (30-60)) were shorter than for center-based PR (median (IQR) 60 min (60-90)). Synchronous (video) telerehabilitation was more often delivered from a metropolitan setting (65%) than a rural/remote setting (35%). The most common telerehabilitation training modalities were walking (89%), free/machine weights (63%), bodyweight resistance exercises (58%) and resistance bands (50%).

The PR essential component of an initial in-person center-based assessment was performed in 100% of CBPR and in 89% of telerehabilitation programs (Figure 2). Individually prescribed and progressed endurance and resistance training was delivered in most CBPR programs (91%), but fewer telerehabilitation programs (78%). Staff training specific to the telerehabilitation models being delivered was undertaken by 33% of services delivering remote programs (n=15/45).

Discussion

This study characterizes availability and delivery of PR in Australia. CBPR program availability is largely consistent with pre-pandemic levels, but with a reduction of group size. Telerehabilitation availability, although less than during COVID-19 restrictions, remains substantially higher than pre-pandemic availability.^{5,7,8} Despite diversified program delivery models, the majority of both CBPR and telerehabilitation programs complied with the essential components of PR.

In the current post-pandemic era, there is greater availability of telerehabilitation services for people with chronic respiratory disease. In keeping with the increased telerehabilitation service availability seen here, 86% of UK PR programs now offer a remotely-delivered home-based PR option, up from 34% pre-pandemic.⁸ Expanding the modalities of PR delivery offered within clinical practice may support broader, more equitable, access to PR for people with chronic lung diseases.² Importantly, this continued telerehabilitation availability also does not detract from the quality and availability of CBPR. Telerehabilitation program models are not suitable for all patients,² likewise there is increasing patient preference for a return to in-person consultation, waning concerns about COVID-19 infection and variable administrative and regulatory support for hybrid care delivery models (i.e. face-to-face as well as telehealth),⁹ which all support the ongoing need for CBPR. Given that telerehabilitation is a recommended alternative to CBPR in international guidelines,² continuing to support the implementation of telerehabilitation along with CBPR across a variety of healthcare contexts is important if equitable delivery is to be sustainable.

While most telerehabilitation programs (89%) complied with the PR essential component of a center-based assessment, individualised prescription/progression of endurance and resistance training was less often reported to be undertaken (78%). In addition, relatively few services provided telerehabilitation model-specific training. Experience and competency with technology are known factors in the successful delivery of remote healthcare.¹⁰ Whether enhanced telerehabilitation model-specific training would improve clinician confidence to deliver telerehabilitation, including compliance with individualised prescription and progression of exercise training, remains to be determined.

Access to PR is an issue on a global scale.^{2,11} Potential to improve PR service access is a proposed benefit of telerehabilitation models.^{1,2} This study highlighted that CBPR group size reduced post-pandemic, along with telerehabilitation being more commonly delivered 1:1

rather than in a group format. This indicates the possibility that overall PR program capacity could have reduced post-pandemic, impeding program access for patients. Whether changes in program funding, or other contributors such as referral practices, have contributed to reduced service capacity requires exploration. In Australia, healthcare is largely funded under a universal scheme for subsidization and reimbursement, however in regions where PR reimbursement is complex, such as the US, fluctuating service capacity based on financial drivers may have profound effects on access to PR for patients.⁶

The cross-sectional nature of this work relied upon participant recollection of service delivery over the previous four-year period. This requirement for extended recall, coupled with the potential for changes to staffing during the intervening period, may have impacted historical program knowledge held by the respondent. The response rate for this study was 40%, which is lower than a previous Australian survey of PR services.⁵ This may be attributed to the use of an online method of survey delivery without incentive,¹² although is in keeping with accepted online survey response rates (mean 44.1%).¹³ That all Australian states and territories are represented, including rural, regional and metropolitan services, supports the data being largely reflective of the current state of Australian PR.

Conclusion

Telerehabilitation services continue to be more available to people with COPD and other chronic respiratory diseases than pre-pandemic. Most Australian telerehabilitation programs currently meet PR essential components, supporting the ability of such models to deliver effective PR programs. However, telerehabilitation services and CBPR program capacity have both declined post-COVID. This highlights the importance of ensuring sustainability of

effective PR programs, irrespective of model of delivery, to support widespread access to this recommended treatment for people living with COPD and other chronic respiratory diseases.

Pre-proof

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Author contributions: NSC conceptualized the study. All authors developed the study protocol and data analysis plan. AKM collected and analysed data. AKM and NSC interpreted the data. AKM and NSC drafted the manuscript. All authors revised and approved the final manuscript.

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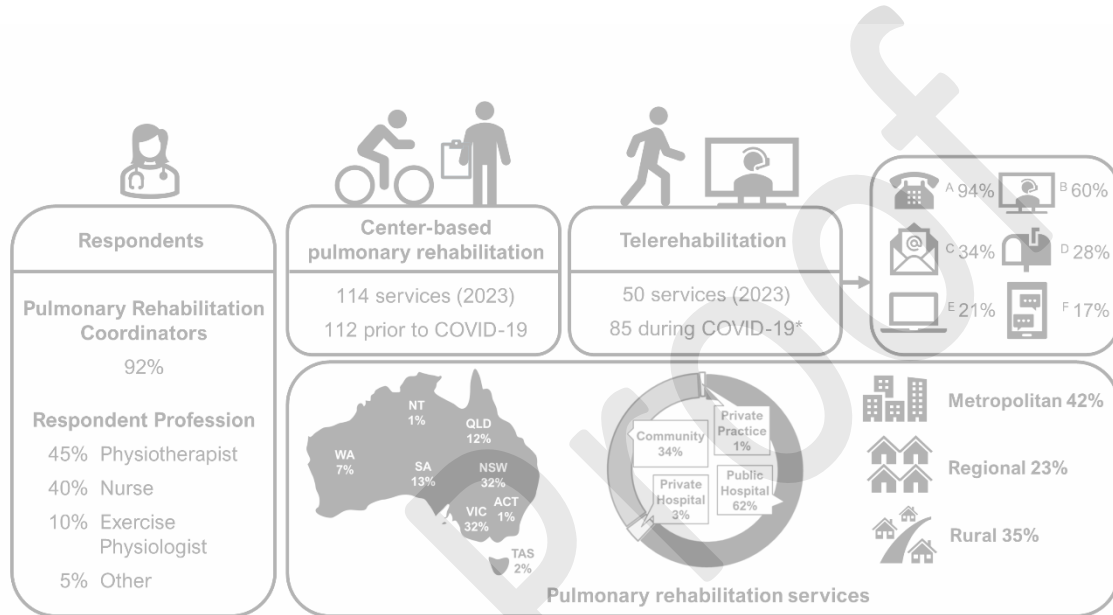
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Figure legend

Figure 1: Summary of Australian pulmonary rehabilitation (PR) services.








* $p < 0.001$ vs. 2023 (McNemar test).

A Telephone; B Video-call/conference; C Email; D Postal service; E Desktop or mobile application; F Text message.



ACT Australian Capital Territory; NSW New South Wales; NT Northern Territory; QLD Queensland; SA South Australia; TAS Tasmania; VIC Victoria; WA Western Australia.

Figure 2: Pulmonary rehabilitation program structures and satisfaction of essential components.

	Center-based pulmonary rehabilitation	Telerehabilitation	
		 Telephone	 Video-conferencing
Program structure	Program duration 7+ weeks 95% Session duration median 60 min (IQR 60-90) 1:1 delivery 35% Group delivery 99% Group size median 7 patients (IQR 6-8)	Program duration 7+ weeks 80% Session duration median 30 min (IQR 20-30)	Program duration 7+ weeks 89% Session duration median 45 min (IQR 30-60) 1:1 delivery 93% Group delivery 39% Group size median 3 patients (IQR 2-4)
Essential components of pulmonary rehabilitation	Initial center-based patient assessment  100% Individually prescribed and progressed endurance and resistance training  91%	Initial center-based patient assessment  89% Individually prescribed and progressed endurance and resistance training  78% Staff undertook specific training to deliver tele-PR  33%	

IQR Interquartile range.

Online Supplement

Online supplemental table S1: Survey structure

Topic	Question (* denotes forced responses)	Response options
Center-based pulmonary rehabilitation	Do you currently deliver center-based pulmonary rehabilitation services (i.e. in-person)?*	Yes/No
	Did you deliver center-based pulmonary rehabilitation services <u>prior to</u> the Australian implementation of restrictions in response to the COVID-19 pandemic (i.e. prior to March 2020)?*	Yes/No
	Is your current delivery of center-based pulmonary rehabilitation services <u>different</u> compared with that provided prior to the COVID-19 pandemic (i.e. prior to March 2020)?*	Yes/No/Unsure
	What has changed in your delivery of center-based pulmonary rehabilitation compared with the services prior to the COVID-19 pandemic (you may select more than one box)?	Staffing (number and/or hours) - Increased Staffing (number and/or hours) - Reduced Service funding - Increased Service funding - Reduced Rehabilitation group size (patient number) - Increased Rehabilitation group size (patient number) - Reduced Training program duration (weeks) - Increased Training program duration (weeks) - Reduced In-person training frequency (sessions per week) - Increased In-person training frequency (sessions per week) - Reduced Other (please specify): ____
	If you would like to elaborate on any important changes, please do so below.	Open response
	Please indicate the factors contributing to why center-based pulmonary rehabilitation is no longer delivered by your service (you may select more than one box).	Permanent closure/reallocation of rehabilitation venue Loss/reduction to allocated funding Loss of staff from organisation Reallocation of staff to other worksites within organisation Loss of organizational/managerial support Loss of materials/equipment for pulmonary rehabilitation

		Continuing COVID-19 restrictions prevent pulmonary rehabilitation delivery Switch to full remote delivery of pulmonary rehabilitation (i.e. telerehabilitation) Other (please specify): ____
	Regarding center-based pulmonary rehabilitation, please indicate the average number of patients within exercise groups throughout 2023 (excludes sessions delivered 1:1).	Open response
Telerehabilitation	Do you currently deliver pulmonary rehabilitation services remotely (i.e. the patient undertakes pulmonary rehabilitation at a location other than the center)?*	Yes/No
	You have indicated that you currently deliver pulmonary rehabilitation via remote means, but not via center-based pulmonary rehabilitation. Please briefly describe why this is the case.	Open response
	Did you provide a remotely delivered pulmonary rehabilitation service at any time during 2020-2022 due to COVID-19 restrictions?*	Yes/No
	If a remote service was delivered during 2020-2022 but is no longer provided from your pulmonary rehabilitation site, why is that no longer the case? What model(s) of pulmonary remote rehabilitation delivery did you use? What factors contributed to stopping remote delivery? What would need to change for you to begin again? Please provide as much detail as you are able.	Open response
	Are there any remote models of pulmonary rehabilitation that you delivered during 2020-2022 that are <u>not currently delivered</u> by your service?	Yes/No
	If you selected 'Yes' to the previous question, please briefly explain what remote pulmonary rehabilitation models are no longer delivered and indicate what factors contributed to this change. What would need to change for you to begin again? Please provide as much detail as you are able.	Open response

	<p>Please select all remote pulmonary rehabilitation services that you <u>currently</u> deliver (you may select more than one box).*</p>	<p>Telephone Text message Video-call/video-conference Interactive web-based rehabilitation/mobile application Email Postal service</p>
	<p>You may deliver remote pulmonary rehabilitation via a method not listed above, or via a combination of multiple remote methods (e.g. video-calls and text messages each week). If so please briefly describe your method.</p>	<p>Open response</p>
	<p>Do you intend to continue delivering all <u>remote pulmonary rehabilitation</u> option(s) indicated for the foreseeable future?</p> <p>Please state what remote pulmonary rehabilitation methods you no longer intend to deliver, and briefly explain why. Are there specific factors that are driving this decision?</p>	<p>Yes/No</p> <p>Open response</p>
	<p>Please indicate the factors that have contributed to enabling your <u>remote</u> delivery of pulmonary rehabilitation services. You may select more than one box.</p> <p>Please provide any additional details regarding these contributing factors that you think may be relevant.</p>	<p>Ongoing COVID-19 restrictions Staffing capacity/availability Support from management Available funding Available IT support Availability of equipment Patient access to internet for video-call and video-conference engagement Patient preference Clinician preference Other (please specify): ____</p> <p>Open response</p>
	<p>Does your delivery of [<i>specific remote PR method</i>] generally include one or more home visits by a physiotherapist or other healthcare professional?</p>	<p>Yes - Physiotherapist only Yes - Other healthcare professional only Yes - Physiotherapist and other healthcare professional No</p>

	<p>If a healthcare professional other than a physiotherapist completes a home visit for pulmonary rehabilitation delivered via [<i>specific remote PR method</i>], please indicate their occupation.</p>	<p>Nurse Allied health assistant Occupational therapist Exercise physiologist Other (please specify): ____</p>
	<p>Do patients that undertake <u>remote</u> pulmonary rehabilitation (other than video-calls/video-conferencing) undertake any exercise training sessions with real time supervision from a healthcare professional within your team?</p>	<p>Yes/No</p>
	<p>Please indicate the frequency of real time supervision of exercise training sessions for pulmonary rehabilitation delivered via [<i>specific Remote PR method</i>].</p>	<p>At the initial home visit only At any subsequent home visits Once per week via video Twice per week via video Other (please describe): ____</p>
	<p>Is any equipment provided to the patient for pulmonary rehabilitation delivered via [<i>specific Remote PR method</i>]? Please note that this includes exercise equipment (e.g. dumbbells, exercise bikes) and technology equipment (e.g. electronic tablets, oxygen saturation monitor).</p>	<p>Yes (please specify) ____ No</p>
	<p>Do the healthcare professionals in your team who deliver <u>remote</u> pulmonary rehabilitation undertake specific training (e.g. motivational interviewing)?</p> <p>If 'Yes', please briefly provide details regarding the specific training and indicate the associated models of remote pulmonary rehabilitation delivery.</p>	<p>Yes/No</p> <p>Open response</p>
<p>Service delivery and essential components of pulmonary rehabilitation</p>	<p>For your <u>center-based</u> pulmonary rehabilitation program, how do you deliver <u>center-based</u> exercise training sessions? You may select more than one box.</p> <p>Regarding center-based pulmonary rehabilitation, please indicate the average number of patients within exercise groups throughout 2023 (excludes sessions delivered 1:1).</p> <p>You indicated that you deliver remote pulmonary rehabilitation via <u>video-call/video-conferencing</u>. Please indicate below if your contact with patients via this method is with individuals and/or with groups (you may select more than one box).</p>	<p>Individual (1:1) training sessions/Group training sessions</p> <p>Open response</p> <p>Individual/Group</p>

	Regarding group <u>video-calls/video-conferencing</u> , please indicate the average number of patients within group calls throughout 2023 (excludes calls to individuals).	Open response
	What is the typical duration (in minutes) of a single [<u>center-based PR or specific remote PR method</u>] session?	Open response
	Please indicate the general program length for pulmonary rehabilitation delivered via [<u>center-based PR or specific remote PR method</u>].	< 4 weeks 4-6 weeks 7-8 weeks > 8 weeks
	Before a <u>center-based</u> pulmonary rehabilitation program begins, does the patient complete an initial assessment at the center with a healthcare professional?	Yes/No
	Before a pulmonary rehabilitation program <u>via a remote method</u> begins, does the patient complete an initial assessment at the center with a healthcare professional?	Yes/No
	Please select all assessments performed within the initial assessment you deliver at the center. You may select more than one box.	Patient history Cardiopulmonary exercise testing (laboratory) A field exercise test (e.g. 1-minute sit-to-stand test, 6-minute walk test) Quality of life assessment Dyspnoea assessment Nutritional status evaluation Occupational status evaluation Other (please specify):____
	If there is a difference between the inclusions of initial assessments for center-based and remote pulmonary rehabilitation methods, please briefly describe below:	Open response

	<p>Please indicate any factors which contribute to being unable to complete an initial center-based assessment with a healthcare professional. You may select more than one box.</p> <p>If you feel that the factors which contributed to being unable to complete an initial center-based assessment are different for <u>center-based</u> and <u>remote</u> pulmonary rehabilitation delivery, please provide additional comments. Please ignore this question if you deliver pulmonary rehabilitation via only one mode (i.e. only center-based or remote).</p>	<p>Ongoing COVID-19 restrictions Insufficient staffing capacity/availability Insufficient funding Unavailable equipment/space Geographic accessibility issues (travel time and transport access) Patient preference An initial patient assessment is not required The assessment is performed during a home visit by a healthcare professional Other (please specify): ____</p> <p>Open response</p>
	<p>Do patients undertaking [<i>center-based PR or specific remote PR method</i>] receive an individually prescribed and progressed exercise program?</p> <p>If 'Yes', please briefly describe the common training prescribed (e.g. walk training, resistance-banded exercises).</p>	<p>Yes – Individually prescribed and progressed endurance and resistance training Yes – Individually prescribed and progressed endurance training only Yes – Individually prescribed and progressed resistance training only No</p> <p>Open response</p>
Demographic questions	Please indicate your role within your service.	Program coordinator/Other staff member
	Please indicate your occupation.	Physiotherapist Nurse Allied health assistant Occupational therapist Exercise physiologist Other (please specify): ____

	<p>Please indicate the occupations of all staff within your pulmonary rehabilitation team. You may select more than one box.</p>	<p>Physiotherapist Nurse Allied health assistant Occupational therapist Exercise physiologist Fitness instructor/Personal trainer Dietitian Respiratory physician Psychologist Other (please specify):___</p>
	<p>Please provide the state or territory for your primary pulmonary rehabilitation site.</p>	<p>Australian Capital Territory (ACT) New South Wales (NSW) Northern Territory (NT) Queensland (QLD) South Australia (SA) Tasmania (TAS) Victoria (VIC) Western Australia (WA)</p>
	<p>Please provide the postcode for your pulmonary rehabilitation site. If your service conducts pulmonary rehabilitation across multiple sites, please use the postcode of the main site from which the program is administered.</p>	<p>Enter postcode</p>
	<p>Please select the option that best describes the primary site from which you deliver pulmonary rehabilitation services.</p>	<p>Public hospital Private hospital Community Other (please specify)___</p>
	<p>If you have any other comments that you would like to make, please do so below.</p>	<p>Open response</p>