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SPECIAL ARTICLE

Pulmonary Rehabilitation: The Year in Review 2025

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Abstract

Pulmonary rehabilitation (PR) is a cornerstone of therapy for people with chronic lung disease. Over the years, there has been a tremendous amount of research in the field. Researchers have studied improved delivery methods for PR that improve patient outcomes. This article will review several important articles in the field over the last year.

Keywords: pulmonary rehabilitation, COPD, telerehabilitation, interstitial lung disease (ILD), education, exercise testing

Introduction

Pulmonary rehabilitation (PR) is a multidisciplinary comprehensive intervention that includes aerobic and resistive exercise training through an individualized, structured exercise program.[1] For patients with COPD, this treatment significantly improves exercise capacity, reduces dyspnea, and improves health-related quality of life. It is also associated with a decrease in hospital readmission rates and improved survival for individuals following hospitalization for a COPD exacerbation.[2] Research in the field has continued to progress, and many studies over the past year have further defined who might benefit from PR, as well as how the provision of such services can be improved. This article will describe several important studies and editorials published during 2025.

Utilization of PR

Utilization of PR historically remains low in the United States despite its well-known benefits.[3] In a retrospective, cross-sectional analysis of patients with chronic respiratory diseases, the use of PR from 2014 through 2019 was evaluated in over 800,000 people with chronic respiratory diseases. PR was started in a minority of patients (2.3%), with an annual participation rate between 1.5% and 1.7%. This analysis showed that PR was most often initiated in those with interstitial pulmonary fibrosis, and this group had the highest completion rate.[4]

The availability of PR programs is a major reason for a lack of utilization for PR. Since the COVID-19 epidemic, a significant loss of PR programs in this country has occurred. From the U.S. Veterans Administration Service,

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the largest integrated health care system in the United States, both the numbers of center-based and remotely-based PR programs were evaluated. For patients with COPD, from 2010 to 2022, the greatest number of PR programs (either center-based or remotely delivered) was noted in 2015 (no. = 122). A dramatic decline in the number of programs occurred in 2020 to 37 programs. Over the ensuing 2 years, there was a lack of recovery of programs, with only 27 programs remaining in 2021 and 35 programs remaining in 2022.[5] There was a slight increase in the number of remotely delivered programs to a total of 11 in 2022. This decline in PR programs has resulted in a lack of availability of PR for many patients with chronic lung disease. Emphasis on the development of both center-based PR programs and remotely delivered PR programs is desperately needed.

Other reasons for the lack of utilization have also been studied. A qualitative study was performed to explore the determinants of behavior of health care professionals (HCPs) regarding referral to PR. A variety of questions were addressed to 22 HCPs from a tertiary care center recruited, with data collected from 15. The interview transcripts were analyzed using a reflexive thematic analysis. Two major themes from these HCPs were noted: a need to care for the person with COPD and not just treat the disease, and instilling hope that PR will benefit that person.[6]

Several ideas and recommendations emerged. The HCP should be perceived to be actively listening to the patient with COPD and withhold any personal judgments. The HCP should establish a trusting relationship with the person with COPD and empower the person with COPD to engage in shared decision-making processes. It is also important for the HCP to have enthusiasm for the PR program along with sharing vicarious experiences about PR from other people with COPD. The HCP should describe the intervention to help allay any fears and personalizing a positive outcome following program completion. Finally, having PR endorsed by a physician was of importance. These data provide several thoughts that will help to provide a blueprint for interactions between HCPs and people with COPD and should ultimately help with referral for PR.

Components of PR

Education

Research in the field of PR initially involved patients with COPD and formed the basis for various PR guidelines.[7–11] A recent update to the American Association of Cardiovascular and Pulmonary Rehabilitation Guidelines is scheduled for publication.[12] Core PR program components include patient assessment, exercise testing and training, patient education, psychosocial evaluations and interventions, and outcome measurement. Although a great amount of research has been conducted for most of these components, less research has been conducted in the educational component.

Current educational interventions for PR often involve general didactic sessions on the disease process and treatment options. These interventions may not reflect the actual learning styles of the individuals being educated. The identification of the informational needs, learning styles, and psychological profiles for people with COPD or asthma was conducted[13] as an observational study in 2022 and 2023 at a tertiary care center. The subjects' informational needs using a LINQ survey, learning styles, psychological profiles, and health status using either the COPD Assessment Test (CAT) or Asthma Control Test (ACT) were assessed. Various learning styles including multimodal, visual, oral, kinesthetic, and read/write styles were studied in 122 subjects and their home caregivers.

The most prevalent psychological profile differed between the subjects and home caregivers, with subjects being in the "optimist" category and caregivers being in the "fighter" category. A variety of informational approaches are needed for patients and caregivers. Most preferred a read/write style of learning in a unimodal nature, with 50% preferring more than one learning style. This study emphasizes the need to know your patient's and home caregiver's learning styles and to provide multimodal educational learning interventions as part of the PR program.

Exercise testing

A variety of exercise tests (eg, laboratory and field-based testing) have been used to assess exercise tolerance in patients undergoing PR, yet the type of testing that provides the greatest sensitivity to change has yet to be determined. Symptomatic subjects with COPD ($n = 144$) were randomized to 6 weeks of long-acting muscarinic antagonist therapy, PR, or usual care. Each participant performed an incremental cycle exercise test, constant work rate cycle test, incremental shuttle walk test, endurance shuttle walk test, 6-min walk test, and a 4-min gait speed test. Data obtained in 103 subjects showed significant improvements in all exercise tests after PR ($P < .05$). The greatest improvements were seen in constant work rate protocols, with the percentage change in the constant work rate cycle test being 42% and in the endurance shuttle walk test being 41%. The magnitude of change was much greater following PR compared to bronchodilator therapy. These results may change how the approach to outcome measurement prior to and following PR is made.[14]

Functional capacity using the 6-min walk test has also undergone increased study. Three 6-min walk tests were performed in 1,167 subjects with COPD. A threshold

improvement of greater than 42 m was used to identify improvers. Two hundred ten subjects (18%) improved greater than the predetermined threshold from the second to the third test. Those subjects with a 6-min walk distance <350 m and GOLD stages 1 and 2 were more likely to improve beyond the threshold. Performing more than one 6-min walk test may be necessary to help improve outcome measurement following a PR program.[15]

With the proliferation of alternative delivery models for PR being developed and used, can remote exercise testing be effectively conducted in the home? Adults with chronic respiratory disease who were undertaking PR were invited to undergo a Modified Incremental Step Test under in-person supervision or remote supervision via videoconferencing. Thirty-eight participants completed the study. Excellent agreement between the tests was noted for total step count despite higher counts with in-person supervision. No difference was noted in nadir oxygen saturation and peak heart rate. Participant satisfaction with telehealth was high, and there were no adverse events. More studies on the safety and reliability of such exercise testing in remote settings will need to be performed.[16]

Diseases Other than COPD

Although PR has been mostly studied for patients with COPD, over the last decade people with other types of chronic respiratory diseases (eg, interstitial pulmonary fibrosis, pulmonary hypertension) have been shown to benefit from its use. The effects of survival following PR in these patient groups are unknown. Two randomized controlled trials on subjects with interstitial lung disease evaluated the effects of referral to PR.[17,18] Outcomes included either the date of death, lung transplantation, or censoring in 182 subjects with interstitial pulmonary fibrosis. Death occurred in 62%, and lung transplantation occurred in 6%. Those remaining alive made up the latter 20%.[19] For those subjects completing PR, a median survival of 6.1 years was noted. For those subjects who did not undergo PR, a median survival of 4.7 years was noted. Although this did not represent a statiscally significant difference, the 5-year survival in those subjects who completed PR showed a 44% lower risk of mortality. The authors concluded that participation in PR among patients with interstitial lung disease may impact survival at 5 years, and PR should be offered and included as part of the treatment.

The frequency of referral for those patients with pulmonary arterial hypertension (PAH) was investigated. A retrospective cohort study of subjects with PAH enrolled in the Pulmonary Hypertension Association Registry was conducted. Referral rates to PR were 17%, 26.6%, and 32.3% at the first, second, and third follow-up visits, respectively. Subjects referred to PR were more likely to be female, had a worse functional class, had higher risk scores, a lower health-related quality of life, shorter 6-min walk distance, and higher rates of supplemental oxygen use. Referral to PR was low among subjects with PAH and was significantly impacted by demographic and socioeconomic factors.[20]

Delivery Models (Telehealth and Telemonitoring)

Since the COVID-19 epidemic, a rapid evolution of telemonitoring and telehealth programs has occurred throughout health care. Various types of program structures exist, including both synchronous and asynchronous programs. Synchronous telehealth refers to real-time, live interactions between a patient and HCP, usually via 2-way video or telephone. Asynchronous telehealth involves the secure digital transmission of recorded medical data and information. Studies are underway to evaluate the effects of telehealth PR interventions.

A secondary analysis of previously published randomized controlled trials was performed to determine the clinical response to home-based PR compared to center-based PR and to determine if any participant baseline characteristic was associated with response to PR relative to either delivery model. Response or nonresponse to PR using various outcomes (eg, 6-min walk distance, health-related quality of life as measured by the Chronic Respiratory Disease Questionnaire [CRQ], and symptoms as measured by the Modified Medical Research Council scale) was evaluated in 266 subjects at the end of the PR program and 12 months later. The number of responders versus nonresponders was not different between either group at the end of the PR program or at 12 months. A 4 times greater risk of program noncompletion was noted in the center-based group (58% completion rate) versus the telerehabilitation group (90% completion rate) (relative risk 3.89, 95% CI 2.28–6.63). There were no specific patient characteristics that involved being suited for either program.[21]

A multi-center randomized controlled trial evaluating an application-based model of PR was compared with enhanced standard care. Two hundred seventy-eight subjects across 18 centers in Germany and Switzerland were randomized to either a 12-week interventional program or standard care. Exercise capacity was measured by the 1-min sit-to-stand test, and health status was measured by the CAT. No difference in either outcome at either the end of the intervention or following another 12 weeks was noted. Adherence to the intervention was low, with 40% of those randomized being adherent users of the application. This study showed similar outcomes for both an application-based PR model compared to standard care.[22]

Which delivery model of a home-based intervention is best? Should the virtual program be conducted in a synchronous or asynchronous fashion? These are just a few of the questions involved in the provision of home-based interventions. A study in adults with stable COPD referred to a PR program asked the subject to self-select either a center-based PR program or a virtual home-based PR program. A 6- to 8-week personalized self-management program was provided, along with weekly telephone calls to those in the virtual program. A remote telemonitoring platform was added to some subjects in the virtual program.[23]

The program included standardized assessments, a clinician-created home program, avatar-guided exercises, educational material, health diary, daily COPD action plan, and a goal-setting feature. The study included 40 subjects who completed the program (17 in the center-based PR program and 23 in the virtual PR program). Four subjects in each group withdrew, with overall adherence to the program being >80%. Feasibility of including qualitative analysis of adherence, reasons for withdrawal, and self-reported barriers to the use of PR at home (assessed by a System Usability Scale) was studied. Those subjects in the virtual PR program scored the software as being highly usable. Improvement in 6-min walk distance, CAT score, and a St George Respiratory Questionnaire were noted in both groups. This study provides a basis for the use of one type of telemonitoring program that is feasible, usable, and effective and should help provide the basis for future research and development in the fields of telerehabilitation.

The current state of virtual PR in the United States was recently studied in 30 clinical facilities. The delivery of virtual PR is not standardized. Most programs provided similar key components of PR but differed in their in-person assessments, in-person standardized exercise testing, and provision of consistent protocols for exercise progression. Half of the programs did not include a safety assessment. Limited access to the program was a major issue for the virtual PR service.[24] In an accompanying editorial, another well-designed VA center-based program, not included in the survey, described their program, which included a safety assessment and emergency protocol.[25] The development of future programs that will include the core components of a comprehensive PR program is needed.

Economic Impact of Telerehabilitation

The economic impact of providing PR in a telehealth setting is an important consideration for the development of such programs. In a study evaluating this impact, the clinical effectiveness using the CRQ and cost-utility analysis using quality-adjusted life years of a telerehabilitation program was compared to a center-based PR program. The tele PR group met twice weekly in a virtual group session with synchronous supervision using videoconferencing. The initial exercise session was supervised by a physiotherapist during an in-home visit, with subsequent visits conducted virtually.[26] Data collected over 12 months included effectiveness (dyspnea measured by the CRQ) and health care cost data (individual-level administrative data and self-reported data). The effectiveness and the total cost were not different between groups. The delivery of telerehabilitation appeared to be a cost-effective alternative model of PR for people with chronic respiratory disease. Ongoing studies are underway to evaluate the outcomes and cost-effectiveness of PR performed in other alternative delivery settings.

The virtual and remote delivery of PR has undergone great expansion over the last 2 years. It is the feeling of most professionals in the field that PR performed "in-person" (eg, a center-based program) continues to be the recommended choice.[27] In response to this growth of telehealth services, the American Association of Cardiovascular and Pulmonary Rehabilitation convened a group to develop consensus recommendations of what components should be contained within remotely delivered cardiac and PR programs.[28] They evaluated the delivery of PR services through a variety of models (in-person, virtual remote [synchronous and asynchronous], and hybrid delivery). The core components (including patient assessment, program components, method of delivery, and quality assurance) should be provided in all programs regardless of the delivery model. Each patient should have an initial in-facility assessment as well as the performance of an exercise test and a field exercise test. This assessment should also include quality of life and dyspnea measures, nutritional status, psychosocial evaluation, and occupational status. The program components should include endurance and exercise training. Progression of exercise should also be provided. A summary of key characteristics for either type of mode of delivery, as well as suggestions for exercise progression, is provided. In addition, recommendations regarding medical director involvement, technology delivery, and handling of medical emergencies are made. In the latter instance, processes to ensure the handling of medical emergencies in the home environment should be developed including handling those emergencies that may occur during a group session.

Disease Management and the Respiratory Therapist

The respiratory therapist plays a key role in the evaluation and management of patients with chronic lung disease during routine care and PR. Several programs have been developed using the respiratory therapist as a primary disease manager (University of California Davis Medical Center, Davis, CA; Lung Partners at Crouse Hospital, Syracuse, NY). Significant improvements in health-related quality of life, exacerbation reduction, and decrease in total hospitalization rate have been shown in

both programs using respiratory therapists as the primary disease manager.[29,30] The involvement of respiratory therapists as disease managers has been recently reviewed.[31]

The American Association for Respiratory Care has recommended using respiratory therapists as disease managers and has developed standards for such individuals. In order to qualify as a respiratory disease manager, as per these standards, a respiratory therapist should have completed an accredited educational program, acquired the National Board for Respiratory Care-Registered Respiratory Therapist credential, have a state license to practice, have a baccalaureate degree in an appropriate field, and be competent and proficient in providing patient care in the clinical setting. Many respiratory therapists have already started to provide primary disease management, with great opportunities being available in the future.[32]

Summary

PR has been shown to benefit many patients with chronic lung disease. Each year, there are an increasing number of studies published that expand upon the referral to and provision of PR services. The educational needs and learning styles of both patients and caregivers are an important first step.

Appropriate development of telehealth PR services needs ongoing investigation. A series of editorials have reviewed various aspects of telerehabilitation that will need to be addressed in the future including clarification of the terminologies used for remotely delivered PR,[33] the equality of all-telerehabilitation programs,[34] and how to provide cost-effective care.[35] The future is bright for PR for patients with chronic lung disease as further research into the development of newer programs and delivery models is completed.

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