



Expanding Implementation of Tele-Pulmonary Rehabilitation: The New Frontier

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Pulmonary rehabilitation (PR) is one of the most effective interventions for improving the health of individuals with chronic obstructive pulmonary disease (COPD) and other chronic respiratory diseases (1–3). Poor access to PR centers often results in the omission of PR from treatment armamentaria (4, 5). Fewer than 2% of patients with COPD have access to PR worldwide (6). Access is particularly limited in rural areas (7); travel distance impacts the odds of participation (4). Over the past several years, and accelerated by the severe acute respiratory syndrome coronavirus 2

(SARS-CoV-2) pandemic, PR delivery via telehealth has emerged as an attractive alternative to center-based PR to overcome some barriers to access. However, despite the expansion of telehealth to the delivery of many aspects of patient care, tele-PR has been largely limited to the research setting.

In this issue of *AnnalsATS*, Alwakeel and colleagues (pp. 39–47) report on the feasibility, safety, and efficacy of a practical, real-world strategy to implement tele-PR throughout the Quebec province in Canada (8). In this prospective study, individuals with COPD referred for PR were enrolled in a center-based PR program with extensive rehabilitation experience or in community-based tele-PR at satellite centers with exercise equipment. The PR sessions occurred concurrently at the primary and satellite centers via videoconferencing, facilitated locally by PR staff at each site. Of seven satellite sites, six continued to participate by 3 years. Comparable improvements in the 6-minute-walk distance (46 vs. 53 m) and reduction in the COPD Assessment Test scores (4.0 vs. 2.7 units) were seen after PR, without between-group differences. Notably, compared with center-based PR, the tele-PR program was associated with a higher completion rate (83% vs. 72%), without major adverse events. Strikingly, over the 3-year study period, the implementation of tele-PR at the satellite centers doubled the number of patients enrolled and quadrupled the number of sessions attended as compared with the primary PR center alone. Although participants were not randomized, individuals at the center and satellite sites had comparable baseline characteristics.

The study investigators are to be applauded, as their well-designed model of tele-PR delivery not only demonstrates real-world feasibility, safety, and efficacy of tele-

PR but also confirms the ability of tele-PR to improve access to PR and illustrates a possible pathway forward for more widespread implementation of tele-PR.

Several issues regarding tele-PR are, however, worthy of additional consideration. Tele-PR has been defined and delivered in several ways. Both asynchronous interventions, wherein patients exercise on their own or with the aid of instructional videos with periodic check-in, and synchronous interventions via real-time videoconferencing have resulted in significant improvements in functional capacity, quality of life, and hospitalizations (9–16), but outcomes are heterogeneous. Tele-PR heterogeneity is compounded further by variable exercise training intensity and whether exercise equipment is used or not. These issues have raised concerns about the standardization and benefits of tele-PR. The low-intensity exercise training provided in some tele-PR programs may result in improved walking endurance without changes in aerobic fitness; this limitation may be offset by better patient uptake of, adherence to, and completion of tele-PR. The diversity of exercise prescriptions and varying degrees of supervision have, however, made it difficult to generate an evidence base to support widespread implementation of tele-PR (17). It is therefore appealing to develop a solution whereby access to PR is improved while also retaining the exercise intensity and standardization associated with center-based PR.

In addition to patient-related barriers to tele-PR implementation, which include lack of exercise equipment, electronic devices, and/or internet access, or lack of skills to use them, health system–related barriers include a lack of consistent “real-world” approaches, accepted quality standards, and national metrics for

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delivering tele-PR. Accordingly, insurance payers do not routinely reimburse tele-PR in some countries such as the United States. Health systems have not yet invested widely in infrastructure to support delivery of tele-PR; cost-effectiveness data in the real-world setting are largely lacking. Moreover, legal and privacy concerns regarding delivery of tele-PR are not yet fully delineated.

A key strength of the model of tele-PR delivered in the study by Alwakeel and colleagues (8) was their ability to standardize the program across sites. The hub-and-spoke model whereby PR is delivered from a central location via videoconferencing to peripheral satellite sites creates a hybrid between center-based and remotely delivered tele-PR that is attractive in multiple respects. First, it potentially mitigates concerns regarding standardization of PR that may be of concern to insurance payers. Second, this model of remote PR potentially can be expanded to other sites such as publicly or privately funded community gyms and recreation centers, provided that skilled staff and adequate equipment can be guaranteed. Third, this model does not depend on individuals' need for exercise or electronic equipment, internet access, or computer skills and hence may

enhance access for socioeconomically disadvantaged persons. Fourth, participant safety can be monitored by on-site staff. Moreover, this model of tele-PR offers strong community support to participants, unlike home-based tele-PR. Lastly, this model of tele-PR is also potentially attractive for expanding delivery of maintenance PR.

Nevertheless, this tele-PR model has some limitations. First, it may be difficult to implement in non-nationalized health systems. It may, however, be possible to establish hub-and-spoke models of tele-PR delivery within individual states, within the Veterans Affairs and/or regional health systems. Second, the group-based tele-PR model delivered at community centers still requires short-distance travel and does not overcome the limitations to group sessions posed by the SARS-CoV-2 pandemic.

Although the optimal model for delivery of tele-PR remains uncertain, more widespread, real-world implementation of this tele-PR model would improve PR access, help to determine if it can be successful in nonnationalized health systems, and enable analysis of its cost-effectiveness. Further research is also needed to determine what

components and structure of tele-PR are most successful, as different patient groups may have a need for programs of differing structure—"one size" likely does not "fit all." Importantly, tele-PR is not intended to replace center-based PR but rather to complement it, as an alternative strategy for those who may lack access to traditional center-based programs. People with complex multimorbidity are often best served by center-based PR, wherein multimodality treatment interventions are available that are not routinely feasible in a tele-PR format. Home-, rather than group-based tele-PR may, however, be necessary in the context of a pandemic. Ultimately, it would be desirable for health systems to adopt the perspective that PR delivered via various models based on individuals' needs, including tele-PR for some, is a treatment intervention with the potential not only to improve and maintain patients' health but also to serve as a preventative health strategy with broad-reaching potential to improve the lives of individuals with chronic respiratory diseases. ■

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Administrative Data for Palliative Care Research: Friend or Foe?

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Patients with chronic obstructive pulmonary disease (COPD) receive palliative care far less often than those with cancer, despite having comparable or greater needs (1). Many have called for earlier and more frequent palliative care in COPD, which has strong face validity in clinical practice, yet the evidence base in this population is less robust than that in those with cancer or heart failure (2, 3). Thus, the benefits of palliative care in COPD and other understudied chronic diseases are commonly inferred from the evidence that exists in these other populations (2–4). Although this “one-size-fits-all” approach may enable more rapid progress in increasing palliative care for these

vulnerable populations, it also risks using a scarce resource in an inefficient and potentially ineffective manner.

In this issue of *AnnalsATS*, Maclagan and colleagues (pp. 48–57) report results from the largest study to date examining the effects of palliative care in COPD (5). By using health administrative databases from Ontario, Canada, they examined the association between receipt of palliative care and days alive at home per person-year through at least 1 year or death among patients who had their second or later COPD-related hospitalization between April 2010 and March 2017. Palliative care exposure was defined as receipt of palliative care during the hospitalization or within the subsequent 30 days in any setting. The authors derived a propensity score to estimate a patient’s likelihood of receipt of palliative care and then matched patients who received palliative care 1:1 with those who did not on the basis of their propensity score and sociodemographic and disease characteristics. Secondary outcomes included the place of death and rates of acute care use and mortality.

Among the more than 35,000 patients with advanced COPD included in this cohort study, 1,788 (5%) received palliative care. In the matched sample analysis, patients who received palliative care were followed for a median of 463 days, compared with 664 days in the non-palliative care group. There was no difference in the number of days spent at home between groups. Patients who received palliative care died at a higher rate and were more likely to die at home, although the latter difference disappeared in a sensitivity analysis in which patients who died in nursing homes were included as at-home deaths. Receipt of palliative care was not

associated with a reduction in emergency department or intensive care unit use but was associated with an increased rate of hospitalization among those who received community-based palliative care. Results were similar regardless of the number of prior COPD-related hospitalizations.

We warmly congratulate Maclagan and colleagues (5) on an important contribution to the evidence base for palliative care in COPD. In a recent systematic review of 28 randomized trials of palliative care interventions among more than 13,000 patients with noncancer serious illness (2), only three trials of 441 patients in total focused on COPD as a primary diagnosis, and none demonstrated improvements in patient outcomes (6–8). Although the quality and quantity of serious illness care research has significantly progressed in the past decade (9), clinical trials are not always feasible and often take many years to complete. Thus, researchers may leverage existing data sources and advances in causal inference methods to rapidly generate new evidence toward improving palliative care delivery. This largely negative study engenders important reflection about optimal palliative care delivery for patients with COPD specifically and highlights opportunities and challenges when using administrative data for serious illness research more generally.

Palliative care is fundamentally a heterogeneous intervention and is even more so when one examines it at the population level across different healthcare settings as this study did. However, the vast majority of palliative care in this study was delivered in the community, where the bulk of evidence exists in other populations (2, 3). And yet, no

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