



Pulmonary Rehabilitation after a Chronic Obstructive Pulmonary Disease Exacerbation: Impact on Readmission Risk in a Real-World Setting

Chronic Obstructive Pulmonary Disease (COPD) is a highly prevalent chronic illness with significant associated morbidity and mortality (1). Currently, the third leading cause of death worldwide, it places a considerable burden on the patient, family, and society owing to a progressive decline in health status, increases in disability-associated life-years and years of life lost, and high healthcare utilization (2, 3). The high prevalence of COPD even in high-income nations, despite the presence of robust healthcare systems, suggests that current services to address this disease remain inadequate (3).

Exacerbations are major events in the lives of individuals with COPD, as they lead to even further deterioration in health status, disease progression, hospitalizations and readmissions, and increased mortality (2, 4). Pulmonary rehabilitation (PR), a highly effective intervention for stable COPD (5, 6), delivers benefits that match or exceed those of bronchodilator therapy, with lower costs per quality-adjusted life-year (7). PR is also effective when provided soon after an exacerbation, with significant improvements in exercise tolerance and health-related quality of life as well as reduced risk of readmission and improved survival (8, 9). Current guidelines recommend PR within 3 weeks of a hospitalization for COPD (5, 10, 11).

In this issue of the *Journal*, Stefan and colleagues (pp. 1015–1023) report on a large retrospective cohort of Medicare beneficiaries with COPD, examining the association between initiation of PR within 90 days of discharge and rehospitalization (12). The authors reviewed hospitalizations for fee-for-service Medicare beneficiaries 66 years and older who were hospitalized for a COPD exacerbation in 2014. Data were obtained from 4,446 hospitalizations and included 197,376 patients, of which 2,721 (1.5%) initiated PR within 90 days of discharge. For the full cohort, initiation of PR within 90 days compared with no PR or PR started after 90 days was associated with a lower all-cause readmission rate at 1 year (56.4% vs. 64.6%) and lower mean number of readmissions (1.2 vs. 1.5; $P < 0.001$). Number of days spent in hospital per person-year was also lower in those who initiated PR within 90 days of discharge (11.5 vs. 22.6), and those who initiated PR also spent fewer days in a nursing home after discharge. In a propensity-matched cohort adjusted for unbalanced patient covariates as well as community characteristics, the authors found that initiation of PR was also associated with a lower risk of COPD-specific rehospitalizations (hazard ratio, 0.86).

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Major strengths of the current study are the large cohort of individuals with COPD, the accuracy of data obtained regarding readmissions and death, and the real-world setting in which data were collected from multiple hospital settings across the United States. A previous meta-analysis relied on small randomized controlled trials, in which moderate quality evidence also showed that PR reduced hospital readmissions (odds ratio, 0.44); however, the results were heterogeneous, with four of eight studies showing large reductions in risk of hospital admission and four studies showing no effect (8). Another strength of the study is the use of methodology (multistate modeling), which allowed for a flexible approach to longitudinal data with different events, including the time-varying exposure to the PR intervention, recurrent readmissions, and the competing risk of death.

There are, however, some limitations to the study. First and foremost, this is an observational study, and therefore patients were not matched and randomized to treatment (PR). Compared with patients who did not initiate PR or who started after 90 days, those who initiated PR within 90 days of discharge were younger, more likely to be non-Hispanic White, and tended to live closer to a PR facility. They also had lower comorbidity and frailty scores. Although findings remained significant after propensity-matched analysis and landmark analysis, the potential for unmeasured confounding remains. The Centers for Medicare and Medicaid services database allows for accurate identification of certain factors, including readmissions, death, tobacco use, comorbidities, and county characteristic; however, it is lacking in additional significant details, such as objective data for disease severity (Pulmonary Function Testing), adherence to recommended pharmacotherapy, willingness to participate in the intervention, number and type of PR sessions delivered, and other social and environmental factors that are well-documented barriers to initiating PR. The study population was also limited to patients 66 years of age and enrolled in fee-for-service Medicare; therefore, the results may not be generalizable to younger patients and those enrolled in other health plans. Finally, given the small numbers of patients that attended PR, self-selection and healthy user bias may overestimate the association between PR and readmission.

Despite these limitations, the current study underscores some critical issues that deserve our attention. The risk of readmissions in both groups (those that received PR and those that did not) is unacceptably high; 56.4–64.5% of patients were readmitted at least once in the year after their index admission. Of almost 200,000 patients, only 2,721 (1.5%) initiated PR within 90 days, a generous time frame given current guideline recommendations (5, 10, 11). Other data have shown that this poor rate of uptake for PR continues longitudinally, with only 1.9% of patients receiving PR within 6

months of hospitalization and 2.7% of patients receiving PR at 12 months postdischarge (13). Underutilization of effective treatment in the setting of high COPD readmission rates should be unacceptable and warrant swift action.

The issue of underutilization of PR is complex and includes multiple factors: lack of knowledge and subsequent referral to PR by healthcare providers, low uptake and completion rates for those patients who are referred to PR, and underfunding and poor institutional support for existing programs. This confluence of factors has led to a severe shortage of PR programs, geographic inaccessibility to many deserving patients, and subsequent health disparities (14, 15). There is cause for some optimism on the horizon, as novel models of PR delivery, such as home-based programs and telerehabilitation, are being developed under robust research efforts (16). This study, together with previously published companion pieces on PR participation and the association of PR posthospitalization and mortality (9, 13), should provide further ammunition and urgency to advocacy efforts that promote greater availability and accessibility to PR. Our patients deserve no less! ■

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