

Combined balance and pulmonary rehabilitation in older adults with chronic respiratory disease: A narrative review of fall risk and respiratory outcomes

Deepu. B^{1*}, Dr. Joseph E²

1 Research Scholar, Sunrise University, Alwar, Rajasthan, India

deepumpmt@gmail.com

2 Assistant Professor, Department of Physiotherapy, Sunrise University, Alwar, Rajasthan, India

Abstract: Background. Ageing brings decline in musculoskeletal integrity, postural control and respiratory efficiency. Older adults with chronic respiratory conditions such as chronic obstructive pulmonary disease, asthma and interstitial lung disease face compounded risks of impaired balance, reduced pulmonary function and falls. The interaction between respiratory and balance impairment creates a case for rehabilitation strategies that address both together.

Objective. This narrative review examines what is known about balance impairment and fall risk in older adults with chronic respiratory disease, what pulmonary rehabilitation achieves in this age group, and whether adding balance-oriented training to rehabilitation reduces fall risk or improves respiratory outcomes.

Approach. Observational studies, randomised trials, prospective cohort studies and systematic reviews addressing balance, falls, respiratory muscle function and pulmonary rehabilitation in older adults with chronic respiratory disease were examined.

Findings. Postural control is impaired in chronic obstructive pulmonary disease relative to age-matched peers, and fall rates are correspondingly raised. Pulmonary rehabilitation delivers measurable benefit across all age bands, including patients over 85. Programmes incorporating balance-oriented or supplementary training improved dynamic balance, chest mobility and expiratory muscle strength in prospective studies. Evidence that rehabilitation reduces falls themselves remains weak and inconsistent, and adults over 80 remain at substantially higher residual fall risk after rehabilitation than younger patients.

Conclusion. Age alone is not a reason to withhold pulmonary rehabilitation. Balance-oriented components improve functional and respiratory measures, but fall prevention in the oldest patients requires explicit attention rather than being assumed to follow from rehabilitation itself.

Keywords: older adults; pulmonary rehabilitation; balance training; fall risk; chronic respiratory disease; respiratory muscle function

1. INTRODUCTION

Ageing is accompanied by a decline in physiological function that includes musculoskeletal integrity, postural control and respiratory efficiency. Older individuals, particularly those with chronic respiratory conditions such as chronic obstructive pulmonary disease (COPD), asthma and interstitial lung disease, face increased risks of impaired balance, reduced pulmonary function and heightened susceptibility to falls [1]. The interplay between respiratory and

balance impairment in these individuals creates a clear need for rehabilitation strategies that address both concerns at once. In this context, integrating balance training with pulmonary rehabilitation has emerged as a promising approach to improving stability, reducing fall risk and supporting respiratory efficiency in older patients.

Chronic respiratory disease has a substantial effect on balance and mobility. Breathlessness, muscle weakness, fatigue and reduced oxygenation lower habitual physical activity, which in turn erodes muscle strength and postural control. Impaired respiratory function also compromises core stability, since the diaphragm and intercostal muscles contribute to postural equilibrium. Frequent exacerbations and prolonged inactivity accelerate deconditioning and raise fall risk further. Older adults with respiratory disorders show a higher prevalence of falls arising from dizziness, altered gait and orthostatic hypotension, reflecting both disease pathology and the side effects of medication.

Pulmonary rehabilitation is a structured, multidisciplinary intervention designed to improve exercise capacity, symptom burden and quality of life in chronic respiratory disease. Conventional programmes combine breathing exercises, endurance training and education in energy conservation. They improve respiratory muscle strength, reduce dyspnoea and support the performance of daily activities. Conventional rehabilitation does not, however, directly target balance or fall risk, and this leaves a gap in comprehensive care for older patients.

Balance training focuses on proprioception, muscle coordination and postural control. For older patients with respiratory disorders, it may counteract weakness and instability and so reduce the likelihood of falling. Static and dynamic balance drills, proprioceptive work and lower-limb strengthening improve neuromuscular coordination and postural stability. Balance training may also benefit respiratory function indirectly, by improving endurance and mobility so that patients participate more fully in rehabilitation exercise, and by preventing injuries that would otherwise lead to further immobility and respiratory decline. This review examines how far the available evidence supports these expectations.

2. SCOPE OF THIS REVIEW

This is a narrative review drawing on observational studies, randomised trials, prospective cohort studies and systematic reviews concerned with postural control, falls, respiratory muscle function and pulmonary rehabilitation in older adults with chronic respiratory disease.

3. BALANCE IMPAIRMENT AND FALL RISK IN CHRONIC RESPIRATORY DISEASE

That postural control is impaired in COPD is now well established. A systematic review of postural control in this population brought together the evidence for deficits relative to healthy peers [2], and controlled studies using clinical balance measures reached the same conclusion [3]. Observational work confirmed impairment on laboratory and clinical measures alike [4].

These deficits translate into falls. An observational cohort study documented fall frequency in people with COPD [5], and an earlier analysis had already argued that the fall burden in this group warranted dedicated investigation rather than being treated as incidental to the respiratory diagnosis [6]. Balance has also been shown to relate to objectively monitored physical activity in older patients with COPD, linking postural capability to the activity levels that rehabilitation seeks to raise [7].

Reporting practice across this literature is inconsistent. The prevalence of fallers, the incidence rate of falls and the frequency of falls per person have each been used as the headline measure, which complicates comparison between studies and makes prospective recording with a standard definition an urgent methodological need.

4. PULMONARY REHABILITATION IN OLDER ADULTS

The scope and standards of pulmonary rehabilitation are set out in the joint statement of the American Thoracic Society and European Respiratory Society, which describes its components and the evidence supporting them [8].

Whether older patients derive comparable benefit has been examined directly. A retrospective analysis of 3,157 patients with COPD referred to inpatient rehabilitation in Switzerland between 2013 and 2019 assessed the Functional Independence Measure, the Feeling Thermometer and the six-minute walk test at admission and discharge. Programmes ran six days a week for a mean of 18.85 days. All three measures improved significantly in every age band, and the percentage gains did not differ significantly between age groups, including patients over 85 years [9]. Age alone therefore provides no basis for withholding rehabilitation.

5. BALANCE-ORIENTED TRAINING WITHIN PULMONARY REHABILITATION

The evidence that rehabilitation improves balance, and the evidence that it reduces falls, are not the same thing, and they point in different directions.

A systematic review examining the effect of rehabilitation on mortality, balance and fall risk in stable COPD screened 3,216 records and included seven studies, none of which addressed falls exclusively. Findings on balance were inconsistent across the two cohort studies, with a favourable effect in one. Two randomised trials examined survival, one reporting a significant benefit at one year and the other none at three years; both were underpowered and neither had survival as its primary outcome. The authors concluded that the evidence for a meaningful effect on balance or survival was weak and equivocal [10].

Prospective studies of rehabilitation with additional training components have been more encouraging on functional measures. In 51 older adults with chronic respiratory disease undertaking a three-week programme combining speleotherapy with endurance and strength training, half showed below-average chest mobility at baseline. After the programme, mean Four Square Step Test time fell from 10.2 ± 1.9 s to 9.1 ± 1.7 s and mean chest mobility rose from 4.5 ± 5.5 cm to 5.4 ± 2.8 cm, both significant changes [11]. A companion study of respiratory muscle function in 44 completers aged 65 and over recorded significant improvement in maximum inspiratory pressure, sniff nasal inspiratory pressure and maximum expiratory pressure (all $P < 0.05$), although in participants over 70 only the 9.3 cmH₂O gain in maximum expiratory pressure reached significance — leading the authors to suggest greater emphasis on inspiratory muscle training [12].

The most direct evidence on residual fall risk comes from a retrospective parallel-group study of in-hospital rehabilitation comparing patients above and below 80 years, using a gait speed of 0.8 m/s or less to identify fall risk. Older patients began with more severe symptoms, lower physical performance and exercise capacity and higher fall risk ($P = 0.0001$). Both groups improved after rehabilitation with no significant difference between them, but 53.4% of those over 80 remained at risk of falling compared with 17.5% of younger patients ($P = 0.0001$). The authors concluded that fall prevention should be an explicit component of rehabilitation for patients over 80 [13].

Finally, a randomised trial of six months of balance training delivered during rehabilitation reported improvement in health-related quality of life, fatigue and mood in patients with COPD, indicating that the benefits of a balance component extend beyond postural measures alone [14].

Table 1. Studies of pulmonary rehabilitation, balance and fall risk in older adults discussed in this review.

Study	Design and participants	Intervention	Key findings
Spielmanns et al. (2023) [9]	Retrospective cohort; 3,157 patients with COPD, 2013–2019	Inpatient pulmonary rehabilitation, mean 18.85 days, six days weekly	Six-minute walk test, Feeling Thermometer and Functional Independence Measure improved significantly in every age band including patients over 85; percentage gains did not differ across age groups
Hakamy et al. (2017) [10]	Systematic review; seven studies from 3,216 records, stable COPD	Pulmonary rehabilitation	Effect on balance favourable in one of two cohort studies; two underpowered randomised trials of survival gave discordant results; evidence judged weak and equivocal
Metel et al. (2022) [11]	Prospective study; 51 older adults with chronic respiratory disease	Three-week subterranean rehabilitation with endurance and strength training	Four Square Step Test time fell from 10.2 ± 1.9 s to 9.1 ± 1.7 s; chest mobility rose from 4.5 ± 5.5 cm to 5.4 ± 2.8 cm

Study	Design and participants	Intervention	Key findings
Metel et al. (2023) [12]	Prospective study; 44 completers aged 65 years and over	Three-week subterranean rehabilitation	Maximum inspiratory pressure, sniff nasal inspiratory pressure and maximum expiratory pressure all improved ($P < 0.05$); above age 70 only maximum expiratory pressure improved significantly (+9.3 cmH ₂ O)
Tarasconi et al. (2023) [13]	Retrospective parallel-group study; patients above versus below 80 years	In-hospital pulmonary rehabilitation	Both age groups improved with no significant between-group difference, but 53.4% of those over 80 remained at fall risk versus 17.5% of younger patients ($P = 0.0001$)
Mkacher et al. (2015) [14]	Randomised controlled trial; patients with COPD	Six months of balance training during pulmonary rehabilitation	Improvement in health-related quality of life, fatigue and mood

6. DISCUSSION

Taken together, the evidence supports three propositions with differing degrees of confidence. That balance and postural control are impaired in chronic respiratory disease is firmly established. That pulmonary rehabilitation improves functional status, walking capacity and

perceived health in older patients, including the very old, is well supported. That rehabilitation reduces the number of falls sustained is not established, and the systematic review evidence describes the case as weak and equivocal.

The gap between improved balance measures and unchanged fall outcomes deserves attention rather than elision. Balance instruments assess capability under supervised conditions; falls occur in unstructured environments where fatigue, medication effects, footwear, lighting and comorbidity intervene. The residual fall risk observed in patients over 80 after rehabilitation — more than half still at risk on gait speed criteria — illustrates the point directly: rehabilitation improved their measured performance without moving most of them out of the risk category.

Comorbid depression is a further consideration in this population, having been identified among predictors of all-cause mortality in patients with severe COPD admitted for rehabilitation [15]. Mood, adherence and functional gain are not independent of one another, and a balance component that improves mood may support engagement with the wider programme even where its direct postural effect is modest.

The practical implication is that fall prevention in older patients should be designed into rehabilitation as an explicit objective, with its own assessment, targets and follow-up, rather than treated as a by-product of exercise training. Consistent prospective recording of falls, using an agreed definition, is the precondition for evaluating whether that design works.

7. LIMITATIONS OF THIS REVIEW

This is a narrative rather than a systematic review. Studies were not identified through a registered protocol, no formal risk-of-bias appraisal was undertaken, and no quantitative synthesis was attempted. The studies discussed vary in design, setting, participant age and severity, intervention content and outcome measures; several are retrospective or single-centre. The conclusions offered are an orientation to the current evidence rather than an estimate of effect.

8. CONCLUSION

Older adults with chronic respiratory disease show impaired postural control and elevated fall risk, and both worsen with age. Pulmonary rehabilitation benefits patients in every age band examined, including those over 85, and age alone is not a reason to withhold it. Programmes

incorporating balance-oriented or supplementary training improve dynamic balance, chest mobility and expiratory muscle strength. What the evidence does not yet show is that any of this reduces the number of falls older patients actually sustain; more than half of patients over 80 remain at fall risk after completing rehabilitation. Fall prevention for the oldest patients therefore needs to be an explicit component of programme design, supported by prospective fall recording and by trials powered for fall outcomes rather than for balance measures alone.

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