They also summarize the published and ongoing trials on newer pharmacological approaches targeting the various classes of pulmonary hypertension (PH).

As this review outlines the modern interventional approaches, we would like to highlight the role of exercise-based cardiopulmonary rehabilitation (EBCR) for PH. Exercise intolerance, which is a hallmark of PH, is known to occur from a complex interplay of physiological mechanisms, of which a few have been known to respond to exercise training. Much of the exercise training programs to date have focused on either supervised or hybrid training (ie, supervised followed by home based) that include a combination of aerobic and resistance training, with only a few home-based programs. The recent statement by the European Respiratory Society wonderfully elucidates the process of exercise-based evaluations and exercise prescription through a systematic search of the available evidence. Overall, EBCR has shown improvements in 6-minute walk distance, peak oxygen consumption, and workload by 53 to 72 m, 1.5 to 2.2 mL/kg per minute, and 14.9 W, respectively. These changes have been accompanied by improvements in quality of life and cardiac index (at rest and maximal exercise), along with significant reductions in mean pulmonary arterial pressure and pulmonary vascular resistance at rest. These findings indicate that EBCR, among those stabilized with pharmacotherapy, would favorably affect functional capacity and quality of life in patients with PH. However, the long-term effects of EBCR on survival and disease progression are yet to be ascertained. In light of the current pandemic, there is a need to consider the use of alternate models of delivery of EBCR using technology-driven models.

All things considered, we firmly believe that exercise-based interventions are imperative to the holistic management of patients with PH. As mentioned in the recent European Respiratory Society statement, “individually adjusted exercise training rehabilitation programs supervised by PH expert centres and rehabilitation professionals are likely to be safe for patients with PH who are stable on medical therapy,” with special emphasis on “stable medical therapy.” Once again, we commend the authors for their excellent work on this complex topic.

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Grant Support: The work was supported by the junior and senior research fellowships (S.S. and G.P., respectively) from the Indian Council of Medical Research, Government of India through the research grant 5/4/1-9/2019-NCD-II.

Potential Competing Interests: The authors report no competing interests.

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https://doi.org/10.1016/j.mayocp.2021.11.005

In reply—Exercise-Based Cardiopulmonary Rehabilitation: A Suitable Addition to Pharmacological Therapy for Pulmonary Hypertension

I am thankful for kind comments by Babu et al1 regarding our recent focused review of pulmonary hypertension. They have also provided an argument favoring the addition of exercise-based cardiopulmonary rehabilitation to medical therapy for pulmonary arterial hypertension (PAH), noting that this topic was not addressed in the review. There was no intention to provide a comprehensive review, and omitted certain topics that seemed more appropriate for guideline statements or Task Force reviews as highlighted by Babu et al.

Current recommendations for treatment of PAH have considered structured exercise potentially beneficial, as measured most commonly by improvement in 6-minute walk distance. Indeed, the 2015 European Society Cardiology/European Respiratory Society guidelines recommended a supervised and closely monitored exercise and respiratory training program in specialized clinics as an add-on to medical therapy for stable patients with pulmonary hypertension (class II, level of evidence B), recognizing the limited published literature confirming benefits.2

More recently as noted by Babu et al, a literature review summary produced by a European Respiratory
Society Task Force led by Grünig et al\textsuperscript{3} resulted in a firmer recommendation favoring benefits. The objectives of this European Respiratory Society Task Force were to summarize the current state of knowledge and open questions regarding the clinical effects of exercise training, training modalities, and mechanisms of action in patients with PAH.

The literature was summarized by the Task Force as follows: exercise training has been found to improve exercise capacity, muscular function, quality of life, and possibly right ventricular function and pulmonary hemodynamics. The Task Force then tempered their findings by admitting that further studies are needed to confirm these data, to investigate the effect on risk profiles, and to identify the most advantageous training methodology and underlying pathophysiological mechanisms.

There is appreciation for the enthusiastic endorsement of exercise training by Babu et al; however, there are multiple challenges including methodological flaws in currently published studies and lack of standardization of the training components in cardiopulmonary programs for PAH. In addition, randomized controlled trials investigating the effect of exercise training on disease progression and survival are still lacking.

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Potential Competing Interests: The author reports no competing interests.