survived, highlighting the complex nature of decisions in the current COVID-19 landscape.

The major limitation of our study is its retrospective and single-center nature. There were a number of variables inadequately recorded in electronic notes. There are missing clinical observation data; however, these missing data are clearly highlighted in our summaries and do not prevent analysis.

Our study suggests that the ROX index is a useful predictor of failure of HFNC in COVID-19 respiratory failure to identify patients early who are likely to require MV, as suggested in earlier studies, and warrants prospective validation studies in this setting. In addition to existing literature, our data also support HFNC use guided by ROX index in individuals who have do-not-intubate orders as the ceiling of care, who have hitherto been excluded from published analyses. Further studies are required to characterize the role of the ROX index and risk stratification of HFNC failure to guide resource management and palliative care decision-making in patients deemed not suitable for MV.

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References

1 Coronaviridae Study Group of the International Committee on Taxonomy of Viruses. The species severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nat Microbiol* 2020;5:536–544.
2 Docherty AB, Harrison EM, Green CA, Hardwick HE, Pius R, Norman L, *et al*. Features of 16,749 hospitalised UK patients with COVID-19 using the ISARIC WHO Clinical Characterisation Protocol [preprint]. *medRxiv*; 2020 [accessed 2020 May 11]. Available from: https://www.medrxiv.org/content/10.1101/2020.04.23.20076042v1.
3 Delclaux C, L'Her E, Alberti C, Mancebo J, Abroug F, Conti G, *et al*. Treatment of acute hypoxemic nonhypercapnic respiratory insufficiency with continuous positive airway pressure delivered by a face mask: a randomized controlled trial. *JAMA* 2000;284:2352–2360.
4 Frat JP, Thille AW, Mercat A, Girault C, Ragot S, Perbet S, *et al*.; FLORALI Study Group; REVA Network. High-flow oxygen through nasal cannula in acute hypoxemic respiratory failure. *N Engl J Med* 2015;372:2185–2196.
5 Cosentini R, Brambilla AM, Aliberti S, Bignamini A, Nava S, Maffei A, *et al*. Helmet continuous positive airway pressure vs oxygen therapy to improve oxygenation in community-acquired pneumonia: a randomized, controlled trial. *Chest* 2010;138:114–120.
6 Roca O, Messika J, Caralt B, García-de-Acilu M, Sztrymf B, Ricard JD, *et al*. Predicting success of high-flow nasal cannula in pneumonia patients with hypoxemic respiratory failure: the utility of the ROX index. *J Crit Care* 2016;35:200–205.
7 Roca O, Caralt B, Messika J, Samper M, Sztrymf B, Hernández G, *et al*. An index combining respiratory rate and oxygenation to predict outcome of nasal high-flow therapy. *Am J Respir Crit Care Med* 2019;199:1368–1376.
8 Blez D, Soulier A, Bonnet F, Gayat E, Garnier M. Monitoring of high-flow nasal cannula for SARS-CoV-2 severe pneumonia: less is more, better look at respiratory rate. *Intensive Care Med* 2020;46:2094–2095.
9 Zucman N, Mullaert J, Roux D, Roca O, Ricard JD; Contributors. Prediction of outcome of nasal high flow use during COVID-19-related acute hypoxemic respiratory failure. *Intensive Care Med* 2020;46:1924–1926.
10 National Institute for Health and Care Excellence. Overview COVID-19 rapid guideline: critical care in adults. 2020; [accessed 2020 Aug 5]. Available from: https://www.nice.org.uk/guidance/ng159.
11 Vincent JL, Taccone FS. Understanding pathways to death in patients with COVID-19. *Lancet Respir Med* 2020;8:430–432.

The Relation between Persistent Poor Health after COVID-19 and Respiratory Complications or Initial Disease Severity

To the Editor:

We read with interest the recent article by Townsend and colleagues that described respiratory recovery and self-reported health at the time of outpatient attendance after coronavirus disease (COVID-19) infection (1). The authors graded participants into three groups by initial severity (not requiring admission, requiring hospital admission, and requiring intensive care unit [ICU] care) by an analysis of chest radiography, a 6-minute walk test (6MWT), fatigue, frailty, subjective return to health, and some inflammatory markers (1). The authors concluded that none of the measures of persistent respiratory disease were associated with initial disease severity (1).

Because self-reported health and symptoms such as fatigue have an essentially subjective basis, the study is limited by its analysis of only a chest radiograph. This study should be complemented with computed tomography (CT) or lung function, as the follow-up protocols of scientific societies include lung function among their main evaluations (2). This takes on particular importance because, in Townsend and colleagues' study, persistent chest radiograph abnormalities attributable to COVID-19 were seen in only 4% of patients (5/115) (1), but other authors have shown approximately 70% persistence of altered CT at 3-month follow-up (3).

We believe that lung function should be incorporated into this type of analysis to allow an assessment of how the respiratory system is working. A recent meta-analysis has shown that altered diffusion persists in 36% of patients with nonsevere COVID-19 and 66% of patients with severe COVID-19 between 1 and 3 months after infection (4). A recent study has reported a reduced diffusion capacity in 22% of patients without oxygen requirements and in 56% of patients with ICU requirements 6 months after the infection (5). These results reinforce the picture of greater functional respiratory compromise in the most severe patients. Without lung function assessment, it is particularly difficult to establish a strong relationship between respiratory complications and poor post–COVID-19 health.

One of the most relevant assessments in the follow-up of patients after COVID-19 is physical capacity, and the 6MWT is a useful instrument that is widely used in healthy subjects and for studying many diseases (6). This test provides useful information not only about physical capacity but also about exertional desaturation (6). The authors used this test, but only 71% of the subjects were able to perform it (1). One wonders what happened to those who could not perform the test, whether they suffered the most severe cases, and how many of them were in the ICU. This information is relevant as recent studies of patients after COVID-19 have reported a significant reduction in the distance walked in the 6MWT and a significant connection between the number of patients with scores less than the lower limit and the severity of the disease (5). It would also be useful to see the score as a percentage of the recommended reference values (6).

Finally, the common characteristic of the studies described above is that they have a significant number of patients across the entire spectrum of severity (3–5). In Townsend and colleagues, of the 487 patients who were offered a follow-up appointment, only 153 (31.4%) accepted, of whom only 19 (3.9%) had been in the ICU. It is difficult to establish how representative this group is of the COVID-19 population, which represents the clear possibility of selection bias.

The study by Townsend and colleagues is an important step in investigating the possible causes of the persistence of symptoms and the functional sequelae after COVID-19, but future investigations should incorporate lung function or CT and use a more representative sample so that the consequences after COVID-19 infection can be analyzed while minimizing the risk of misinterpretation.

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References

1 Townsend L, Dowds J, O'Brien K, Sheill G, Dyer AH, O'Kelly B, *et al*. Persistent poor health after COVID-19 is not associated with respiratory complications or initial disease severity. *Ann Am Thorac Soc* 2021:18:997–1003.
2 George PM, Barratt SL, Condliffe R, Desai SR, Devaraj A, Forrest I, *et al*. Respiratory follow-up of patients with COVID-19 pneumonia. *Thorax* 2020; 75:1009–1016.
3 Zhao YM, Shang YM, Song WB, Li QQ, Xie H, Xu QF, *et al*. Follow-up study of the pulmonary function and related physiological characteristics of COVID-19 survivors three months after recovery. *EClinicalMedicine* 2020;25:100463.
4 Torres-Castro R, Vasconcello-Castillo L, Alsina-Restoy X, Solís-Navarro L, Burgos F, Puppo H, *et al*. Respiratory function in patients post-infection by COVID-19: a systematic review and meta-analysis. *Pulmonology* [online ahead of print] 25 Nov 2020; DOI: 10.1016/j.pulmoe.2020.10.013.
5 Huang C, Huang L, Wang Y, Li X, Ren L, Gu X, *et al*. 6-month consequences of COVID-19 in patients discharged from hospital: a cohort study. *Lancet* 2021;397:220–232.
6 Holland AE, Spruit MA, Troosters T, Puhan MA, Pepin V, Saey D, *et al*. An official European Respiratory Society/American Thoracic Society technical standard: field walking tests in chronic respiratory disease. *Eur Respir J* 2014;44:1428–1446.

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Reply: The Relation between Persistent Poor Health after COVID-19 and Respiratory Complications or Initial Disease Severity

From the Authors:

We appreciate the comments of Torres-Castro and colleagues and welcome the opportunity to provide further details on respiratory follow up and ill-health in our post–coronavirus disease (COVID-19) cohort (1). Our study was a pragmatic approach to the follow up of COVID-19 survivors, in line with current published recommendations (2). This approach allowed for the entire spectrum of acute COVID-19 infections to be evaluated, from those managed in the community to those admitted to the intensive care unit (ICU). We included all patients attending the clinic in our analysis, regardless of completion of all assessments, to