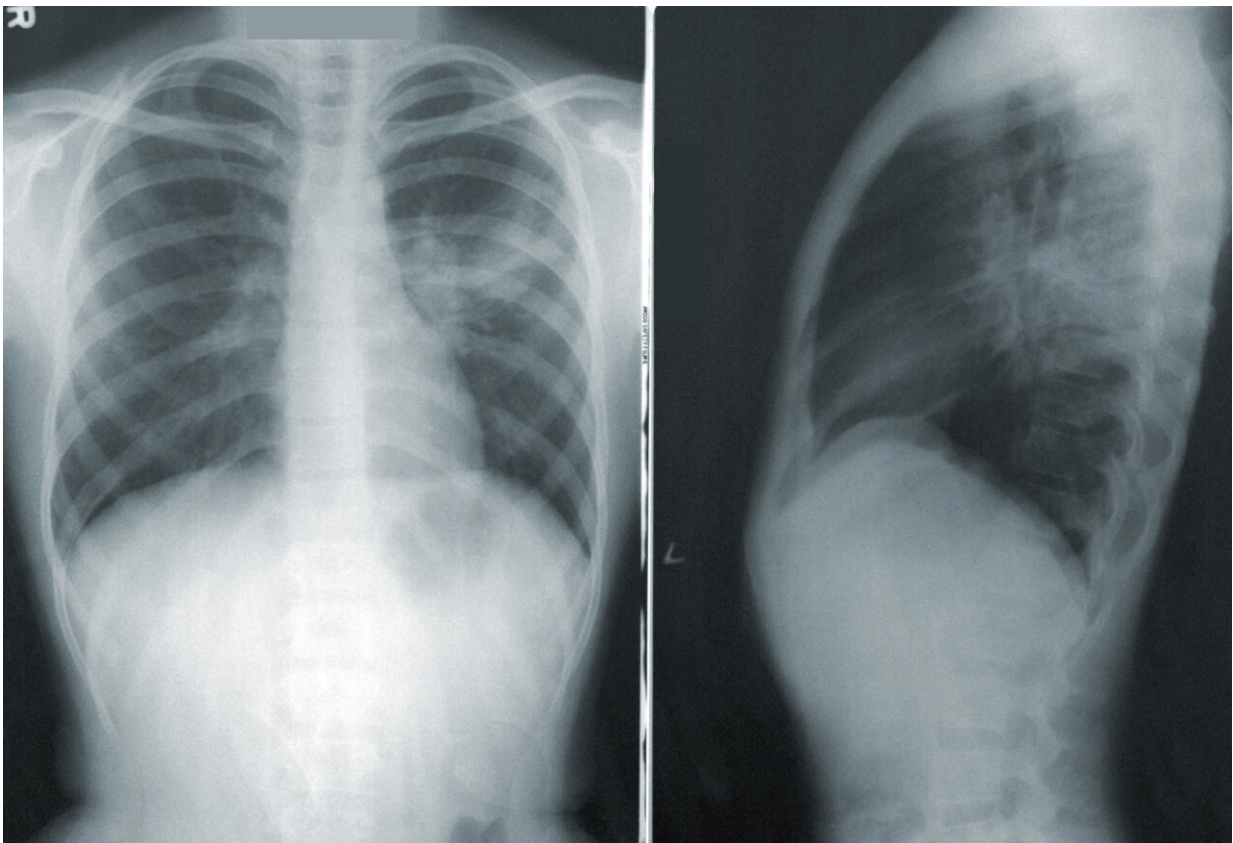# New computational technique reveals changes to lung function post COVID-19 infection

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Credit: Unsplash/CC0 Public Domain

As a respiratory disease, COVID-19 infection mainly affects the lungs.

While most people recover completely, a significant number of individuals experience symptoms that can persist for weeks or months post COVID infection, sometimes referred to as "long COVID." It remains unclear whether these symptoms are associated with any long-term damage that reduces the function of the lungs and respiratory system.

To investigate this, a study led by University of Oxford researchers used a novel computational approach to assess how COVID-19 may affect long-term lung function. The results have been published in the *Journal of Applied Physiology*.

The study was based on 178 participants who were grouped into four categories:

1. Control participants, who had not had COVID-19;
2. Those who had COVID-19 and were managed in the community;
3. Those who were hospitalized with COVID-19 but not admitted to an intensive care unit (ICU);
4. Those who were admitted to an ICU with severe COVID-19 and in most cases received invasive mechanical ventilation.

The participants were studied six months and twelve months after COVID-19 infection, using a novel computational approach to assess lung function.

Key findings

- Prior COVID-19 infection was associated with more uneven inflation of the lungs during normal breathing. This is something that is part of normal aging in the lung. The changes seen after COVID-19 in this study are roughly equivalent to those associated with 15 years of normal aging, but are still much

smaller than those seen in established lung disease.

- There was an association between hospitalization with COVID-19 and smaller lung volumes, but it is not known whether the smaller volumes are caused by COVID-19 infection, or instead represent a predisposing factor for more severe infection.
- Admission to the ICU was associated with an enlarged respiratory dead space (the volume of gas that is breathed into the lungs but does not participate in gas exchange). This may have been caused by COVID-19 infection, but equally may have been caused by the process of mechanical ventilation.

The research team assessed lung function using a novel technique called computed cardiopulmonography. In this method, participants breathe through a mouthpiece connected to the measuring device that uses lasers to take highly precise measurements of gas composition. These measurements are then fed into a computational model of the respiratory and cardiovascular systems to estimate values for aspects relating to the individual's lung function. For each individual, the model was adjusted to take into account physiological factors that can influence lung function, such as sex, age, height, and body mass.

This technique has already been shown capable of predicting whether patients with asthma required an increase in their medication. It also shows promise as a method to detect sub-clinical lung disease, opening the possibility of eventually treating patients earlier to prevent the onset of more significant disease.

Lead author Professor Peter Robbins, from the University of Oxford's Department of Physiology, Anatomy and Genetics, said, "Our study illustrates the capability of this new technique to study aspects of lung function not so easily measured through standard clinical tests. However, without measurements prior to infection, it is not possible to conclude

whether these differences result directly from COVID-19 infection, or whether they are actual risk factors associated with the lungs that predispose towards more serious disease."

Respiratory Consultant Dr. Nayia Petousi, from the University of Oxford's Nuffield Department of Medicine and one of the clinical leads for the study, said, "We hope that by providing insight into the understanding of post-COVID effects on the lungs the results can be of help in the clinical management of patients."

More information: Snapper R. M. Magor-Elliott et al, Altered lung physiology in two cohorts post COVID-19 infection as assessed using computed cardiopulmonography, *Journal of Applied Physiology* (2022). DOI: 10.1152/japplphysiol.00436.2022

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