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## Diagnostic accuracy of thoracic imaging modalities for the detection of COVID-19

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### Abstract

The ongoing coronavirus disease 2019 (COVID-19) pandemic continues to present diagnostic challenges. The use of thoracic radiography has been studied as a method to improve the diagnostic accuracy of COVID-19. The 'Living' Cochrane Systematic Review on the diagnostic accuracy of imaging tests for COVID-19 is continuously updated as new information becomes available for study. In the most recent version, published in March 2021, a meta-analysis was done to determine the pooled sensitivity and specificity of chest X-ray (CXR) and lung ultrasound (LUS) for the diagnosis of COVID-19. CXR gave a sensitivity of 80.6% (95%CI: 69.1-88.6) and a specificity of 71.5% (95%CI: 59.8-80.8). LUS gave a sensitivity rate of 86.4% (95%CI: 72.7-93.9) and specificity of 54.6% (95%CI: 35.3-72.6). These results differed from the findings reported in the recent article in this journal where they cited the previous versions of the study in which a meta-analysis for CXR and LUS could not be performed. Additionally, the article states that COVID-19 could not be distinguished, using chest computed tomography (CT), from other respiratory diseases. However, the latest review version identifies chest CT as having a specificity of 80.0% (95%CI: 74.9-84.3), which is much higher than the previous version which indicated a specificity of 61.1% (95%CI: 42.3-77.1). Therefore, CXR, chest CT and LUS have the potential to be used in conjunction with other methods in the diagnosis of COVID-19.

**Key Words:** COVID-19; Chest x-ray; Computed tomography; Lung ultrasound; Specificity and sensitivity; Diagnostic accuracy

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**Core Tip:** The global coronavirus disease 2019 (COVID-19) outbreak has greatly impacted the world, with almost 200 million cases worldwide and more than 4 million deaths (as of July 21, 2021). Reverse transcriptase polymerase chain reaction is the current gold-standard for diagnosing COVID-19, but due to a diagnostic error rate greater than 10%, alternate modes of diagnosis are needed. Our review demonstrates that chest X-ray, chest computed tomography and lung ultrasound may have the potential to aid healthcare workers in the diagnosis of COVID-19.

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## TO THE EDITOR

We appreciate Kumar *et al*[1] consideration of our study in their paper on the discrepancies in the clinical and radiological profiles of coronavirus disease 2019 (COVID-19)[1]. In this paper, the use of chest computed tomography (CT), chest X-ray (CXR), and lung ultrasound (LUS) as possible diagnostic tools for the COVID-19 is discussed. The authors cite the findings from two versions of the Cochrane Review titled “Thoracic imaging tests for the diagnosis of COVID-19.” As more information becomes available, this systematic review has aimed to keep pace with the new data. The most recent version of the review, published in March 2021, has shown differences in the sensitivities and specificities of these three image modalities compared to the findings in prior versions reported in the article by Kumar *et al* [1].

Firstly, the authors cited the initial review by Salameh *et al*[2], which determined that CXR had a pooled sensitivity of CXR is 82.1% (95%CI: 62.5-92.7)[1,2] in patients who had COVID-19. The second version of the review, by Islam *et al*[3], determined that CXR had a sensitivity ranging from 56.9% to 89.0% and specificity ranging from 11.1% to 88.9%[1,3] in patients with COVID-19. As opposed to the first two versions, in the third and most recent version, there was a sufficient number of studies, evaluating the diagnostic accuracy of CXR, to perform a meta-analysis. The updated version of the review conducted a meta-analysis with 9 studies and 3694 participants for CXR. The following imaging modality had sensitivity and specificity of 80.6% (95%CI: 69.1-88.6) and 71.5% (95%CI: 59.8-80.8)[4], respectively. These findings demonstrate that CXR is moderately sensitive and moderately specific to COVID-19, and may have the potential to be used as a secondary method for diagnosis, however, due to the limited number of studies, accuracy estimates must be carefully interpreted[4]. In the upcoming fourth version of the systematic review, additional studies evaluating CXR have been included. In this review, additional analyses have been done to support our conclusion, and potential sources of variabilities in CXR accuracy estimates will be discussed.

Secondly, the article by Kumar *et al*[1] states that chest CT may not be capable of discriminating COVID-19 from other respiratory diseases[1]. The review by Salameh *et al*[2] obtained a pooled specificity of 18.1% (95%CI: 3.71-55.8)[2] for chest CT, in cases where CT scans were used as the primary diagnostic test, which was subsequently updated to 61.1% (95%CI: 42.3-77.1) in the subsequent edition [3]. The third and most recent version identified that the specificity of chest CT has increased substantially to 80.0% (95%CI: 74.9-84.3), based on 41 studies with 16133 patients[4]. The improved specificity could be due to the stricter inclusion criteria for this version. In the most recent version, studies that published index test findings without clearly defining the images as positive or negative[4] for COVID-19, were excluded. An alternate explanation for the improved specificity could be the increase in studies that use well-developed definitions for index test positivity (*e.g.* Co-RADS)[4]. Furthermore, studies from the later stage of the pandemic were included with each review version which affected our specificity values through improved knowledge about the indications of COVID-19 in imaging results [4].

Lastly, the most recent version of the ‘Living’ Cochrane Systematic Review observed that in patients suspected of having COVID-19, LUS had a sensitivity and specificity rate of 86.4% (95%CI: 72.7-93.9) and 54.6% (95%CI: 35.3-72.6)[4], respectively. The accuracy estimates were produced through a meta-analysis including 5 studies with 446 patients[4]. These findings differ from the second review version cited by Kumar *et al*[1], which reported a sensitivity of 96.8% and sensitivity of 62.3% for LUS[1,3]. The second version of the review was based off of one study, therefore a meta-analysis was not completed[1, 3]. The increase in studies in the most recent version reduced the role of chance in our results, and provided a better picture of the diagnostic accuracy of LUS; however, the number of studies remains small and all data should be carefully interpreted.

In summary, the most recent version of the ‘Living’ Cochrane Systematic Review was able to perform further analyses on the diagnostic accuracy of CXR and LUS. The data demonstrates that CXR is moderately specific and moderately sensitive, while LUS is sensitive, but not specific for the diagnosis

of COVID-19. Additionally, the review demonstrated that chest CT is moderately specific for the diagnosis of COVID-19. We hope that future studies will be more rigorous and transparent when designing and reporting the findings of their study. We admire the continued interest in our systematic review and will update our review as more information on the diagnostic accuracy of these imaging modalities becomes available.

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## FOOTNOTES

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