

What can research evidence tell us about:

## The use of computed tomography (CT) for detecting COVID-19 Pneumonia:

### Rapid Evidence Review

[26 Jun 2020]

#### Key Message

*Computed tomography (CT) is not used for primary screening and diagnosis of COVID-19. But, it has very high detection capacity in later time and can be used for evaluation of COVID-19 pneumonia. For patients with suspected COVID-19 pneumonia but false negative RT-PCR, cross checking with CT and repeated RT-PCR is essential in order to avoid misdiagnosis.*

#### Summary of the review

- Use of CT as a first-line diagnostic or screening tool in COVID-19 is not beneficial
- For patients with suspected COVID-19 pneumonia but a false negative RT-PCR, cross checking with CT and repeated RT-PCR is essential in order to avoid misdiagnosis
- Chest CT offers a great sensitivity for detecting COVID-19 pneumonia among symptomatic individuals, especially in a severe situation
- Chest CT serves for evaluating potential complications, disease severity and progression of COVID-19 pneumonia
- The imaging feature of CT findings differ at early, intermediate and later stage of COVID-19 pneumonia
- The diagnosis of CT in children is difficult

#### What is Rapid evidence Review?

Rapid evidence review addresses the needs of policymakers and managers for research evidence that has been appraised and contextualized to a specific context in a matter of hours or days. This rapid evidence review goes beyond research evidence and integrates multiple types and levels of evidence

#### Where did this Rapid Evidence Review come from?

This document was created in response to issues related about effectiveness of CT to diagnose COVID-19 pneumonia. It was prepared by the Knowledge Translation Directorate, Ethiopian Public Health Institute.

#### **+** Included:

- Key findings from research findings

#### **X** Not included:

- Recommendations
- Detailed descriptions



#### Rapid and Responsive Evidence Partnership (RREP)



## Background

A number of cases with pneumonia occurred starting from December 2019 that had previously not been found in humans. Subsequently, World Health Organization named coronavirus disease 2019 (COVID-19). The clinical spectrum of COVID-19 ranges from asymptomatic to critically ill cases. Fever and cough are the most common manifestations in symptomatic adults. Not only patients with symptoms but also patients in the incubation period can become the source of infection. Therefore, early diagnosis is very important (Cuiping Bao X. L., 2020; Tu-Hsuan Chang, 2020).

The nucleic acid test or genetic sequencing serves as the gold standard method for confirmation of infection, yet several recent studies have reported false-negative results of RT-PCR (Zhao W, 2020). Insufficient cellular material or inadequate detection and extraction techniques were found to be reasons for the false-negative results (Araujo-Filho JAB, 2020). One of the challenges in managing COVID-19 is the identification of a swift, accessible, and reliable diagnostic modality that could serve as an alternative to RT-PCR (Wei J, 2020). In line with this, the diagnosis of COVID-19 requires comprehensive consideration of exposure history, clinical manifestations, laboratory tests, and imaging examinations (Tenda ED, 2020). It was suggested that patients with typical computed tomography (CT) findings but negative RT-PCR results should be isolated, and RT-PCR should be repeated to avoid misdiagnosis (Hamerow, 2020). Several countries are looking at the role of chest imaging for the diagnostic workup of patients with suspected or probable COVID-19 disease and to inform clinical management of COVID-19.

### How this Rapid Evidence Review was prepared?

The methods used to prepare in this rapid evidence review were adapted from the SURE Rapid Response Service:

[www.evipnet.org/sure/rr/methods](http://www.evipnet.org/sure/rr/methods)

AND

McMaster Health Forum, COVID-19 Evidence Network to support Decision-making, COVID-END

<https://www.mcmasterforum.org/networks/covid-end>

In this review, we have searched for relevant evidence about the effectiveness of CT imaging to diagnose COVID-19 pneumonia.

We identified the Population, Concept and Context (PCC) with respect to the objective of the review to facilitate searching of relevant articles.

**Population:** Human population

**Concept:** Imaging Diagnosis of COVID-19 pneumonia.

**Context:** Global studies were considered without restriction to any geographical context.

**Data sources:** We searched in PubMed, Cochrane Library, JBI Library, Epistemonikos, and Evidence aid databases.

This rapid evidence review therefore provides the best available evidence on the use of chest imaging, more specifically CT, for the detection of COVID-19 Pneumonia. This rapid review will support policy makers or clinicians in our setting on the use of CT for clinical management of COVID-19 patients but not intended to replace the clinical judgment or specialist consultation.

## Review findings

We found seven relevant systematic reviews that provide evidence about the effectiveness of CT imaging in COVID-19 pneumonia. The methodological quality of the included systematic reviews were assessed using AMSTAR. However, if scores were already made by authors of the included studies, we reported those rates. The summary of the findings from these documents are presented below. Besides, recommendation from the WHO guide on the use of chest imaging in COVID-19 is annexed in this document (Annex 1). The full report of the guide can also be available from: <https://www.who.int/publications-detail-redirect/use-of-chest-imaging-in-covid-19>.

### 1. Evidence about the effectiveness of CT for screening, diagnosis, and evaluation of COVID-19 pneumonia

We found four systematic reviews dealing with evidence on the use of CT in different stage of COVID-19 for screen and diagnose. Out of it, we found one systematic review about evaluating potential complications, disease severity and progression of COVID-19 pneumonia (Zhonghua Sun, 2020). The summary of the findings (when to use, and with whom it will be effective) are indicated in table 1 (Cuiping Bao X. L., 2020; Buyun Xu, 2020; Hyungjin Kim, 2020).

**Table 1:** Key findings of the most relevant systematic reviews about the CT effectiveness in screening and diagnosis of COVID-19 Pneumonia.

Type of document	Area of Focus	Key findings	Evidence quality (AMSTAR score)
Systematic reviews (n=4)	▪ Detection of COVID-19 by chest CT	➤ The detection of COVID-19 pneumonia with chest CT imaging is very high among symptomatic individuals	(5/10)
	▪ Diagnostic test accuracy of chest CT for detecting COVID-19	➤ Chest CT offers the great sensitivity for detecting COVID-19, especially in a region with severe epidemic situation. ➤ Chest CT provides a fast, convenient, and effective method to early recognize	(4/10)

		suspicious cases and might contribute to confine epidemic	
	▪ Screening or diagnosis	➤ Computed tomography scan for primary screening and diagnosis of COVID-19 not be beneficial in a low prevalence region due to substantial rate of false positive.	(7/10)
	▪ Chest CT imaging findings in the screening or diagnosis of COVID-19	➤ Use of CT as a first-line diagnostic or screening tool in COVID-19 is not recommended ➤ CT could serve as a complementary role in diagnostic, evaluating potential complications, disease severity and progression	(5/10)

## 2. Evidence on COVID-19 patients with typical CT findings

We found one relevant systematic review dealing with evidence on CT imaging feature in initial, later and follow up stage (Sana Salehi, 2020). Similarly, one systematic review indicated the challenge of CT diagnosis among children (Tu-Hsuan Chang, 2020). The key findings from the relevant one systematic review on feature of CT in COVID-19 pneumonia presented (Jieyun Zhu, 2020) in table 2.

**Table 2:** Key findings of the most relevant documents (systematic reviews) about the features of CT in COVID-19 pneumonia.

Type of document	Area of Focus	Key findings	Evidence quality (AMSTAR score)
Systematic reviews (n=3)	▪ Evidence about the features of CT imaging in COVID-19 pneumonia	➤ The most common chest CT findings were patchy and Ground glass opacities. ➤ The lung lesions of patients with COVID-19 mostly bilateral lungs or multilobar involved.	(8/11)
	▪ Evidence of CT features during initial and follow-up characteristics of COVID-19 pneumonia	➤ Initial CT findings include bilateral multilobar GGO with a peripheral or posterior distribution, mainly in the lower lobes and less frequently within the right middle lobe. ➤ In the later stages of the disease septal thickening, bronchiectasis, pleural thickening, and subpleural involvement are some of the less common findings ➤ Follow-up CT in the intermediate stage of disease shows an increase in the number and size of GGOs and progressive	(4/10)

		transformation of GGO into multifocal consolidative opacities, septal thickening, and development of a crazy paving pattern, with the greatest severity of CT findings visible around day 10 after the symptom onset.	
	<ul style="list-style-type: none"> <li>▪ Evidence about COVID-19 feature in children</li> </ul>	<ul style="list-style-type: none"> <li>➤ More children who were infected with COVID-19 were asymptomatic and mild cases which make diagnosis and infection source control more challenging.</li> <li>➤ Below half of children with COVID-19 shows GGO in CT findings</li> </ul>	(9/10)

### 3. Evidence related to the role of CT in case of RT-PCR false negative

Reverse-transcriptase polymerase chain reaction (RT-PCR) remains the gold standard for the definitive diagnosis of COVID-19 infection, despite reports of false-negative results (due to insufficient cellular material or inadequate detection and extraction techniques). In suspected cases with PCR negative cases, perhaps CT scan could aid or accelerate the speed of diagnosis of COVID-19 pneumonia (Zhao W, 2020; Araujo-Filho JAB, 2020). The summary of the findings from two systematic reviews related to the diagnosis of CT in suspected case of COVID-19 pneumonia but RT-PCR negative conditions are presented (Sana Salehi, 2020; Buyun Xu, 2020) in table 3.

**Table 3:** Key findings of the most relevant systematic reviews on the effectiveness of CT during false-negative RT-PCR

Type of document	Area of Focus	Key findings	Evidence quality (AMSTAR score)
Systematic reviews (n=2)	Evidence of CT during RT-PCR negative cases of COVID-19 pneumonia	Chest CT is essential for patients with suspected COVID-19 pneumonia when the RT-PCR screening test is negative	(4/10)
	Evidence on the accuracy of chest CT when false-negative RT-PCR for detecting COVID-19	The performance of chest CT in patients with initial false-negative RT-PCR shows significant role	(4/10)

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## **Conflicts of interest**

No conflicting of interest.

## **Acknowledgments**

This rapid evidence review was prepared with support from the Rapid and Responsive Evidence Partnership (RREP). RREP is funded by the International Development Research Center (IDRC) and Hewlett Foundation. The funder did not have a role in drafting, revising, or approving the content of the rapid evidence review. Dr. Gemechu Geleto (MD, Consultant Radiologist, Radiology department Head and Instructor at Negelle Arsi General Hospital and Medical College) reviewed the document and provide technical assistance.

## **This Rapid Evidence Review should be cited as:**

Samson ML, Yosef GA, Sabit AA, Firmaye BW, Dagmawit SL, Tsegaye GM, Desalegn AG, Ermias WA, Zelalem KW, Getachew TE. The use Computed Tomography for detecting COVID-19: Rapid Evidence Review. Knowledge Translation Directorate, Ethiopian Public Health Institute, Addis Ababa, Ethiopia. 12 Jun 2020.

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## Annex 1: WHO Recommendations for the use of chest imaging in COVID-19

# Recommendations



<p><b>R1</b></p>	<p>For asymptomatic contacts of patients with COVID-19, WHO suggests not using chest imaging for the diagnosis of COVID-19.</p> <p><i>Conditional recommendation, based on expert opinion</i></p>	<p><b>Remark</b></p> <p>RT-PCR should be done to confirm diagnosis.</p>
<p><b>R2</b></p>	<p><b>R2.1</b> For symptomatic patients with suspected COVID-19, WHO suggests not using chest imaging for the diagnostic workup of COVID-19 when RT-PCR testing is available with timely results.</p> <p><i>Conditional recommendation, based on low certainty evidence</i></p>	<p><b>Remark</b></p> <p>RT-PCR should be done to confirm diagnosis.</p>
	<p><b>R2.2</b> For symptomatic patients with suspected COVID-19, WHO suggests using chest imaging for the diagnostic workup of COVID-19 when:</p> <ol style="list-style-type: none"> <li>(1) RT-PCR testing is not available;</li> <li>(2) RT-PCR testing is available, but results are delayed; and</li> <li>(3) Initial RT-PCR testing is negative, but with high clinical of suspicion of COVID-19.</li> </ol> <p><i>Conditional recommendation, based on low certainty evidence</i></p>	<p><b>Remarks</b></p> <p>Imaging should be used as one element of the diagnostic workup that otherwise includes clinical and laboratory data. Patients likely to benefit are those who:</p> <ul style="list-style-type: none"> <li>• have severe symptoms and/or signs on physical exam;</li> <li>• require emergency procedures or other urgent interventions (e.g. for stroke or requiring haemodialysis);</li> <li>• have presentations that could represent complications of COVID-19 (e.g. pneumonia, pulmonary arterial thrombosis or thromboembolism);</li> <li>• need to be admitted irrespective of diagnosis (e.g. disease is severe or likely to progress), to help with disposition or triaging (e.g. to dedicated COVID-19 ward vs non-COVID-19 ward);</li> <li>• need to be transferred to another facility;</li> <li>• live with people at high risk if infected with COVID-19 (e.g. immunocompromised, persons aged over 60 years);</li> <li>• live in small homes, overcrowded households or densely-populated settings, where isolation is very difficult to implement; live in communities with people at high risk such as retirement homes or dormitories.</li> </ul>
<p><b>R3</b></p>	<p>For patients with suspected or confirmed COVID-19, not currently hospitalized and with mild symptoms, WHO suggests using chest imaging in addition to clinical and laboratory assessment to decide on hospital admission versus home discharge.</p> <p><i>Conditional recommendation, based on expert opinion</i></p>	<p><b>Remarks</b></p> <p>Imaging should be used as one element of the patient evaluation that otherwise includes clinical, laboratory and epidemiological data. Patients likely to benefit are those who:</p> <ul style="list-style-type: none"> <li>• are at high risk of disease progression;</li> <li>• have associated comorbidities (e.g. diabetes, hypertension, heart disease, obesity) or other chronic diseases which might decompensate and/or are aged over 60 years;</li> <li>• live with individuals at high risk of morbidity and mortality associated with COVID-19 (e.g. persons aged over 60 years, immunocompromised), whether at home or retirement home;</li> <li>• live in small homes, overcrowded households or densely-populated settings where isolation is very difficult to implement.</li> <li>• represent an increased risk of dissemination within their community due to their occupational, social or other circumstances.</li> </ul>
<p><b>R4</b></p>	<p>For patients with suspected or confirmed COVID-19, not currently hospitalized and with moderate to severe symptoms, WHO suggests using chest imaging in addition to clinical and laboratory assessment to decide on regular ward admission versus intensive care unit (ICU) admission.</p> <p><i>Conditional recommendation, based on very low certainty evidence</i></p>	<p><b>Remarks</b></p> <p>Imaging should be used as one element of the patient evaluation that otherwise includes clinical and laboratory data. Patients likely to benefit are those who:</p> <ul style="list-style-type: none"> <li>• are at higher risk of disease progression (e.g. with comorbidities);</li> <li>• are not responding to supportive treatment (e.g. oxygen supplementation);</li> <li>• present acute clinical deterioration not elucidated.</li> </ul>
<p><b>R5</b></p>	<p>For patients with suspected or confirmed COVID-19, currently hospitalized and with moderate to severe symptoms, WHO suggests using chest imaging in addition to clinical and laboratory assessment to inform the therapeutic management.</p> <p><i>Conditional recommendation, based on very low certainty evidence</i></p>	<p><b>Remarks</b></p> <p>Imaging should be used as one element of patient evaluation that otherwise includes clinical and laboratory data. Patients likely to benefit are those who:</p> <ul style="list-style-type: none"> <li>• are at high risk of disease progression;</li> <li>• are not responding to treatment (oxygen supplementation);</li> <li>• have presentations with clinical suspicion of pulmonary fibrosis, pulmonary artery thrombosis or thromboembolism.</li> </ul>
<p><b>R6</b></p>	<p>For hospitalized patients with COVID-19 whose symptoms are resolved, WHO suggests not using chest imaging in addition to clinical and/or laboratory assessment to inform the decision regarding discharge.</p> <p><i>Conditional recommendation, based on expert opinion</i></p>	<p><b>Remarks</b></p> <p>When imaging is used, it should be one element of the patient evaluation that otherwise includes clinical and laboratory data. Patients likely to benefit from chest imaging are those who:</p> <ul style="list-style-type: none"> <li>• have had a severe form of COVID-19;</li> <li>• have pre-existing chronic lung disease.</li> </ul>