



# WHO guidelines on the use of chest imaging in COVID-19

Web Annex B. GRADE evidence-to-decision tables



WHO guidelines on the use of chest imaging in COVID-19: Web Annex B. GRADE evidence-to-decision tables

ISBN 978-92-4-005573-5 (electronic version)

© World Health Organization 2022

Some rights reserved. This work is available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; <https://creativecommons.org/licenses/by-nc-sa/3.0/igo/>).

Under the terms of this licence, you may copy, redistribute and adapt the work for non-commercial purposes, provided the work is appropriately cited, as indicated below. In any use of this work, there should be no suggestion that WHO endorses any specific organization, products or services. The use of the WHO logo is not permitted. If you adapt the work, then you must license your work under the same or equivalent Creative Commons licence. If you create a translation of this work, you should add the following disclaimer along with the suggested citation: "This translation was not created by the World Health Organization (WHO). WHO is not responsible for the content or accuracy of this translation. The original English edition shall be the binding and authentic edition".

Any mediation relating to disputes arising under the licence shall be conducted in accordance with the mediation rules of the World Intellectual Property Organization (<http://www.wipo.int/amc/en/mediation/rules/>).

**Suggested citation.** Web Annex B. GRADE evidence-to-decision tables. In: WHO guidelines on the use of chest imaging in COVID-19. Geneva: World Health Organization; 2022: CC BY-NC-SA 3.0 IGO.

**Cataloguing-in-Publication (CIP) data.** CIP data are available at <http://apps.who.int/iris>.

**Sales, rights and licensing.** To purchase WHO publications, see <http://apps.who.int/bookorders>. To submit requests for commercial use and queries on rights and licensing, see <https://www.who.int/copyright>.

**Third-party materials.** If you wish to reuse material from this work that is attributed to a third party, such as tables, figures or images, it is your responsibility to determine whether permission is needed for that reuse and to obtain permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

**General disclaimers.** The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by WHO in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by WHO to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall WHO be liable for damages arising from its use.

This publication forms part of the *WHO guidelines on the use of chest imaging in COVID-19*. It is being made publicly available for transparency purposes and information, in accordance with the *WHO handbook for guideline development*, 2nd edition (2014).

# WHO guidelines on the use of chest imaging in COVID-19

Web Annex B. GRADE evidence-to-decision tables

**KQ1 (PICO 1)**

Should chest imaging vs. no chest imaging be used for asymptomatic contacts of patients with COVID-19?

<b>POPULATION:</b>	Asymptomatic contacts of patients with COVID-19
<b>INTERVENTION:</b>	Chest imaging
<b>COMPARISON:</b>	No chest imaging
<b>MAIN OUTCOMES:</b>	<ol style="list-style-type: none"><li>1. Accuracy of the diagnostic modality (rates of true positive, true negative, false positive, false negative)</li><li>2. Clinical outcomes<ul style="list-style-type: none"><li>• Mortality</li><li>• Respiratory failure</li><li>• Multiorgan failure</li><li>• Shortness of breath</li><li>• Recovery</li><li>• Adverse effects of imaging (e.g., exposure to radiation)</li><li>• COVID-19 transmission to health workers</li></ul></li><li>3. Health systems outcomes<ul style="list-style-type: none"><li>• Service use, including:<ul style="list-style-type: none"><li>◦ Length of stay in Emergency Department</li><li>◦ Length of hospital stay</li><li>◦ Length of ICU stay</li></ul></li><li>• Availability of care</li><li>• Access to care</li><li>• Quality of care</li></ul></li></ol>
<b>SETTING:</b>	Laboratory testing (RT PCR) is not available/results are delayed/results are initially negative
<b>PERSPECTIVE:</b>	Societal perspective
<b>BACKGROUND:</b>	
<b>CONFLICT OF INTERESTS:</b>	

**ASSESSMENT**

Desirable Effects How substantial are the desirable anticipated effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <li>● Trivial</li> <li><input type="radio"/> Small</li> <li><input type="radio"/> Moderate</li> <li><input type="radio"/> Large</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>	<ul style="list-style-type: none"> <li>● No study evaluated the accuracy of the diagnostic imaging modality</li> <li>● No study evaluated the effects of chest imaging on clinical outcomes</li> <li>● No study evaluated the effects of chest imaging on health systems outcomes</li> </ul>	<ul style="list-style-type: none"> <li>● Smaller benefit compared to the symptomatic population</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Trivial: 5</li> <li>● Small: 3</li> <li>● Moderate: 1</li> <li>● Large: 0</li> <li>● Varies: 0</li> <li>● Don't know: 0</li> </ul>
●	Update	<p>The panel explored a prevalence of 50%, to reflect evidence of high secondary infection rate amongst household contacts.</p> <p>Please refer to the following:</p> <p><a href="https://doi.org/10.1016/j.jinf.2020.08.033">https://doi.org/10.1016/j.jinf.2020.08.033</a></p> <p><a href="http://dx.doi.org/10.15585/mmwr.mm6944e1">http://dx.doi.org/10.15585/mmwr.mm6944e1</a></p>

CT scanning (update kQ1)					
Test result	Number of results per 1,000 patients tested				
	Prevalence 1%	Prevalence 2%	Prevalence 5%	Prevalence 10%	Prevalence 50%
	True positives	2	4	9	18
	False negatives	8	16	41	82
	True negatives	970	960	931	882
	False positives	20	10	19	18

Se=0.18; Sp=0.98

- No study evaluated the accuracy of CXR or LUS

Undesirable Effects  
How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	

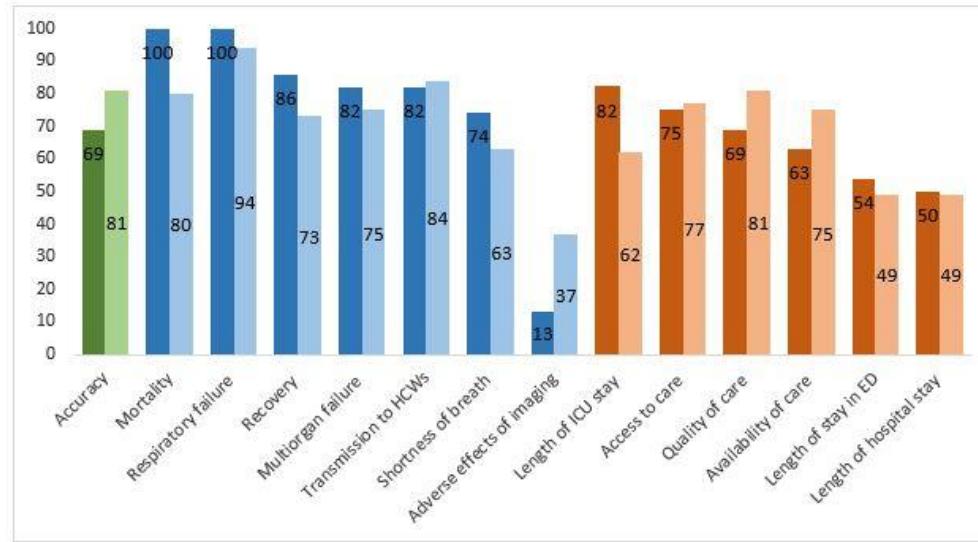
<input type="radio"/> Large <input checked="" type="radio"/> Moderate <input type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• No study evaluated the accuracy of the diagnostic imaging modality</li> <li>• No study evaluated the effects of chest imaging on clinical outcomes</li> <li>• No study evaluated the effects of chest imaging on health systems outcomes</li> </ul>	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• Large: 1</li> <li>• Moderate: 6</li> <li>• Small: 1</li> <li>• Trivial: 1</li> <li>• Varies: 0</li> <li>• Don't know: 0</li> </ul>
•	Update	
<input type="radio"/> Large <input checked="" type="radio"/> Moderate <input type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• No study provided evidence for harms.</li> </ul>	
<p>Certainty of evidence</p> <p>What is the overall certainty of the evidence of effects?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	

<ul style="list-style-type: none"> <li>● Very low</li> <li><input type="radio"/> Low</li> <li><input type="radio"/> Moderate</li> <li><input type="radio"/> High</li> <li><input type="radio"/> No included studies</li> </ul>		<ul style="list-style-type: none"> <li>● Very low for CT scan vs no CT scan</li> <li>● Very low for chest Xray vs no chest Xray</li> <li>● Very low for LUS vs no LUS</li> </ul>
●	Update	
<ul style="list-style-type: none"> <li><input type="radio"/> Very low</li> <li>● Low</li> <li><input type="radio"/> Moderate</li> <li><input type="radio"/> High</li> <li><input type="radio"/> No included studies</li> </ul>		<ul style="list-style-type: none"> <li>● Low for CT scan vs no CT scan</li> <li>● Very low for chest Xray vs no chest Xray</li> <li>● Very low for LUS vs no LUS</li> </ul>
<p><b>Values</b></p> <p>Is there important uncertainty about or variability in how much people value the main outcomes?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<ul style="list-style-type: none"> <li><input type="radio"/> Important uncertainty or variability</li> <li>● Possibly important uncertainty or variability</li> <li><input type="radio"/> Probably no important uncertainty or variability</li> <li><input type="radio"/> No important uncertainty or variability</li> </ul>	<b>Rating of outcomes:</b>	<p>The voting results are</p> <ul style="list-style-type: none"> <li>● Important uncertainty or variability: 2</li> <li>● Possibly important uncertainty or variability: 7</li> <li>● Probably no important uncertainty or variability: 4</li> </ul>

Outcomes	Not important (%)		Important (%)		Critical (%)	
			GDG	Stakeholders	GDG	Stakeholders
	GDG	Stakeholders				
Accuracy	0	1	32	19	69	81
Mortality	0	6	0	16	100	80
Respiratory failure	0	4	0	4	100	94
Multiorgan failure	0	5	19	22	82	75
Shortness of breath	0	6	27	33	74	63
Recovery	0	4	15	25	86	73
Adverse effects of imaging	44	24	44	40	13	37
Transmission to HCWs	7	3	13	14	82	84
Length of stay in ED	14	12	34	40	54	49
Length of hospital stay	13	8	38	44	50	49
Length of ICU stay	0	4	19	36	82	62
Availability of care	0	4	38	23	63	75
Access to care	0	4	25	21	75	77
Quality of care	7	3	25	18	69	81

**Critical outcomes:**

- No important uncertainty or variability:  
1



Green: accuracy of the diagnostic modality; blue: clinical outcomes; orange: health systems outcomes

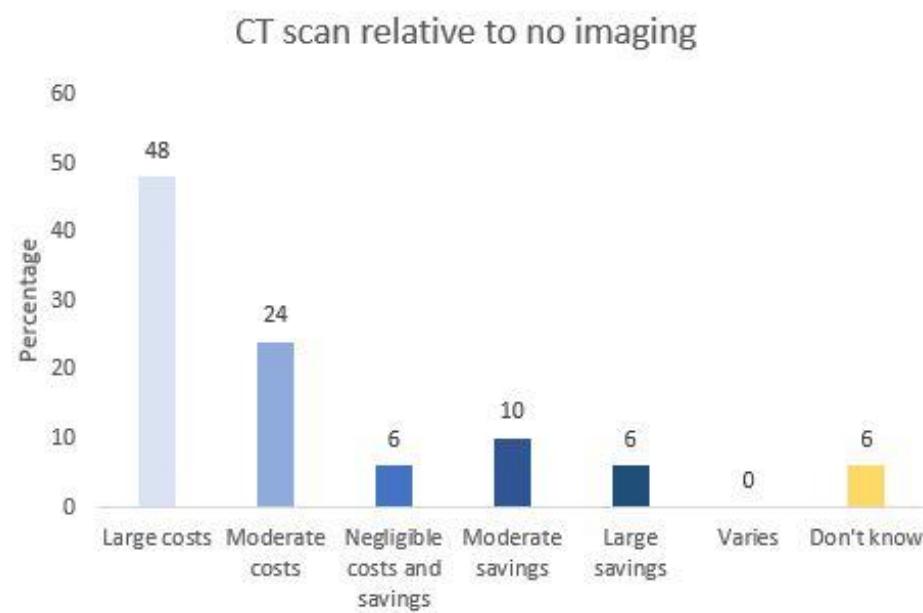
Dark color: GDG; light color: stakeholders

Stakeholder respondents (n=249) included:

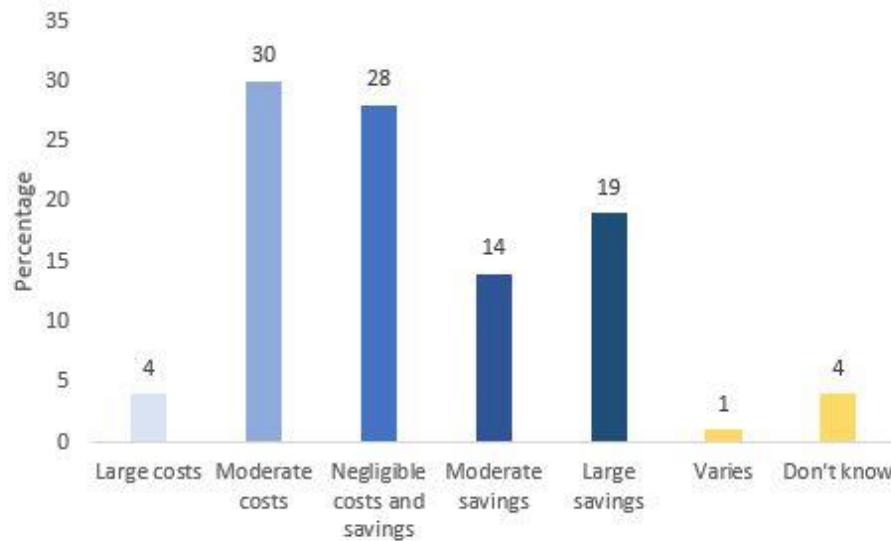
- members of the public (3%)
- patients (2%)
- physicians (22%)
- technicians (53%)
- other health professionals (5%)
- researchers (3%)
- policy-makers (3%)
- other (7%)

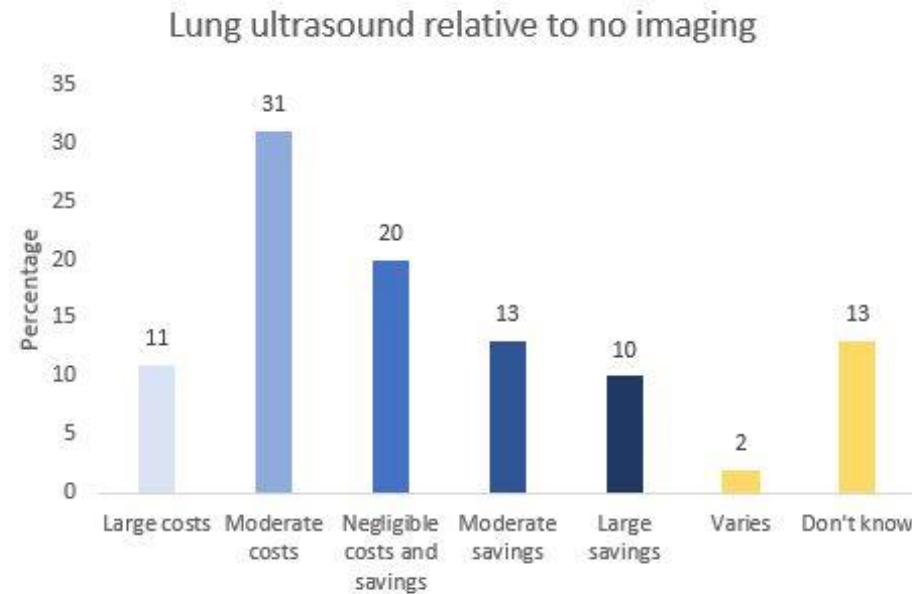
•	Update	
<ul style="list-style-type: none"> <li><input type="radio"/> Important uncertainty or variability</li> <li><input checked="" type="radio"/> Possibly important uncertainty or variability</li> <li><input type="radio"/> Probably no important uncertainty or variability</li> <li><input type="radio"/> No important uncertainty or variability</li> </ul>		One year into the pandemic, no related studies have been published
<b>Balance of effects</b> Does the balance between desirable and undesirable effects favor the intervention or the comparison?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<ul style="list-style-type: none"> <li><input checked="" type="radio"/> Favors the comparison</li> <li><input type="radio"/> Probably favors the comparison</li> <li><input type="radio"/> Does not favor either the intervention or the comparison</li> <li><input type="radio"/> Probably favors the intervention</li> <li><input type="radio"/> Favors the intervention</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>		<p>The voting results are:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Favors the comparison: 5</li> <li><input type="radio"/> Probably favors the comparison: 2</li> <li><input type="radio"/> Does not favor either the intervention or the comparison: 0</li> <li><input type="radio"/> Probably favors the intervention: 3</li> <li><input type="radio"/> Favors the intervention : 0</li> <li><input type="radio"/> Varies: 1</li> <li><input type="radio"/> Don't know : 0</li> </ul>
•	Update	

<ul style="list-style-type: none"> <li>● Favors the comparison</li> <li><input type="radio"/> Probably favors the comparison</li> <li><input type="radio"/> Does not favor either the intervention or the comparison</li> <li><input type="radio"/> Probably favors the intervention</li> <li><input type="radio"/> Favors the intervention</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>		
<p>Resources required How large are the resource requirements (costs)?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Large costs: 10</li> <li>● Moderate costs: 1</li> <li>● Negligible costs and savings: 0</li> <li>● Moderate savings: 1</li> <li>● Large savings: 0</li> <li>● Varies: 0</li> <li>● Don't know : 0</li> </ul>



### Chest X-ray relative to no imaging



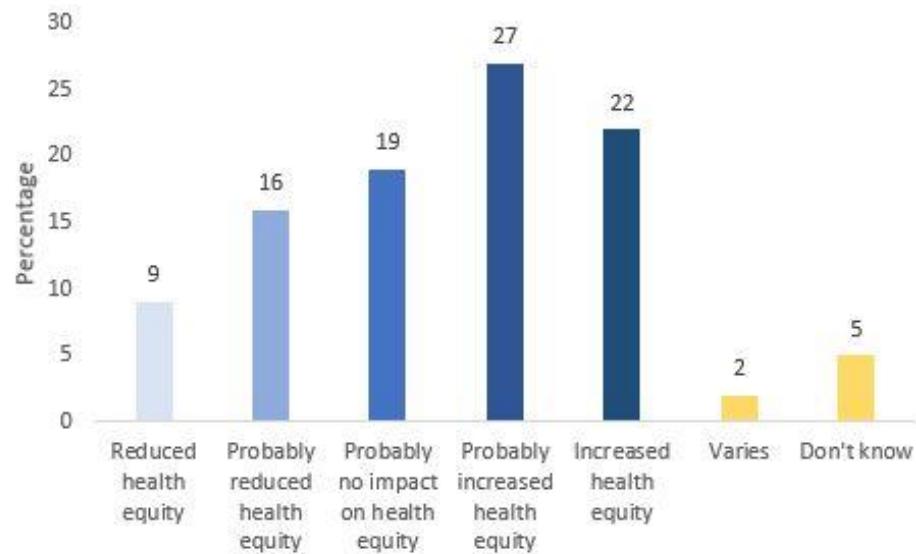


Respondents (n=124) included:

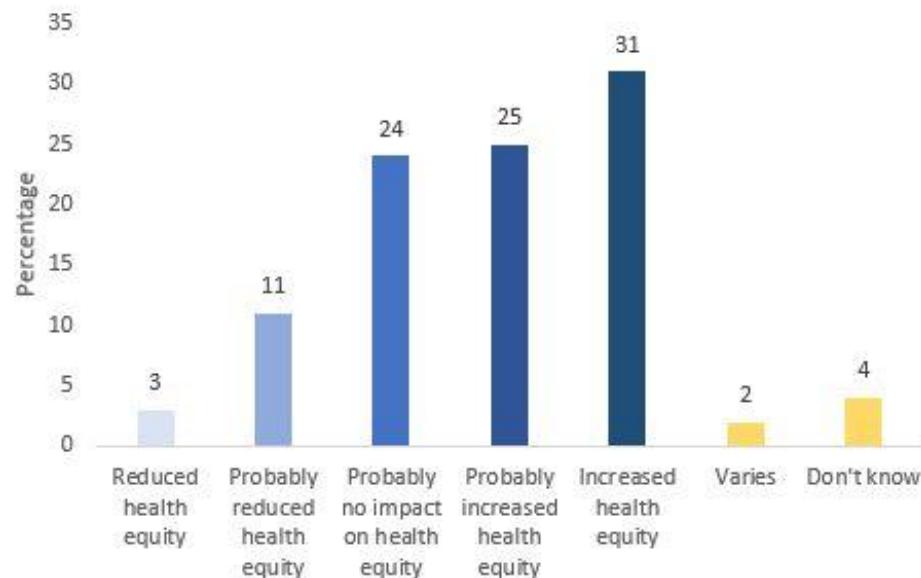
- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

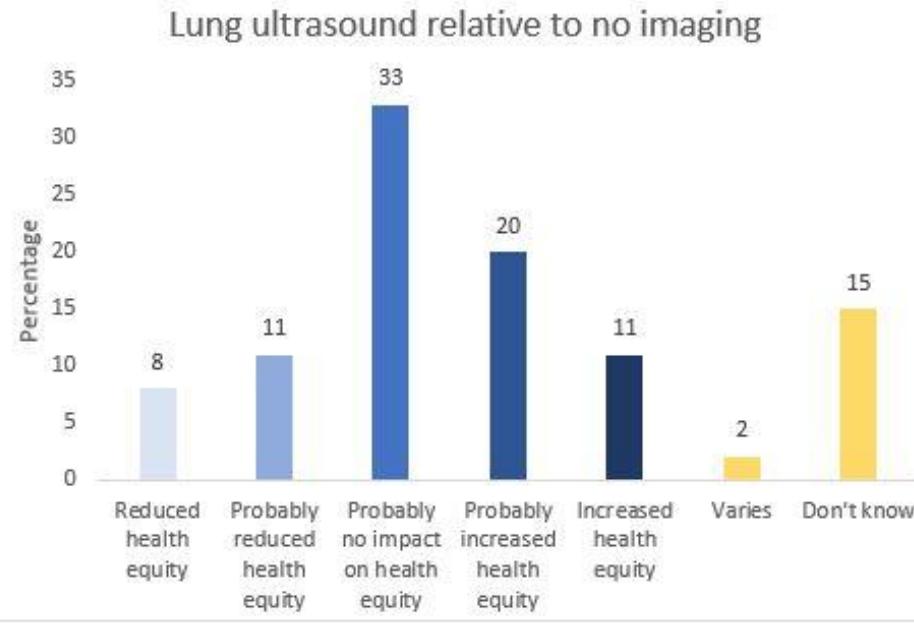
•	Update	
<ul style="list-style-type: none"> <li>● Large costs</li> <li>○ Moderate costs</li> <li>○ Negligible costs and savings</li> <li>○ Moderate savings</li> <li>○ Large savings</li> <li>○ Varies</li> <li>○ Don't know</li> </ul>	<ul style="list-style-type: none"> <li>● <b>No new data available</b></li> </ul>	
<b>Equity</b> What would be the impact on health equity?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<ul style="list-style-type: none"> <li>○ Reduced</li> <li>● Probably reduced</li> <li>○ Probably no impact</li> <li>○ Probably increased</li> <li>○ Increased</li> <li>○ Varies</li> <li>○ Don't know</li> </ul>		<p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Reduced: 5</li> <li>● Probably reduced: 4</li> <li>● Probably no impact : 2</li> <li>● Probably increased: 1</li> <li>● Increased: 2</li> <li>● Varies: 0</li> <li>● Don't know : 0</li> </ul>

CT scan relative to no imaging



### Chest X-ray relative to no imaging



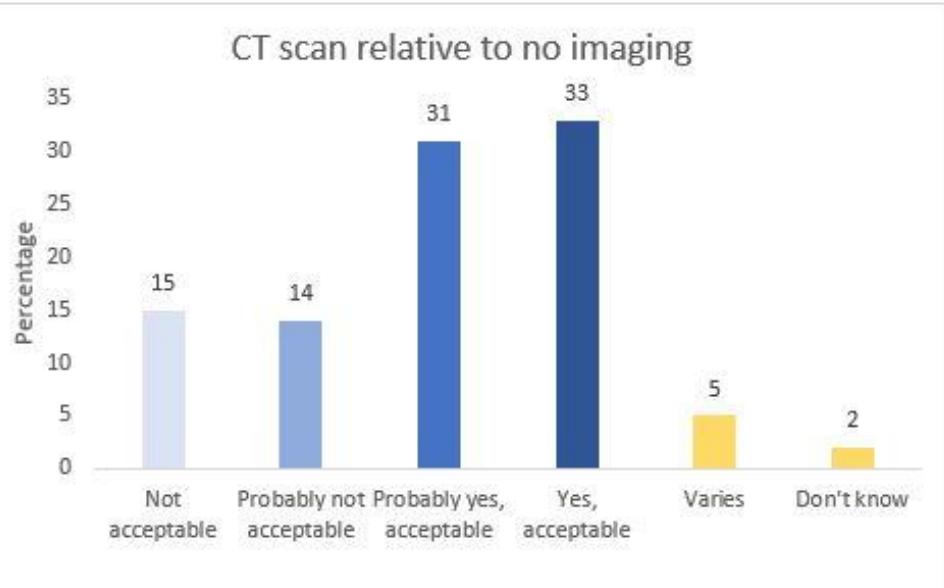


Respondents (n=124) included:

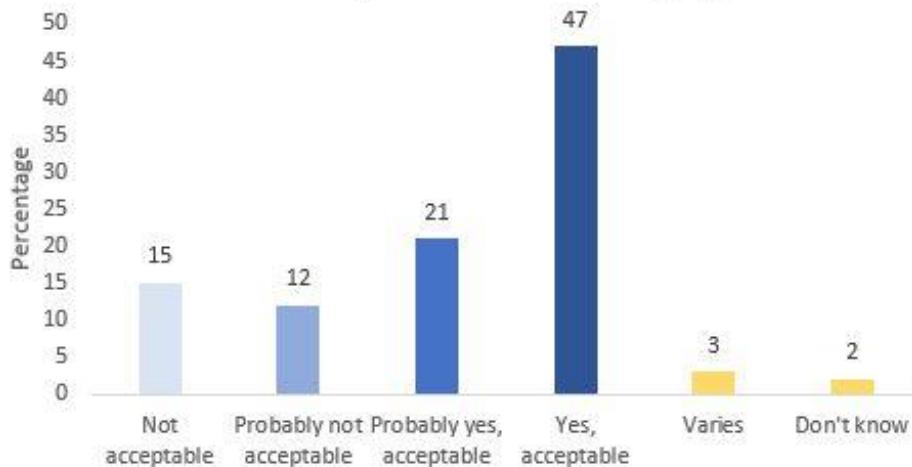
- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

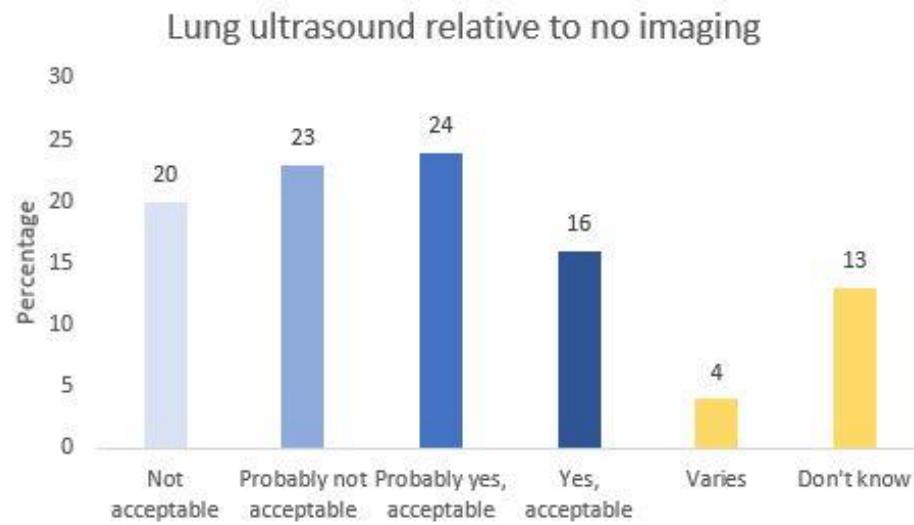


Update

<ul style="list-style-type: none"> <li><input type="radio"/> Reduced</li> <li><input checked="" type="radio"/> Probably reduced</li> <li><input type="radio"/> Probably no impact</li> <li><input type="radio"/> Probably increased</li> <li><input type="radio"/> Increased</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>															
<b>Acceptability</b> Is the intervention acceptable to key stakeholders?																
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS														
	Original															
<ul style="list-style-type: none"> <li><input type="radio"/> No</li> <li><input checked="" type="radio"/> Probably no</li> <li><input type="radio"/> Probably yes</li> <li><input type="radio"/> Yes</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>	 <table border="1"> <caption>CT scan relative to no imaging</caption> <thead> <tr> <th>Acceptability Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Not acceptable</td> <td>15</td> </tr> <tr> <td>Probably not acceptable</td> <td>14</td> </tr> <tr> <td>Probably yes, acceptable</td> <td>31</td> </tr> <tr> <td>Yes, acceptable</td> <td>33</td> </tr> <tr> <td>Varies</td> <td>5</td> </tr> <tr> <td>Don't know</td> <td>2</td> </tr> </tbody> </table>	Acceptability Category	Percentage	Not acceptable	15	Probably not acceptable	14	Probably yes, acceptable	31	Yes, acceptable	33	Varies	5	Don't know	2	The voting results are: <ul style="list-style-type: none"> <li>• No : 0</li> <li>• Probably no : 4</li> <li>• Probably yes: 4</li> <li>• Yes: 2</li> <li>• Varies: 2</li> <li>• Don't know : 0</li> </ul>
Acceptability Category	Percentage															
Not acceptable	15															
Probably not acceptable	14															
Probably yes, acceptable	31															
Yes, acceptable	33															
Varies	5															
Don't know	2															

### Chest X-ray relative to no imaging





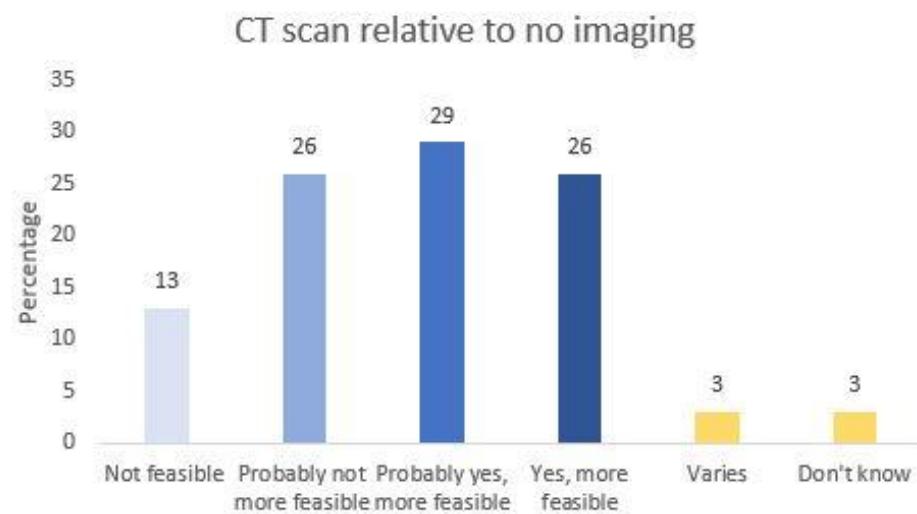
Respondents (n=124) included:

- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

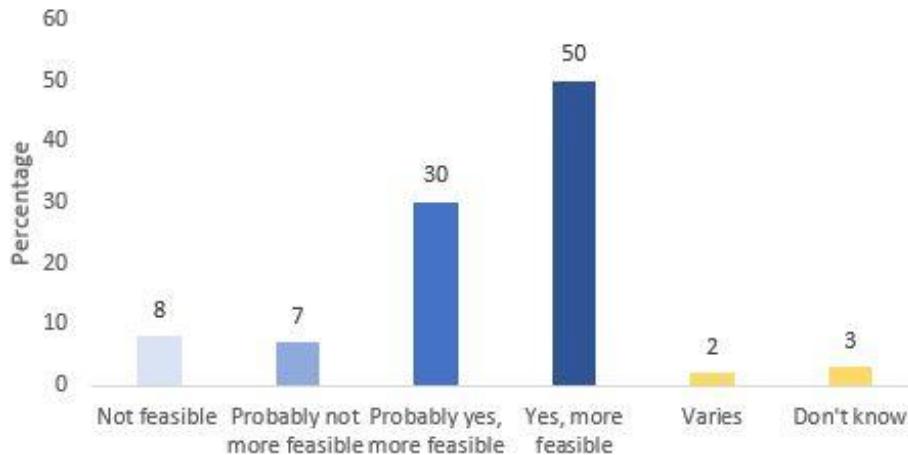


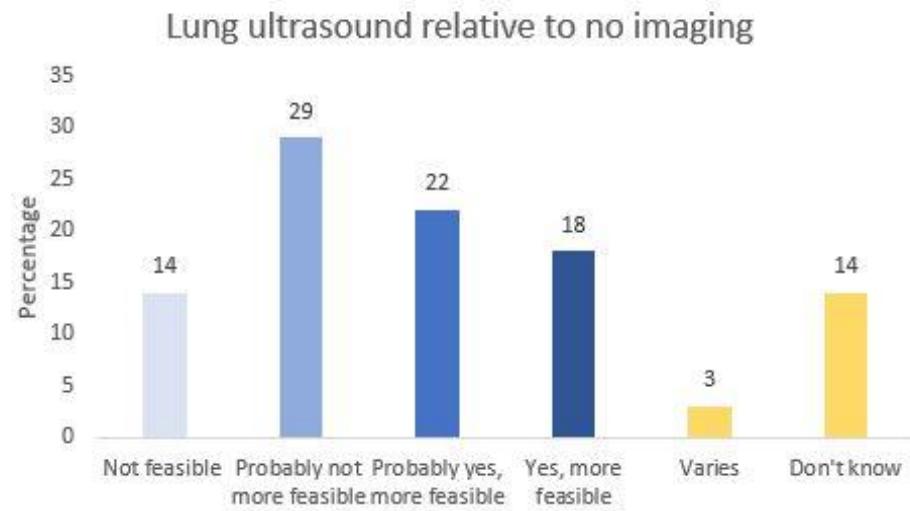
Update

<input type="radio"/> No <input checked="" type="radio"/> Probably no <input type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
<b>Feasibility</b> Is the intervention feasible to implement?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>● No : 2</li> <li>● Probably no : 4</li> <li>● Probably yes: 6</li> <li>● Yes: 3</li> <li>● Varies: 0</li> <li>● Don't know : 0</li> </ul>



### Chest X-ray relative to no imaging





Respondents (n=124) included:

- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

•

Update

<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>	
---	---	--

#### SUMMARY OF JUDGEMENTS

CRITERIA	ORIGINAL	IMPORTANCE FOR DECISION	UPDATE	IMPORTANCE FOR DECISION
DESIRABLE EFFECTS	Trivial		Trivial	
UNDESIRABLE EFFECTS	Moderate		Moderate	
CERTAINTY OF EVIDENCE	Very low		Low	
VALUES	Possibly important uncertainty or variability		Possibly important uncertainty or variability	
BALANCE OF EFFECTS	Favors the comparison		Favors the comparison	
RESOURCES REQUIRED	Large costs		Large costs	
EQUITY	Probably reduced		Probably reduced	
ACCEPTABILITY	Probably no		Probably no	
FEASIBILITY	Probably yes		Probably yes	

#### TYPE OF RECOMMENDATION

Original	Strong recommendation against the intervention	Conditional recommendation against the intervention	Conditional recommendation for either the intervention or the comparison	Conditional recommendation for the intervention	Strong recommendation for the intervention
----------	--	---	--	---	--

<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strong recommendation against the intervention	Update			
<input type="radio"/>	<b>Conditional recommendation against the intervention</b>	Conditional recommendation for either the intervention or the comparison	Conditional recommendation for the intervention	Strong recommendation for the intervention

## CONCLUSIONS

<input type="radio"/>	Original
Recommendation	

For asymptomatic contacts of patients with COVID19, WHO **suggests not** using chest imaging for the diagnosis of COVID-19 (conditional recommendation, based on expert opinion)

### Remarks:

RT-PCR should be done to confirm diagnosis.

The voting results are:

- Strong recommendation against the intervention: 7
- Conditional recommendation against the intervention: 3
- Conditional recommendation for either the intervention or the comparison: 1
- Conditional recommendation for the intervention: 3
- Strong recommendation for the intervention: 0

Justification	<input type="radio"/>	Update
---------------	-----------------------	--------

## Recommendation (#)

For asymptomatic contacts of patients with COVID-19, WHO suggests **not using** chest imaging for the diagnosis of COVID-19.

*(Conditional recommendation, based on low certainty evidence)*

(#) This recommendation and the certainty of its evidence base were judged to remain unchanged after the update of the review conducted before the publication of the second edition of the guide.

### Remarks:

Virologic testing (e.g., with RT-PCR or antigen-detecting Rapid Diagnostic Tests (Ag-RDT)) can be used to confirm diagnosis of COVID-19.

Local protocols related to quarantine and testing should be followed.

## Recommendation reached through consensus and without voting.

## Justification

## Subgroup considerations

## Implementation considerations

Original

1. Consider whether RT-PCR is available and, if the test is performed, whether the results are positive or negative.
2. Consider the use of chest imaging in asymptomatic contacts who progress to develop respiratory symptoms (body temperature monitoring).
3. Consider assessing incidental pulmonary findings suspicious of COVID-19 on imaging performed for other reasons (e.g. thoracic spine radiography, cardiac CT) in countries/regions with previous or current high COVID-19 prevalence.

### Update

1. Consider whether virologic testing is available and, if the test is performed, carefully interpret its results.
2. Consider the use of chest imaging in asymptomatic contacts who progress to develop respiratory symptoms.
3. Consider assessing incidental pulmonary findings suspicious of COVID-19 on imaging performed for other reasons (e.g. thoracic spine radiography, cardiac CT) in countries/regions with previous or current high COVID-19 prevalence.

### Monitoring and evaluation

#### Original

- Monitor the number of requested chest imaging investigations related to COVID-19 and judge their adequacy.
- Monitor the impact of COVID-19-related chest imaging in different clinical scenarios on institutional and national resources (human and financial).
- Monitor the appropriate implementation of workflow and infection prevention and control measures (e.g. personal protective equipment).
- Monitor the number of cases of COVID-19 infections among hospital staff attributable to COVID-19-related chest imaging.
- Compare the results of COVID-19-related chest imaging with the results of RT-PCR (once available).
- Monitor the impact of chest imaging on patient stratification into different COVID-19-related risk profiles.

#### Update

- Monitor the number of requested chest imaging investigations related to COVID-19 and judge their adequacy.
- Monitor the impact of COVID-19-related chest imaging in different clinical scenarios on institutional and national resources (human and financial).
- Monitor the appropriate implementation of workflow and infection prevention and control measures (e.g. personal protective equipment).
- Monitor the number of cases of COVID-19 infections among hospital staff attributable to COVID-19-related chest imaging.
- Compare the results of COVID-19-related chest imaging with the results of virologic testing (once available).
- Monitor the impact of not performing chest imaging on patient stratification into different COVID-19-related risk profiles.

### Research priorities

#### Original

- Conduct randomized controlled trials to compare the effects of using the different imaging modalities and using no imaging (in addition to clinical judgement) on clinical and health services outcomes of interest, for the questions addressed in this rapid advice guide.
- Evaluate access and health insurance coverage of chest imaging services related to COVID-19 in different settings.
- Study the role of artificial intelligence in chest imaging in different settings.
- Assess the incidence of COVID-19 infections among hospital staff attributable to chest imaging of patients with COVID-19 (e.g. in radiologists and radiographers).
- Evaluate the implementation of workflow developed for COVID-19-related chest imaging.
- Evaluate the safety and effectiveness of performing portable chest radiography, with and without RT-PCR testing, at home.

- Evaluate the impact of COVID-19-related imaging on institutional and national resources (human and financial).
- Evaluate the impact of COVID-19-related imaging on equity.
- Assess the values and preferences of different stakeholders for relevant chest imaging modalities in different settings.
- Conduct well-designed studies to assess the diagnostic accuracy measures of the different imaging modalities. These studies should ideally be cohort studies of patients with suspected or confirmed COVID-19 that clearly describe the disease severity and use an adequate reference standard (serial RT-PCR and/or clinical follow-up) and clearly defined criteria for positive imaging.
- Study the characteristics of the chest imaging findings in suspected COVID-19 cases who eventually turn out to be positive.
- Study the diagnostic value of chest imaging in asymptomatic contacts who eventually become symptomatic.
- Assess the frequency of radiological findings of COVID-19 in asymptomatic contacts who are scheduled for urgent or non-urgent interventions (e.g. cardiac catheterization, surgery, endoscopy).
- Study the findings of CT pulmonary angiography in patients with COVID-19, particularly those with severe and moderate symptoms.

- 

Update

- Conduct randomized controlled trials to compare the effects of using the different imaging modalities and using no imaging (in addition to clinical judgement) on clinical and health services outcomes of interest, for the questions addressed in this rapid advice guide.
- Evaluate access and health insurance coverage of chest imaging services related to COVID-19 in different settings.
- Study the role of artificial intelligence in chest imaging in different settings.
- Assess the incidence of COVID-19 infections among hospital staff attributable to chest imaging of patients with COVID-19 (e.g. in radiologists and radiographers).
- Evaluate the implementation of workflow developed for COVID-19-related chest imaging.
- Evaluate the safety and effectiveness of performing portable chest radiography, with and without RT-PCR testing, at home.
- Evaluate the impact of COVID-19-related imaging on institutional and national resources (human and financial).
- Evaluate the impact of COVID-19-related imaging on equity.
- Assess the values and preferences of different stakeholders for relevant chest imaging modalities in different settings.
- Conduct well-designed studies to assess the diagnostic accuracy measures of the different imaging modalities. These studies should ideally be cohort studies of patients with suspected or confirmed COVID-19 that clearly describe the disease severity and use an adequate reference standard (serial RT-PCR and/or clinical follow-up) and clearly defined criteria for positive imaging.
- Study the characteristics of the chest imaging findings in suspected COVID-19 cases who eventually turn out to be positive.
- Study the diagnostic value of chest imaging in asymptomatic contacts who eventually become symptomatic.
- Assess the frequency of radiological findings of COVID-19 in asymptomatic contacts who are scheduled for urgent or non-urgent interventions (e.g. cardiac catheterization, surgery, endoscopy).

**Should chest imaging vs. no chest imaging be used for symptomatic patients with suspected COVID-19; contexts where laboratory testing (RT PCR) is not available/results are delayed/results are initially negative?**

<b>POPULATION:</b>	Symptomatic patients with suspected COVID-19
<b>INTERVENTION:</b>	Chest imaging
<b>COMPARISON:</b>	No chest imaging
<b>MAIN OUTCOMES:</b>	<ol style="list-style-type: none"><li>1. Accuracy of the diagnostic modality (rates of true positive, true negative, false positive, false negative)</li><li>2. Clinical outcomes<ul style="list-style-type: none"><li>• Mortality</li><li>• Respiratory failure</li><li>• Multiorgan failure</li><li>• Shortness of breath</li><li>• Recovery</li><li>• Adverse effects of imaging (e.g., exposure to radiation)</li><li>• COVID-19 transmission to health workers</li></ul></li><li>3. Health systems outcomes<ul style="list-style-type: none"><li>• Service use, including:<ul style="list-style-type: none"><li>◦ Length of stay in Emergency Department</li><li>◦ Length of hospital stay</li><li>◦ Length of ICU stay</li></ul></li><li>• Availability of care</li><li>• Access to care</li><li>• Quality of care</li></ul></li></ol>
<b>SETTING:</b>	Laboratory testing (RT PCR) is not available/results are delayed/results are initially negative
<b>PERSPECTIVE:</b>	Societal perspective
<b>BACKGROUND:</b>	
<b>CONFLICT OF INTERESTS:</b>	

**ASSESSMENT**

Desirable Effects How substantial are the desirable anticipated effects?																																	
JUDGEMENT	RESEARCH EVIDENCE		ADDITIONAL CONSIDERATIONS																														
<input type="radio"/> Trivial <input type="radio"/> Small <input checked="" type="radio"/> Moderate <input type="radio"/> Large <input type="radio"/> Varies <input type="radio"/> Don't know	Original  <b>CT scanning</b>  <table border="1"> <thead> <tr> <th>Test result</th> <th colspan="4">Number of results per 1,000 patients tested</th> </tr> <tr> <th></th> <th>Prevalence 20%</th> <th>Prevalence 40%</th> <th>Prevalence 60%</th> <th>Prevalence 80%</th> </tr> </thead> <tbody> <tr> <td><b>True positives</b></td> <td>184</td> <td>368</td> <td>552</td> <td>736</td> </tr> <tr> <td><b>False negatives</b></td> <td>16</td> <td>32</td> <td>48</td> <td>64</td> </tr> <tr> <td><b>True negatives</b></td> <td>448</td> <td>336</td> <td>224</td> <td>112</td> </tr> <tr> <td><b>False positives</b></td> <td>352</td> <td>264</td> <td>176</td> <td>88</td> </tr> </tbody> </table> <p>Se=0.92; Sp=0.56</p>		Test result	Number of results per 1,000 patients tested					Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%	<b>True positives</b>	184	368	552	736	<b>False negatives</b>	16	32	48	64	<b>True negatives</b>	448	336	224	112	<b>False positives</b>	352	264	176	88	<ul style="list-style-type: none"> <li>Potential benefit of shortening length of stay in ED</li> <li>For patients who already qualify for admission, the CT would be beneficial in COVID19 unit (based on the presentation)</li> <li>Using the CT to rule out COVID-19 might be safest in low prevalence setting (lower FNs)</li> <li>Using the CT to rule in might be safest in high prevalence setting (lower FPs)</li> <li>Disposition of patients whom the decision to admit is already made</li> <li>Implementation of public health measures (those who are likely to be discharged, with not a confirmed PCR delayed/unavailable RT-PCR): outpatient guidance [maximized in low prevalence setting]</li> <li>In patients who have tested negative by PCR but have clinical suspicion, perform a CT scan.</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>Trivial: 2</li> <li>Small: 1</li> <li>Moderate: 8</li> <li>Large: 4</li> <li>Varies: 0</li> <li>Don't know: 0</li> </ul>
Test result	Number of results per 1,000 patients tested																																
	Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%																													
<b>True positives</b>	184	368	552	736																													
<b>False negatives</b>	16	32	48	64																													
<b>True negatives</b>	448	336	224	112																													
<b>False positives</b>	352	264	176	88																													

## CXR

Test result	Number of results per 1,000 patients tested			
	Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%
<b>True positives</b>	128	256	384	512
<b>False negatives</b>	72	144	216	288
<b>True negatives</b>	656	492	328	164
<b>False positives</b>	144	108	72	36

Se=0.64; Sp=0.82

## LUS

Test result	Number of results per 1,000 patients tested			
	Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%
<b>True positives</b>	190	380	570	760
<b>False negatives</b>	10	20	30	40
<b>True negatives</b>	664	498	332	166
<b>False positives</b>	136	102	68	34

Se=0.95; Sp=0.83

	<p>No study evaluated the effects of chest imaging on health outcomes</p> <p>No study evaluated the effects of chest imaging on health systems outcomes</p>																														
•	Update																														
<input type="radio"/> Trivial <input type="radio"/> Small <input type="radio"/> Moderate <input type="radio"/> Large <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• No study provided evidence for the effects of chest imaging on health outcomes</li> <li>• No study provided evidence for the effects of chest imaging on health systems outcomes</li> <li>• These links <a href="#">PICO 2 CT scan vs no CT scan</a>, <a href="#">PICO 2 CXR vs no CXR</a>, and <a href="#">PICO 2 LUS vs no LUS</a> provide access to the full interactive summary of findings tables.</li> </ul> <h2>CT scanning (update kQ2)</h2> <table border="1"> <thead> <tr> <th rowspan="2">Test result</th> <th colspan="4">Number of results per 1,000 patients tested</th> </tr> <tr> <th>Prevalence 20%</th> <th>Prevalence 40%</th> <th>Prevalence 60%</th> <th>Prevalence 80%</th> </tr> </thead> <tbody> <tr> <td><b>True positives</b></td> <td>178</td> <td>356</td> <td>534</td> <td>712</td> </tr> <tr> <td><b>False negatives</b></td> <td>22</td> <td>44</td> <td>66</td> <td>88</td> </tr> <tr> <td><b>True negatives</b></td> <td>648</td> <td>486</td> <td>324</td> <td>162</td> </tr> <tr> <td><b>False positives</b></td> <td>152</td> <td>114</td> <td>76</td> <td>38</td> </tr> </tbody> </table> <p>Se=0.89; Sp=0.81</p>	Test result	Number of results per 1,000 patients tested				Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%	<b>True positives</b>	178	356	534	712	<b>False negatives</b>	22	44	66	88	<b>True negatives</b>	648	486	324	162	<b>False positives</b>	152	114	76	38	
Test result	Number of results per 1,000 patients tested																														
	Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%																											
<b>True positives</b>	178	356	534	712																											
<b>False negatives</b>	22	44	66	88																											
<b>True negatives</b>	648	486	324	162																											
<b>False positives</b>	152	114	76	38																											

## CXR (update kQ2)

Test result	Number of results per 1,000 patients tested			
	Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%
<b>True positives</b>	144	288	432	576
<b>False negatives</b>	56	112	168	224
<b>True negatives</b>	568	426	284	142
<b>False positives</b>	232	174	116	58

Se=0.72; Sp=0.71

## LUS (update kQ2)

Test result	Number of results per 1,000 patients tested			
	Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%
<b>True positives</b>	156	312	468	624
<b>False negatives</b>	44	88	132	176
<b>True negatives</b>	608	456	304	152
<b>False positives</b>	192	144	96	48

Se=0.78; Sp=0.76

## Comparative table (KQ2, prevalence 20%)

Test result	Number of results per 1,000 patients tested		
	CT scanning	CXR	LUS
<b>True positives</b>	178	144	156
<b>False negatives</b>	22	56	44
<b>True negatives</b>	648	568	608
<b>False positives</b>	152	232	192
<b>Se/Sp</b>	Se=0.89; Sp=0.81	Se=0.72; Sp=0.71	Se=0.78; Sp=0.76

## Comparative table (prevalence 40%)

Test result	Number of results per 1,000 patients tested		
	CT scanning	CXR	LUS
<b>True positives</b>	356	288	312
<b>False negatives</b>	44	112	88
<b>True negatives</b>	486	426	456
<b>False positives</b>	114	174	144
<b>Se/Sp</b>	Se=0.89; Sp=0.81	Se=0.72; Sp=0.71	Se=0.78; Sp=0.76

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS																														
	Original																															
<input type="radio"/> Large <input type="radio"/> Moderate <input checked="" type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<p style="text-align: center;"><b>CT scanning</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #4f81bd; color: white;"> <th style="padding: 5px;">Test result</th> <th colspan="4" style="padding: 5px;">Number of results per 1,000 patients tested</th> </tr> <tr style="background-color: #d9e1f2;"> <th style="padding: 5px;"></th> <th style="padding: 5px;">Prevalence 20%</th> <th style="padding: 5px;">Prevalence 40%</th> <th style="padding: 5px;">Prevalence 60%</th> <th style="padding: 5px;">Prevalence 80%</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;"><b>True positives</b></td><td style="padding: 5px; text-align: center;">184</td><td style="padding: 5px; text-align: center;">368</td><td style="padding: 5px; text-align: center;">552</td><td style="padding: 5px; text-align: center;">736</td></tr> <tr> <td style="padding: 5px;"><b>False negatives</b></td><td style="padding: 5px; text-align: center;">16</td><td style="padding: 5px; text-align: center;">32</td><td style="padding: 5px; text-align: center;">48</td><td style="padding: 5px; text-align: center;">64</td></tr> <tr> <td style="padding: 5px;"><b>True negatives</b></td><td style="padding: 5px; text-align: center;">448</td><td style="padding: 5px; text-align: center;">336</td><td style="padding: 5px; text-align: center;">224</td><td style="padding: 5px; text-align: center;">112</td></tr> <tr> <td style="padding: 5px;"><b>False positives</b></td><td style="padding: 5px; text-align: center;">352</td><td style="padding: 5px; text-align: center;">264</td><td style="padding: 5px; text-align: center;">176</td><td style="padding: 5px; text-align: center;">88</td></tr> </tbody> </table> <p style="text-align: center;">Se=0.92; Sp=0.56</p>	Test result	Number of results per 1,000 patients tested					Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%	<b>True positives</b>	184	368	552	736	<b>False negatives</b>	16	32	48	64	<b>True negatives</b>	448	336	224	112	<b>False positives</b>	352	264	176	88	<ul style="list-style-type: none"> <li>● Exposure of radiation</li> <li>● Use low-dose CT</li> <li>● Transmission to HCWs</li> <li>● Transmission to patients</li> <li>● Pregnant/children: higher risk</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Large: 1</li> <li>● Moderate: 4</li> <li>● Small: 6</li> <li>● Trivial: 1</li> <li>● Varies: 2</li> <li>● Don't know: 0</li> </ul>
Test result	Number of results per 1,000 patients tested																															
	Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%																												
<b>True positives</b>	184	368	552	736																												
<b>False negatives</b>	16	32	48	64																												
<b>True negatives</b>	448	336	224	112																												
<b>False positives</b>	352	264	176	88																												

## CXR

Test result	Number of results per 1,000 patients tested			
	Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%
<b>True positives</b>	128	256	384	512
<b>False negatives</b>	72	144	216	288
<b>True negatives</b>	656	492	328	164
<b>False positives</b>	144	108	72	36

Se=0.64; Sp=0.82

## LUS

Test result	Number of results per 1,000 patients tested			
	Prevalence 20%	Prevalence 40%	Prevalence 60%	Prevalence 80%
<b>True positives</b>	190	380	570	760
<b>False negatives</b>	10	20	30	40
<b>True negatives</b>	664	498	332	166
<b>False positives</b>	136	102	68	34

Se=0.95; Sp=0.83

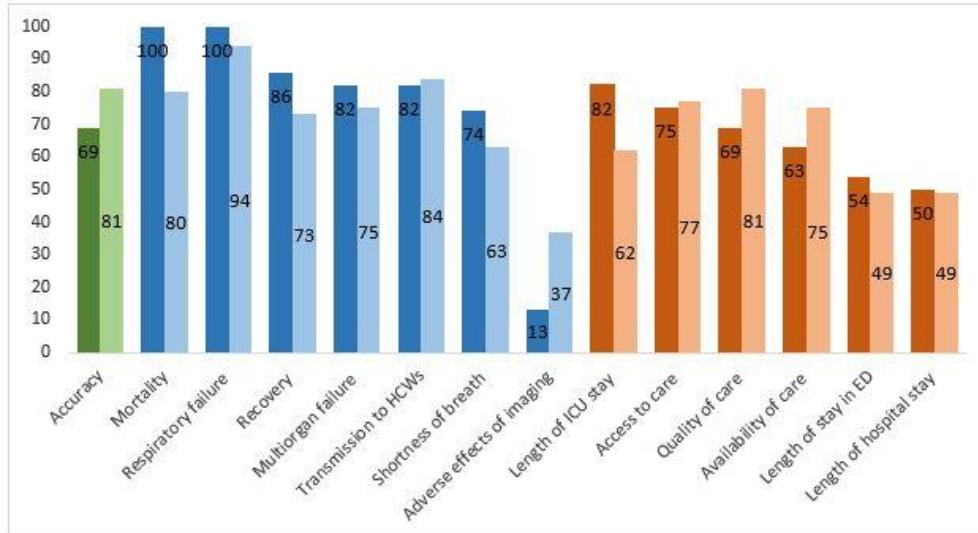
	No study evaluated the effects of chest imaging on health outcomes  No study evaluated the effects of chest imaging on health systems outcomes	
•	Update	
<input type="radio"/> Large <input type="radio"/> Moderate <input type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• No study provided evidence for harms.</li> </ul>	
Certainty of evidence What is the overall certainty of the evidence of effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	

<ul style="list-style-type: none"> <li><input type="radio"/> Very low</li> <li><input checked="" type="radio"/> Low</li> <li><input type="radio"/> Moderate</li> <li><input type="radio"/> High</li> <li><input type="radio"/> No included studies</li> </ul>		Low for CT vs. no CT Very low for CXR vs. no CXR Very low for US vs. no US
•	Update	
<ul style="list-style-type: none"> <li><input type="radio"/> Very low</li> <li><input type="radio"/> Low</li> <li><input checked="" type="radio"/> Moderate</li> <li><input type="radio"/> High</li> <li><input type="radio"/> No included studies</li> </ul>		Moderate for CT vs. no CT Low for CXR vs. no CXR Low for US vs. no US
<p>Values</p> <p>Is there important uncertainty about or variability in how much people value the main outcomes?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<ul style="list-style-type: none"> <li><input type="radio"/> Important uncertainty or variability</li> <li><input checked="" type="radio"/> Possibly important uncertainty or variability</li> <li><input type="radio"/> Probably no important uncertainty or variability</li> <li><input type="radio"/> No important uncertainty or variability</li> </ul>	<b>Outcomes valuation (stakeholders n=249)</b>	The voting results are: <ul style="list-style-type: none"> <li>• Important uncertainty or variability: 2</li> <li>• Possibly important uncertainty or variability: 7</li> <li>• Probably no important uncertainty or variability: 4</li> </ul>

Outcomes	Not important (%)		Important (%)		Critical (%)	
	GDG	Stakeholders	GDG	Stakeholders	GDG	Stakeholders
Accuracy	0	1	32	19	69	81
Mortality	0	6	0	16	100	80
Respiratory failure	0	4	0	4	100	94
Multorgan failure	0	5	19	22	82	75
Shortness of breath	0	6	27	33	74	63
Recovery	0	4	15	25	86	73
Adverse effects of imaging	44	24	44	40	13	37
Transmission to HCWs	7	3	13	14	82	84
Length of stay in ED	14	12	34	40	54	49
Length of hospital stay	13	8	38	44	50	49
Length of ICU stay	0	4	19	36	82	62
Availability of care	0	4	38	23	63	75
Access to care	0	4	25	21	75	77
Quality of care	7	3	25	18	69	81

Critical outcomes (GDG, stakeholders n=249):

- No important uncertainty or variability: 1



Green: accuracy of the diagnostic modality; blue: clinical outcomes; orange: health systems outcomes

Dark color: GDG; light color: stakeholders

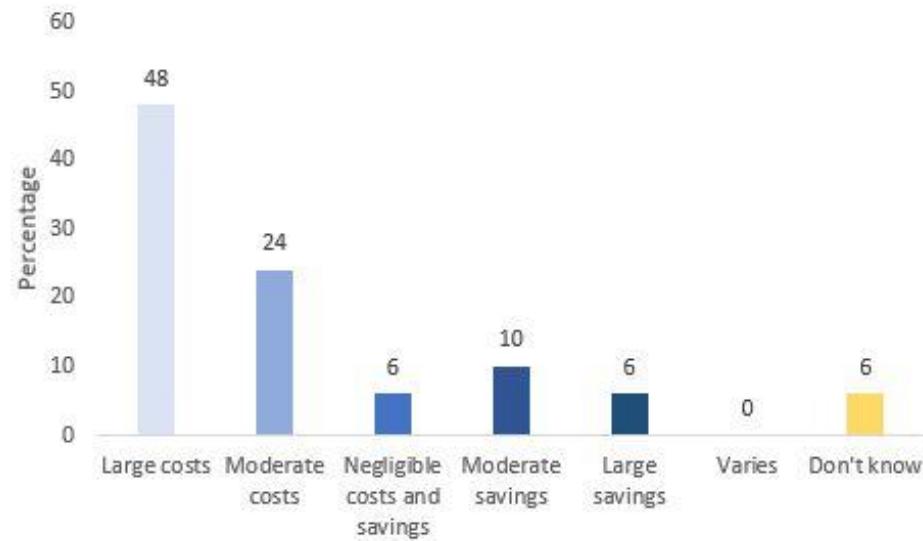
Stakeholder respondents (n=249) included:

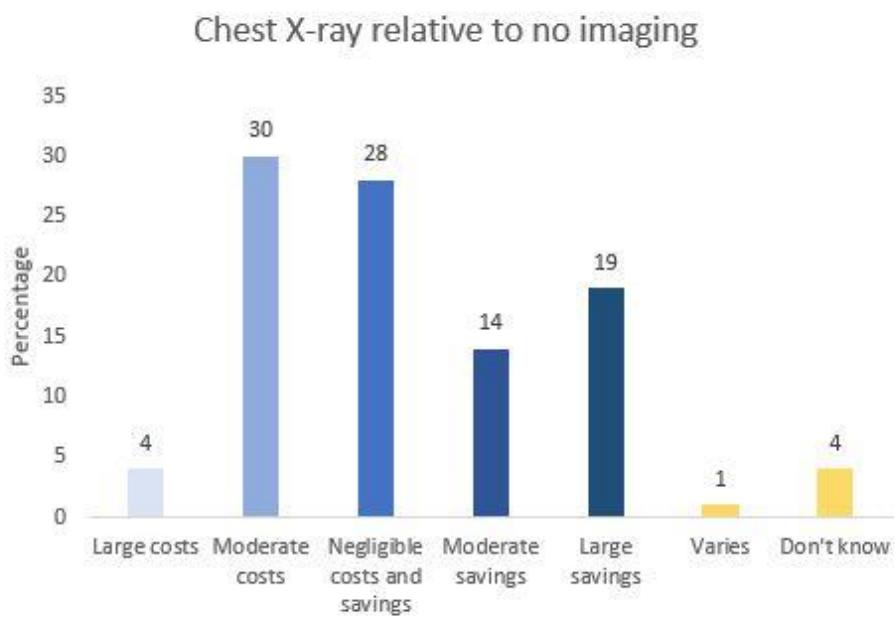
- members of the public (3%)
- patients (2%)
- physicians (22%)
- technicians (53%)
- other health professionals (5%)
- researchers (3%)
- policy-makers (3%)
- other (7%)

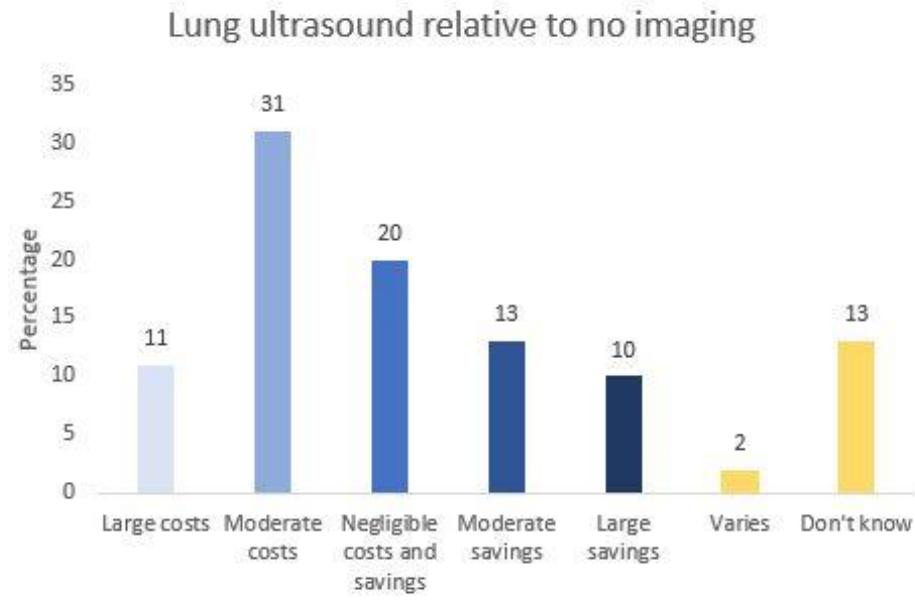
•	Update	
<input type="radio"/> Important uncertainty or variability <input type="radio"/> Possibly important uncertainty or variability <input type="radio"/> Probably no important uncertainty or variability <input type="radio"/> No important uncertainty or variability	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
Balance of effects Does the balance between desirable and undesirable effects favor the intervention or the comparison?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<input type="radio"/> Favors the comparison <input type="radio"/> Probably favors the comparison <input type="radio"/> Does not favor either the intervention or the comparison <ul style="list-style-type: none"> <li>● Probably favors the intervention</li> </ul> <input type="radio"/> Favors the intervention <input type="radio"/> Varies <input type="radio"/> Don't know		<p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Favors the comparison: 1</li> <li>● Probably favors the comparison: 1</li> <li>● Does not favor either the intervention or the comparison: 1</li> <li>● Probably favors the intervention: 7</li> <li>● Favors the intervention: 1</li> <li>● Varies: 2</li> <li>● Don't know: 0</li> </ul>
•	Update	

<ul style="list-style-type: none"> <li><input type="radio"/> Favors the comparison</li> <li><input type="radio"/> Probably favors the comparison</li> <li><input type="radio"/> Does not favor either the intervention or the comparison</li> <li><input type="radio"/> Probably favors the intervention</li> <li><input type="radio"/> Favors the intervention</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>		
<p>Resources required How large are the resource requirements (costs)?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <li><input checked="" type="radio"/> Original</li> </ul>		<ul style="list-style-type: none"> <li><input type="radio"/> Large costs</li> <li><input checked="" type="radio"/> Moderate costs</li> <li><input type="radio"/> Negligible costs and savings</li> <li><input type="radio"/> Moderate savings</li> <li><input type="radio"/> Large savings</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Large costs: 5</li> <li><input checked="" type="radio"/> Moderate costs: 7</li> <li><input type="radio"/> Negligible costs and savings: 1</li> <li><input type="radio"/> Moderate savings: 1</li> <li><input type="radio"/> Large savings: 0</li> <li><input type="radio"/> Varies: 0</li> <li><input type="radio"/> Don't know : 0</li> </ul>

### CT scan relative to no imaging





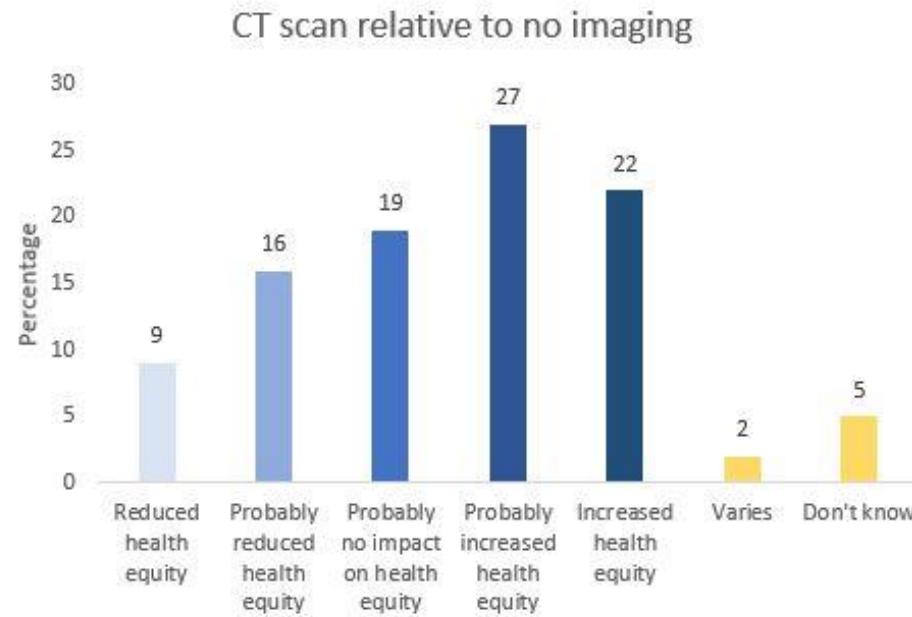


Respondents (n=124) included:

- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

•	Update	
<input type="radio"/> Large costs <input type="radio"/> Moderate costs <input type="radio"/> Negligible costs and savings <input type="radio"/> Moderate savings <input type="radio"/> Large savings <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>	
<b>Equity</b> What would be the impact on health equity?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	

- Reduced
- Probably reduced
- Probably no impact
- Probably increased
- Increased
- Varies
- Don't know

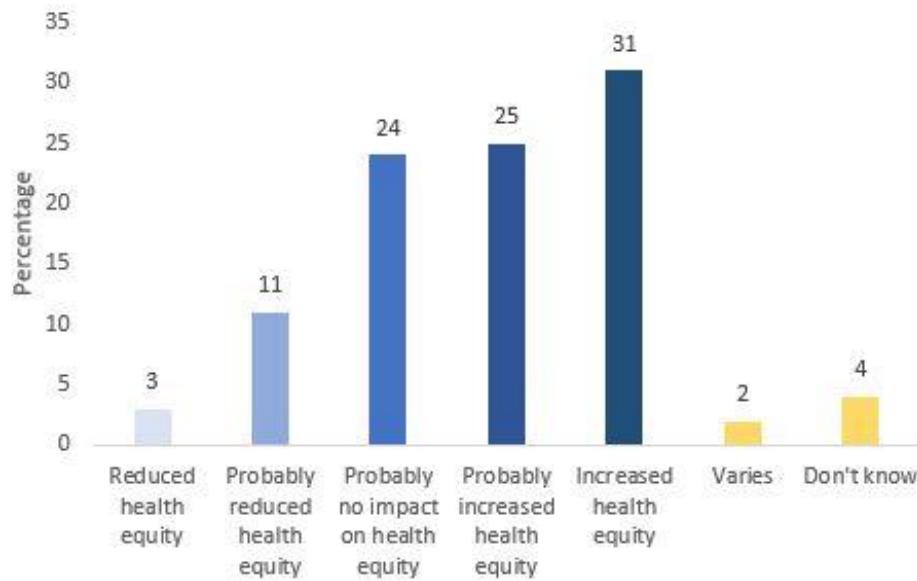


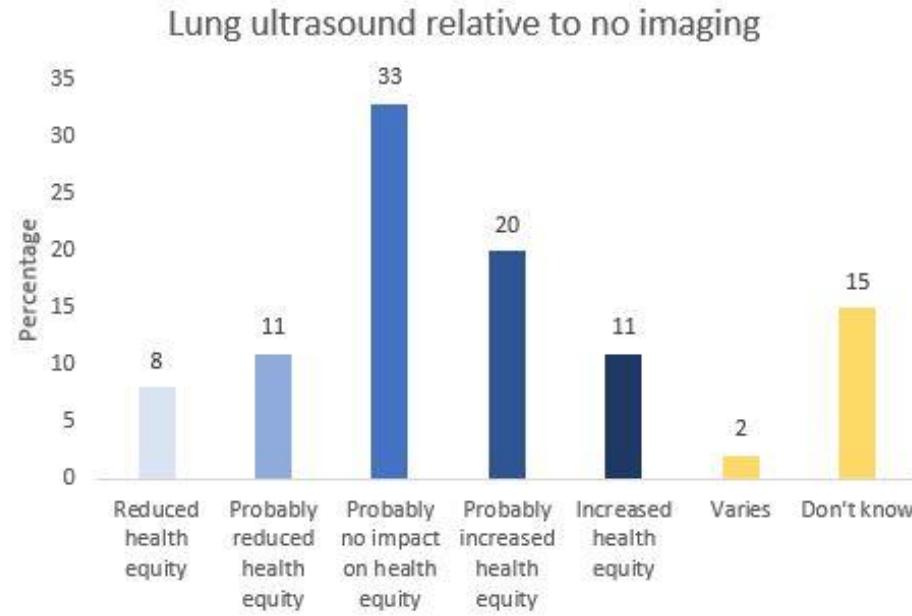
- In some settings when patients have to pay out of pocket, those who are disadvantaged might be affected
- Accessibility of CT scans in communities with limited health resources
- Impact on equity might depend on whether the fees are covered
- diversion of resources from non-COVID care

The voting results are:

- Reduced: 0
- Probably reduced: 8
- Probably no impact : 0
- Probably increased: 4
- Increased: 2
- Varies: 0
- Don't know : 0

### Chest X-ray relative to no imaging

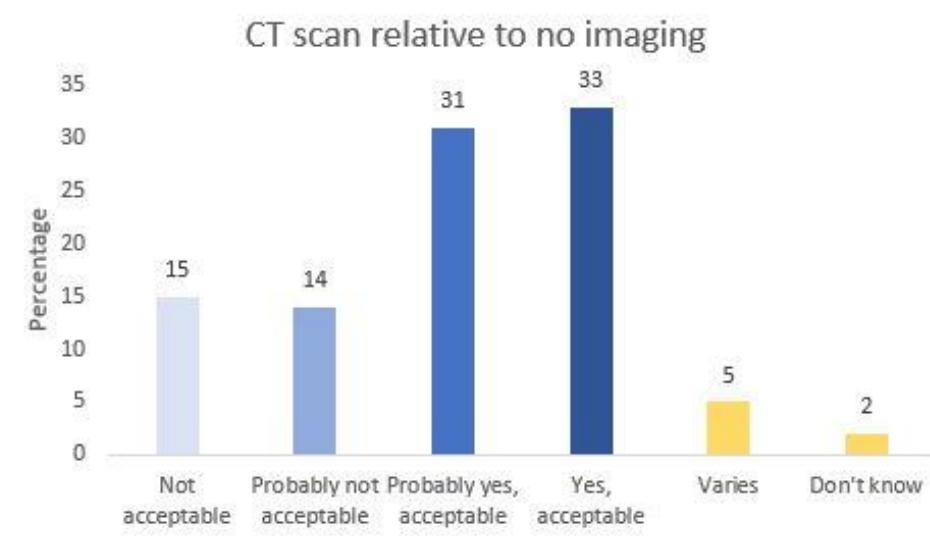




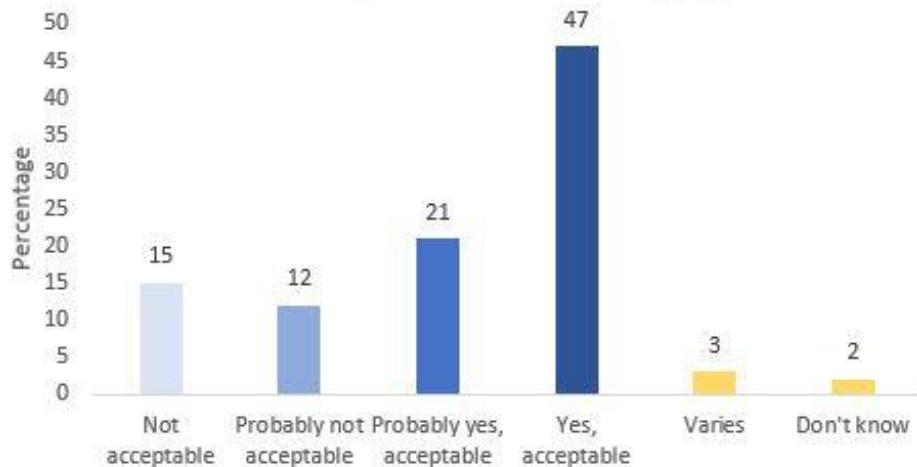
Respondents (n=124) included:

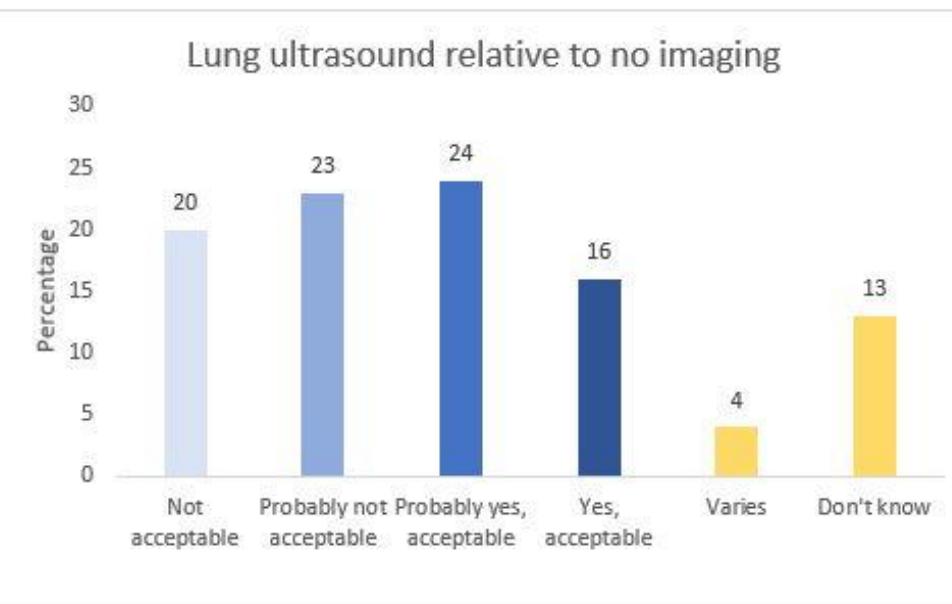
- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

•	Update	
<input type="radio"/> Reduced <input type="radio"/> Probably reduced <input type="radio"/> Probably no impact <input type="radio"/> Probably increased <input type="radio"/> Increased <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	<ul style="list-style-type: none"> <li>● Impact on equity will vary by setting depending on coverage.</li> <li>● In some settings, diversion of resources from non-COVID care (e.g., oncology, cardiovascular, trauma and acute inpatient care) has improved in the second wave compared to the first wave.</li> </ul>
<b>Acceptability</b> Is the intervention acceptable to key stakeholders?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	Original	<ul style="list-style-type: none"> <li>● Providing information to patients is required</li> <li>● Consent would be ideal, but might not be feasible</li> <li>● Likely to be acceptable for patients, less likely to be acceptable to technicians</li> <li>● Varies by the administrator</li> <li>● Might be less acceptable to payers</li> <li>● Perform low-dose CT whenever possible</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>● No : 0</li> <li>● Probably no : 1</li> <li>● Probably yes: 9</li> <li>● Yes: 5</li> <li>● Varies: 0</li> <li>● Don't know : 0</li> </ul>



### Chest X-ray relative to no imaging



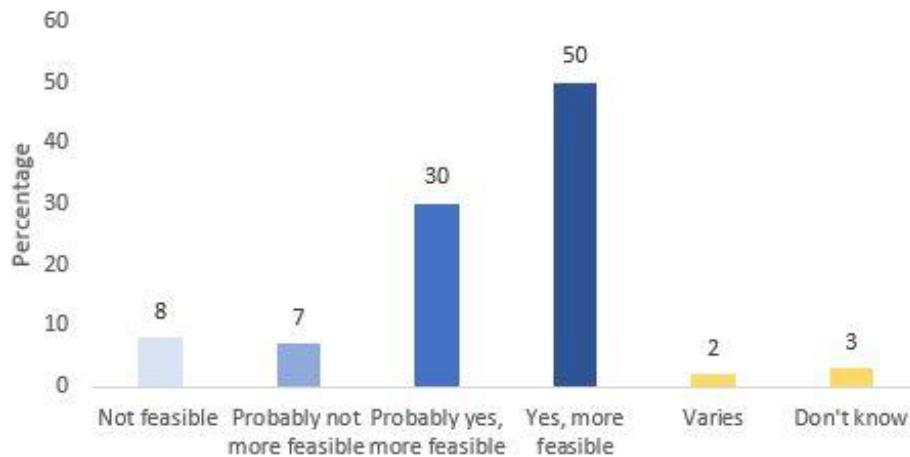


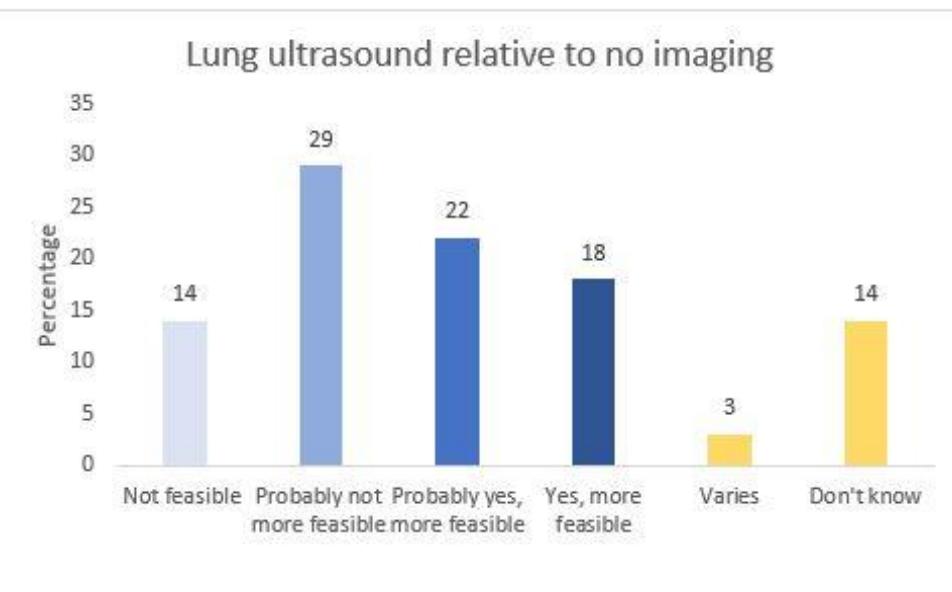
Respondents (n=124) included:

- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

	Update																
<input type="radio"/> No <input type="radio"/> Probably no <input type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>																
Feasibility Is the intervention feasible to implement?																	
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS															
	Original	<ul style="list-style-type: none"> <li>• Need to clean CT unit</li> <li>• Stop the non-urgent use of CT scan (issue of access and availability)</li> <li>• Availability of staff to interpret the scan (24/7)</li> <li>• Adapting the workflow in the CT room</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>• No : 0</li> <li>• Probably no : 0</li> <li>• Probably yes: 10</li> <li>• Yes: 4</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>															
<input type="radio"/> No <input type="radio"/> Probably no <b>• Probably yes</b> <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<table border="1"> <caption>CT scan relative to no imaging</caption> <thead> <tr> <th>Response Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Not feasible</td> <td>13</td> </tr> <tr> <td>Probably not more feasible</td> <td>26</td> </tr> <tr> <td>Probably yes, more feasible</td> <td>29</td> </tr> <tr> <td>Yes, more feasible</td> <td>26</td> </tr> <tr> <td>Varies</td> <td>3</td> </tr> <tr> <td>Don't know</td> <td>3</td> </tr> </tbody> </table>	Response Category	Percentage	Not feasible	13	Probably not more feasible	26	Probably yes, more feasible	29	Yes, more feasible	26	Varies	3	Don't know	3		
Response Category	Percentage																
Not feasible	13																
Probably not more feasible	26																
Probably yes, more feasible	29																
Yes, more feasible	26																
Varies	3																
Don't know	3																

### Chest X-ray relative to no imaging





Respondents (n=124) included:

- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

•

Update

<input type="radio"/> No <input type="radio"/> Probably no <input type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
--	---	--

#### SUMMARY OF JUDGEMENTS

CRITERIA	ORIGINAL	IMPORTANCE FOR DECISION	UPDATE	IMPORTANCE FOR DECISION
DESIRABLE EFFECTS	Moderate			
UNDESIRABLE EFFECTS	Small			
CERTAINTY OF EVIDENCE	Low		Moderate	
VALUES	Possibly important uncertainty or variability			
BALANCE OF EFFECTS	Probably favors the intervention			
RESOURCES REQUIRED	Moderate costs			
EQUITY	Probably reduced			
ACCEPTABILITY	Probably yes			
FEASIBILITY	Probably yes			

#### TYPE OF RECOMMENDATION

Original				
Strong recommendation against the intervention <input type="radio"/>	Conditional recommendation against the intervention <input type="radio"/>	Conditional recommendation for either the intervention or the comparison <input type="radio"/>	Conditional recommendation for the intervention <input type="radio"/>	Strong recommendation for the intervention <input type="radio"/>
Update				

Strong recommendation against the intervention ○	Conditional recommendation against the intervention ○	Conditional recommendation for either the intervention or the comparison ○	Conditional recommendation for the intervention ○	Strong recommendation for the intervention ○
---	--	---	--	---

## CONCLUSIONS

Original

### Recommendation (#)

R2.1. 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 (conditional recommendation, based on low certainty evidence).

(#) This recommendation and the certainty of its evidence base were judged to remain unchanged after the update of the review conducted before the publication of the second edition of the guide.

### Remarks:

RT-PCR should be done to confirm diagnosis of COVID-19.

The voting results are:

- Strong recommendation against the intervention: 2
- Conditional recommendation against the intervention: 9
- Conditional recommendation for either the intervention or the comparison: 2
- Conditional recommendation for the intervention: 3
- Strong recommendation for the intervention: 0

R2.2. For symptomatic patients with suspected COVID-19, WHO suggests using chest imaging for the diagnostic workup of COVID-19 when: (1) RT-PCR testing is not available; (2) RT-PCR testing is available, but results are delayed; and (3) initial RT-PCR testing is negative, but with high clinical suspicion of COVID-19 (Conditional recommendation, based on low certainty evidence).

(#) This recommendation and the certainty of its evidence base were judged to remain unchanged after the update of the review conducted before the publication of the second edition of the guide.

### Remarks:

Imaging should be used as one element of the diagnostic workup that otherwise includes clinical and laboratory data. Patients likely to benefit from chest imaging are those who:

- have severe symptoms and/or signs on physical exam;
- require emergency procedures or other urgent interventions (e.g. for stroke or requiring haemodialysis);
- have presentations that could represent complications of COVID-19 (e.g. pneumonia, pulmonary arterial thrombosis or thromboembolism);
- 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);
- need to be transferred to another facility;
- live with people at high risk if infected with COVID-19 (e.g. immunocompromised, persons aged over 60 years);
- 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.

When choosing the imaging modalities, consider the following.

- Compared to chest CT, chest radiography appears to have lower sensitivity and might have higher specificity. Chest radiography is less-resource intensive, is associated with lower radiation doses, is easier to repeat sequentially for monitoring disease progression, and can be performed with portable equipment at the point of care (which minimizes the risk of cross-infection related to patient transport).
- Chest CT has a relatively high sensitivity but a relatively low specificity and can be useful in patients with some pre-existing pulmonary diseases. However, the absence of radiological signs of pneumonia cannot completely exclude a viral infection.
- Lung ultrasound has very low-certainty evidence supporting its diagnostic accuracy but might be helpful with the appropriate expertise as a supplemental or alternative modality (e.g. in pregnant women, children). Lung ultrasound can be done at the point of care but requires closer physical proximity of the operator to the patient for a longer period and requires specific infection prevention and control precautions.
- The differential diagnoses and potential complications for each specific case (e.g. CT angiography for pulmonary thromboembolism, ultrasound for pleural effusions and heart conditions) should be considered when choosing imaging modality.
- Choice should be made through shared decision-making involving the referring physician, the radiologist and the patient whenever possible. If feasible, the patient should be provided with information regarding the imaging modality to be used and the likelihood of requiring subsequent imaging procedures.

The voting was based on using CT scan vs not using CT scan, however the group decided that this applies to imaging vs no imaging and then the recommendation to use imaging was in the following order: chest x-ray, chest CT scan, LUS.

#### Justification

- 

Update

## Recommendation

### R2.1:

For symptomatic patients with suspected COVID-19, WHO suggests not using chest imaging for the diagnostic workup of COVID-19 when virologic testing is available with timely results.

*(Conditional recommendation, based on moderate certainty evidence)*

#### Remarks:

Virologic testing (e.g., with RT-PCR or antigen-detecting Rapid Diagnostic Tests (Ag-RDT)) can be used to confirm diagnosis of COVID-19.

Local protocols related to isolation and testing should be followed.

#### Recommendation reached through consensus and without voting.

### R2.2:

For symptomatic patients with suspected COVID-19, WHO suggests using chest imaging for the diagnostic workup of COVID-19 when: (1) virologic testing is not available; (2) virologic testing is available, but results are delayed; and (3) virologic testing is negative, but a high clinical suspicion of COVID-19 remains.

*(Conditional recommendation, based on moderate certainty evidence)*

#### Remarks

Virologic testing (e.g., with RT-PCR or antigen-detecting Rapid Diagnostic Tests (Ag-RDT)) can be used to confirm diagnosis of COVID-19.

Local protocols related to isolation and testing should be followed.

Imaging should be used as one element of the diagnostic workup that otherwise includes clinical and laboratory data.

Patients likely to benefit from chest imaging are those who:

- have severe symptoms and/or signs on physical exam;
- require emergency procedures or other urgent interventions (e.g. for stroke or requiring haemodialysis);
- have presentations that could represent complications of COVID-19 (e.g. pneumonia, pulmonary arterial thrombosis or thromboembolism);
- 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);
- need to be transferred to another facility;

- live with people at high risk if infected with COVID-19 (e.g. immunocompromised, persons aged over 60 years);
- 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.

When choosing the imaging modalities, consider the following:

- The evidence supporting Chest CT has a certainty level that is higher than that of other modalities (i.e., moderate versus low). Chest CT can be useful in patients with some pre-existing pulmonary diseases. However, the absence of radiological signs of pneumonia cannot completely exclude a viral infection. Chest CT is less preferred in high prevalence settings as this might lead to its high utilization and diversion of resources from non-COVID-19 patients.
- Chest radiography is less-resource intensive, is associated with lower radiation doses, is easier to repeat sequentially for monitoring disease progression, and can be performed with portable equipment at the point of care (which minimizes the risk of cross-infection related to patient transport). The option of the chest radiography through a glass door may reduce the risk of transmission and the use of PPE.
- Lung ultrasound might be helpful with the appropriate expertise as a supplemental or alternative modality (e.g. in pregnant women, children). Lung ultrasound can be done at the point of care but requires closer physical proximity of the operator to the patient for a longer period and requires specific infection prevention and control precautions.
- The most appropriate imaging modality considering the differential diagnoses for each specific case (e.g. CT angiography for pulmonary thromboembolism, ultrasound for pleural effusions and heart conditions).
- Choice should be made through shared decision-making involving the referring physician, the radiologist and the patient whenever possible. If feasible, the patient should be provided with information regarding the imaging modality to be used and the likelihood of requiring subsequent imaging procedures.

Even when chest imaging is used in the initial diagnostic workup of COVID-19, virologic testing may need to be eventually done to confirm the diagnosis of COVID-19.

**Recommendation reached through consensus and without voting.**

**Justification**

**Subgroup considerations**

Original

• Update

## Implementation considerations

### Original

1. Implement the recommendations based on your equipment availability. Consider the resources needed (budget, health workforce, personal protective equipment, imaging equipment), the need to adapt the clinical workflow and the need to deprioritize other indications for imaging.
2. Consider the use of locally-developed flow charts, infographics and other decision-support tools to facilitate implementation.
3. Bear in mind that recommendations for imaging depend on severity of symptoms and that chest imaging is an essential investigation in those who develop respiratory symptoms or hypoxia.
4. Monitor respiratory symptoms and physical exam findings to guide timing of chest imaging.
5. Consider the use of portable equipment for performing chest radiography at the point of care. In the case of home health care, combine chest radiography and/or lung ultrasound by portable equipment with RT-PCR testing.
6. Mitigate the risk of infection transmission to health care workers and to other patients associated with patient transport to the imaging department (e.g. use of point of care imaging such as portable equipment). (See infection prevention and control precautions in Annex 1.)
7. Consider the possibility of false negative imaging results in patients for whom chest imaging indicates no findings suspicious of COVID-19 (particularly during the first 2 days after symptom onset).
  - a. If discharged from the emergency department or other outpatient assessment setting, patients need to abide by the local public health measures (e.g. quarantine, social distancing) until definitive RT-PCR diagnosis is made.
  - b. If the patient is admitted, health care workers need to consider appropriate clinical precautions until definitive RT-PCR diagnosis is made.
8. When performing chest radiography and chest CT, minimize radiation dose while maintaining diagnostic image quality (e.g. low-dose scanning protocols) and use digital imaging rather than film-screen equipment (16).
9. Consider the potential harms from exposure to ionizing radiation, in particular for pregnant women and children.
10. Ensure proper use of personal protective equipment by health care workers and proper disinfection of equipment and devices (see Annex 1).

11. Provide appropriate training of radiologists and technologists on infection prevention and control practices and ensure efficient management of typical imaging findings of COVID-19 through accepted local protocols.

12. Consider the transfer of images for remote reporting (teleradiology) as needed (e.g. settings where radiologists are not available for on-site reporting).

13. Provide information to patients about safety provisions adopted by the facility for infection prevention and control (see Annex 1) as well as for radiation protection (16).

14. Make provisions to ensure that all patients get the imaging services they need without suffering financial hardship.

- 

Update

Unchanged

#### Monitoring and evaluation

Original

- Monitor the number of requested chest imaging investigations related to COVID-19 and judge their adequacy.
- Monitor the impact of COVID-19-related chest imaging in different clinical scenarios on institutional and national resources (human and financial).
- Monitor the appropriate implementation of workflow and infection prevention and control measures (e.g. personal protective equipment).
- Monitor the number of cases of COVID-19 infections among hospital staff attributable to COVID-19-related chest imaging.
- Compare the results of COVID-19-related chest imaging with the results of RT-PCR (once available).
- Monitor the impact of chest imaging on patient stratification into different COVID-19-related risk profiles.

- 

Update

Unchanged

#### Research priorities

Original

- Conduct randomized controlled trials to compare the effects of using the different imaging modalities and using no imaging (in addition to clinical judgement) on clinical and health services outcomes of interest, for the questions addressed in this rapid advice guide.
- Evaluate access and health insurance coverage of chest imaging services related to COVID-19 in different settings.
- Study the role of artificial intelligence in chest imaging in different settings.
- Assess the incidence of COVID-19 infections among hospital staff attributable to chest imaging of patients with COVID-19 (e.g. in radiologists and radiographers).
- Evaluate the implementation of workflow developed for COVID-19-related chest imaging.
- Evaluate the safety and effectiveness of performing portable chest radiography, with and without RT-PCR testing, at home.
- Evaluate the impact of COVID-19-related imaging on institutional and national resources (human and financial).
- Evaluate the impact of COVID-19-related imaging on equity.
- Assess the values and preferences of different stakeholders for relevant chest imaging modalities in different settings.
- Conduct well-designed studies to assess the diagnostic accuracy measures of the different imaging modalities. These studies should ideally be cohort studies of patients with suspected or confirmed COVID-19 that clearly describe the disease severity and use an adequate reference standard (serial RT-PCR and/or clinical follow-up) and clearly defined criteria for positive imaging.
- Study the characteristics of the chest imaging findings in suspected COVID-19 cases who eventually turn out to be positive.
- Study the diagnostic value of chest imaging in asymptomatic contacts who eventually become symptomatic.
- Assess the frequency of radiological findings of COVID-19 in asymptomatic contacts who are scheduled for urgent or non-urgent interventions (e.g. cardiac catheterization, surgery, endoscopy).
- Study the findings of CT pulmonary angiography in patients with COVID-19, particularly those with severe and moderate symptoms.

•

Update

Unchanged

### KQ3 (PICO 3)

**Should chest imaging vs. no chest imaging be used for patients with suspected or confirmed COVID-19 and mild symptoms presenting to the healthcare system (e.g. emergency department); context of a decision on hospital admission versus home discharge?**

<b>POPULATION:</b>	Patients with suspected or confirmed COVID-19 and mild symptoms presenting to the healthcare system (e.g. emergency department)
<b>INTERVENTION:</b>	Chest imaging
<b>COMPARISON:</b>	No chest imaging

<b>MAIN OUTCOMES:</b>	<ol style="list-style-type: none"> <li>1. Clinical outcomes           <ul style="list-style-type: none"> <li>• Mortality</li> <li>• Respiratory failure</li> <li>• Multiorgan failure</li> <li>• Shortness of breath</li> <li>• Recovery</li> <li>• Adverse effects of imaging (e.g., exposure to radiation)</li> <li>• COVID-19 transmission to health workers</li> </ul> </li>   <li>2. Health systems outcomes           <ul style="list-style-type: none"> <li>• Service use, including:               <ul style="list-style-type: none"> <li>◦ Length of stay in Emergency Department</li> <li>◦ Length of hospital stay</li> <li>◦ Length of ICU stay</li> </ul> </li> <li>• Availability of care</li> <li>• Access to care</li> <li>• Quality of care</li> </ul> </li> </ol>
<b>SETTING:</b>	Decision on hospital admission versus home discharge
<b>PERSPECTIVE:</b>	Societal perspective
<b>BACKGROUND:</b>	
<b>CONFLICT OF INTERESTS:</b>	

#### ASSESSMENT

Desirable Effects How substantial are the desirable anticipated effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<input type="radio"/> Trivial <input type="radio"/> Small <input checked="" type="radio"/> Moderate <input type="radio"/> Large	<ul style="list-style-type: none"> <li>• No study evaluated the effects of chest imaging on clinical outcomes</li> <li>• No study evaluated the effects of chest imaging on health systems outcomes</li> </ul>	<ul style="list-style-type: none"> <li>• Risk stratifying patients</li> <li>• Higher risk for disease progression</li> <li>• Establishing definitive diagnosis</li> </ul>

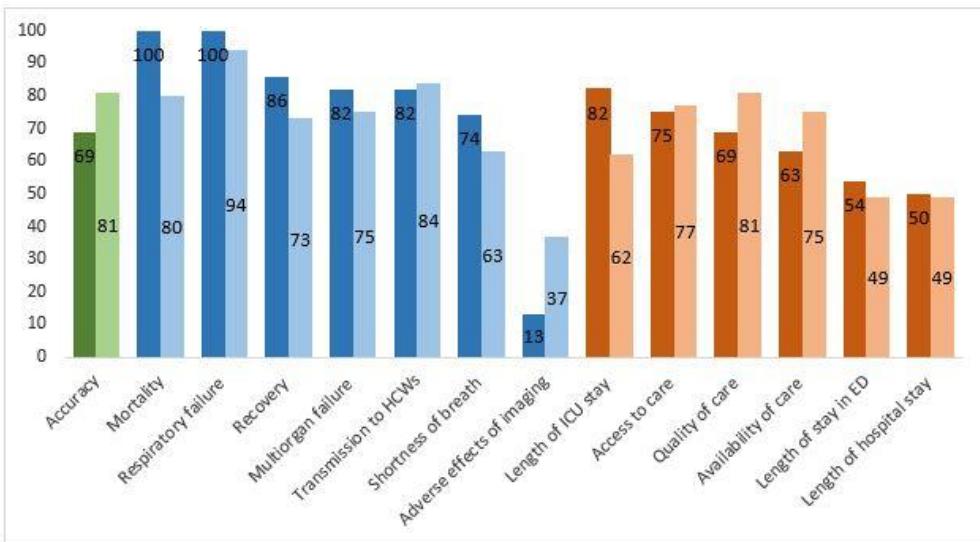
<input type="radio"/> Varies <input type="radio"/> Don't know		<ul style="list-style-type: none"> <li>• Artificial intelligence (AI) may be used in interpreting the results</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>• Trivial: 0</li> <li>• Small: 5</li> <li>• Moderate: 6</li> <li>• Large: 5</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>
•	Update	
<input type="radio"/> Trivial <input type="radio"/> Small <input checked="" type="radio"/> Moderate <input type="radio"/> Large <input type="radio"/> Varies <input type="radio"/> Don't know	<p><b>CT scanning</b></p> <ul style="list-style-type: none"> <li>• CT severity/extent of disease associated with mortality (3 studies) or mortality/ICU admission (1 study)</li> <li>• Adjusted HR 3.74 (1.10-12.77), AUROC 0.75-0.83</li> </ul> <p><b>CXR</b></p> <ul style="list-style-type: none"> <li>• CXR severity score associated with likelihood of hospital admission (adjusted OR 6.2, 95% CI 3.5-11).</li> <li>• Extent of lung involvement on CXR associated with intubation (adjusted OR 4.7 [1.8-13]); ICU, intubation, or death (AUROC 0.77 to 0.84) or intubation (HR 3.69 [2.25-6.07])</li> <li>• No association or negative association with length of stay (k=2)</li> </ul> <p><b>US</b></p> <ul style="list-style-type: none"> <li>• US B-lines associated with ICU admission (adjusted OR 1.6 [1.2-2.1]) and ARDS (adjusted OR 1.7 [1.3-2.3]) but no association with mortality; US severity score associated with Se of 0.81 and 0.59 for hospitalization (poor accuracy for death or intubation)</li> <li>• Nursing home (k=1): US severity score Se 0.58 (0.28-0.85) and Sp 0.64 (0.46-0.79) for mortality; AUROC 0.60 (0.42-0.79)</li> </ul>	

	<ul style="list-style-type: none"> <li><b>No study provided evidence for the effects of chest imaging on health systems outcomes</b></li> </ul>	
Undesirable Effects How substantial are the undesirable anticipated effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<input type="radio"/> Large <input type="radio"/> Moderate <input checked="" type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li><b>No study evaluated the effects of chest imaging on clinical outcomes</b></li> <li><b>No study evaluated the effects of chest imaging on health systems outcomes</b></li> </ul>	<ul style="list-style-type: none"> <li>Risk of radiation</li> <li>Exposure of HCWs</li> <li>The undesirable effects vary based on modality, might be less in chest xray</li> <li>If portable chest x-ray available, harms would be lower in chest x-ray</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>Large: 2</li> <li>Moderate: 1</li> <li>Small: 9</li> <li>Trivial: 0</li> <li>Varies: 3</li> <li>Don't know : 0</li> </ul>
•	Update	

<input type="radio"/> Large <input type="radio"/> Moderate <input checked="" type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● No study provided evidence for harms.</li> </ul>	
Certainty of evidence What is the overall certainty of the evidence of effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<input checked="" type="radio"/> Very low <input type="radio"/> Low <input type="radio"/> Moderate <input type="radio"/> High <input type="radio"/> No included studies	Original	<ul style="list-style-type: none"> <li>● Very low for CT vs. no CT</li> <li>● Very low for CXR vs. no CXR</li> <li>● Very low for US vs. no US</li> </ul>
•	Update	

<ul style="list-style-type: none"> <li><input type="radio"/> Very low</li> <li><input checked="" type="radio"/> Low</li> <li><input type="radio"/> Moderate</li> <li><input type="radio"/> High</li> <li><input type="radio"/> No included studies</li> </ul>		<ul style="list-style-type: none"> <li><input checked="" type="radio"/> Low for CT vs. no CT</li> <li><input type="radio"/> Low for CXR vs. no CXR</li> <li><input type="radio"/> Very low for US vs. no US</li> </ul>																																																																																																															
Values Is there important uncertainty about or variability in how much people value the main outcomes?																																																																																																																	
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS																																																																																																															
	Original																																																																																																																
<ul style="list-style-type: none"> <li><input type="radio"/> Important uncertainty or variability</li> <li><input checked="" type="radio"/> Possibly important uncertainty or variability</li> <li><input type="radio"/> Probably no important uncertainty or variability</li> <li><input type="radio"/> No important uncertainty or variability</li> </ul>	<p><b>Rating of outcomes:</b></p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Outcomes</th> <th colspan="2">Not important (%)</th> <th colspan="2">Important (%)</th> <th colspan="2">Critical (%)</th> </tr> <tr> <th>GDG</th> <th>Stakeholders</th> <th>GDG</th> <th>Stakeholders</th> <th>GDG</th> <th>Stakeholders</th> </tr> </thead> <tbody> <tr> <td>Accuracy</td> <td>0</td> <td>1</td> <td>32</td> <td>19</td> <td>69</td> <td>81</td> </tr> <tr> <td>Mortality</td> <td>0</td> <td>6</td> <td>0</td> <td>16</td> <td>100</td> <td>80</td> </tr> <tr> <td>Respiratory failure</td> <td>0</td> <td>4</td> <td>0</td> <td>4</td> <td>100</td> <td>94</td> </tr> <tr> <td>Multiorgan failure</td> <td>0</td> <td>5</td> <td>19</td> <td>22</td> <td>82</td> <td>75</td> </tr> <tr> <td>Shortness of breath</td> <td>0</td> <td>6</td> <td>27</td> <td>33</td> <td>74</td> <td>63</td> </tr> <tr> <td>Recovery</td> <td>0</td> <td>4</td> <td>15</td> <td>25</td> <td>86</td> <td>73</td> </tr> <tr> <td>Adverse effects of imaging</td> <td>44</td> <td>24</td> <td>44</td> <td>40</td> <td>13</td> <td>37</td> </tr> <tr> <td>Transmission to HCWs</td> <td>7</td> <td>3</td> <td>13</td> <td>14</td> <td>82</td> <td>84</td> </tr> <tr> <td>Length of stay in ED</td> <td>14</td> <td>12</td> <td>34</td> <td>40</td> <td>54</td> <td>49</td> </tr> <tr> <td>Length of hospital stay</td> <td>13</td> <td>8</td> <td>38</td> <td>44</td> <td>50</td> <td>49</td> </tr> <tr> <td>Length of ICU stay</td> <td>0</td> <td>4</td> <td>19</td> <td>36</td> <td>82</td> <td>62</td> </tr> <tr> <td>Availability of care</td> <td>0</td> <td>4</td> <td>38</td> <td>23</td> <td>63</td> <td>75</td> </tr> <tr> <td>Access to care</td> <td>0</td> <td>4</td> <td>25</td> <td>21</td> <td>75</td> <td>77</td> </tr> <tr> <td>Quality of care</td> <td>7</td> <td>3</td> <td>25</td> <td>18</td> <td>69</td> <td>81</td> </tr> </tbody> </table>	Outcomes	Not important (%)		Important (%)		Critical (%)		GDG	Stakeholders	GDG	Stakeholders	GDG	Stakeholders	Accuracy	0	1	32	19	69	81	Mortality	0	6	0	16	100	80	Respiratory failure	0	4	0	4	100	94	Multiorgan failure	0	5	19	22	82	75	Shortness of breath	0	6	27	33	74	63	Recovery	0	4	15	25	86	73	Adverse effects of imaging	44	24	44	40	13	37	Transmission to HCWs	7	3	13	14	82	84	Length of stay in ED	14	12	34	40	54	49	Length of hospital stay	13	8	38	44	50	49	Length of ICU stay	0	4	19	36	82	62	Availability of care	0	4	38	23	63	75	Access to care	0	4	25	21	75	77	Quality of care	7	3	25	18	69	81	<p>The voting results are:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Important uncertainty or variability: 2</li> <li><input checked="" type="radio"/> Possibly important uncertainty or variability: 7</li> <li><input type="radio"/> Probably no important uncertainty or variability: 4</li> <li><input type="radio"/> No important uncertainty or variability: 1</li> </ul>
Outcomes	Not important (%)		Important (%)		Critical (%)																																																																																																												
	GDG	Stakeholders	GDG	Stakeholders	GDG	Stakeholders																																																																																																											
Accuracy	0	1	32	19	69	81																																																																																																											
Mortality	0	6	0	16	100	80																																																																																																											
Respiratory failure	0	4	0	4	100	94																																																																																																											
Multiorgan failure	0	5	19	22	82	75																																																																																																											
Shortness of breath	0	6	27	33	74	63																																																																																																											
Recovery	0	4	15	25	86	73																																																																																																											
Adverse effects of imaging	44	24	44	40	13	37																																																																																																											
Transmission to HCWs	7	3	13	14	82	84																																																																																																											
Length of stay in ED	14	12	34	40	54	49																																																																																																											
Length of hospital stay	13	8	38	44	50	49																																																																																																											
Length of ICU stay	0	4	19	36	82	62																																																																																																											
Availability of care	0	4	38	23	63	75																																																																																																											
Access to care	0	4	25	21	75	77																																																																																																											
Quality of care	7	3	25	18	69	81																																																																																																											

**Critical outcomes:**



Green: accuracy of the diagnostic modality; blue: clinical outcomes; orange: health systems outcomes

Dark color: GDG; light color: stakeholders

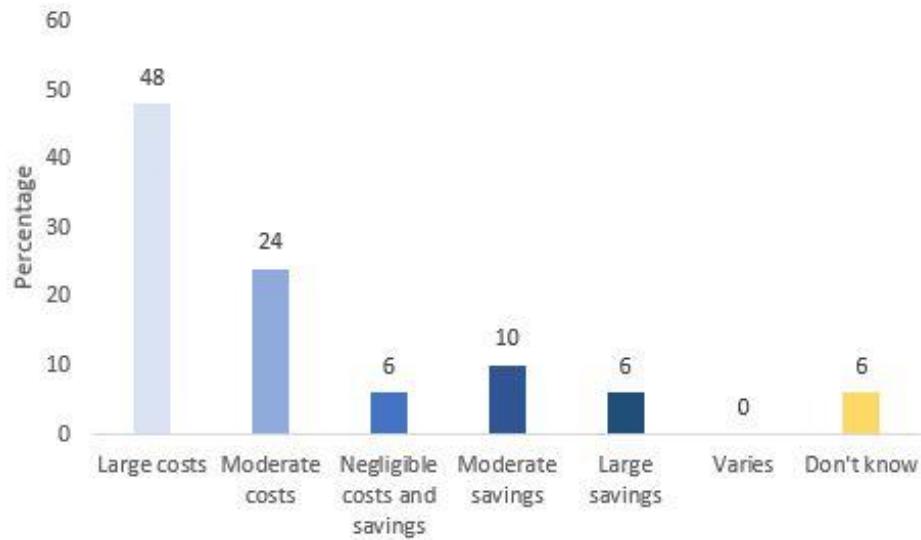
Stakeholder respondents (n=249) included:

- members of the public (3%)
- patients (2%)
- physicians (22%)

	<ul style="list-style-type: none"> <li>•technicians (53%)</li> <li>•other health professionals (5%)</li> <li>•researchers (3%)</li> <li>•policy-makers (3%)</li> <li>•other (7%)</li> </ul>	
•	Update	
<input type="radio"/> Important uncertainty or variability <input checked="" type="radio"/> Possibly important uncertainty or variability <input type="radio"/> Probably no important uncertainty or variability <input type="radio"/> No important uncertainty or variability	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>	
Balance of effects		
Does the balance between desirable and undesirable effects favor the intervention or the comparison?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<input type="radio"/> Favors the comparison <input type="radio"/> Probably favors the comparison <input type="radio"/> Does not favor either the intervention or the comparison <input checked="" type="radio"/> Probably favors the intervention <input type="radio"/> Favors the intervention <input type="radio"/> Varies <input type="radio"/> Don't know		<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• Favors the comparison: 1</li> <li>• Probably favors the comparison: 0</li> <li>• Does not favor either the intervention or the comparison: 0</li> <li>• Probably favors the intervention: 11</li> <li>• Favors the intervention : 2</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>

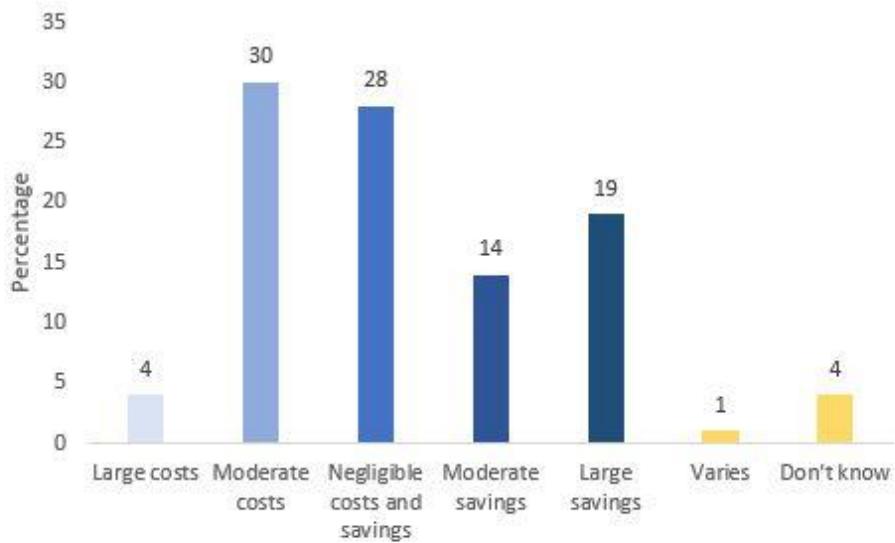
•	Update	
<input type="radio"/> Favors the comparison <input type="radio"/> Probably favors the comparison <input type="radio"/> Does not favor either the intervention or the comparison <input checked="" type="radio"/> Probably favors the intervention <input type="radio"/> Favors the intervention <input type="radio"/> Varies <input type="radio"/> Don't know		
<b>Resources required</b> How large are the resource requirements (costs)?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	<ul style="list-style-type: none"> <li>○ Large costs</li> <li>● Moderate costs</li> <li>○ Negligible costs and savings</li> <li>○ Moderate savings</li> <li>○ Large savings</li> <li>○ Varies</li> <li>○ Don't know</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Large costs: 2</li> <li>● Moderate costs: 10</li> <li>● Negligible costs and savings: 0</li> <li>● Moderate savings: 0</li> </ul>

### CT scan relative to no imaging

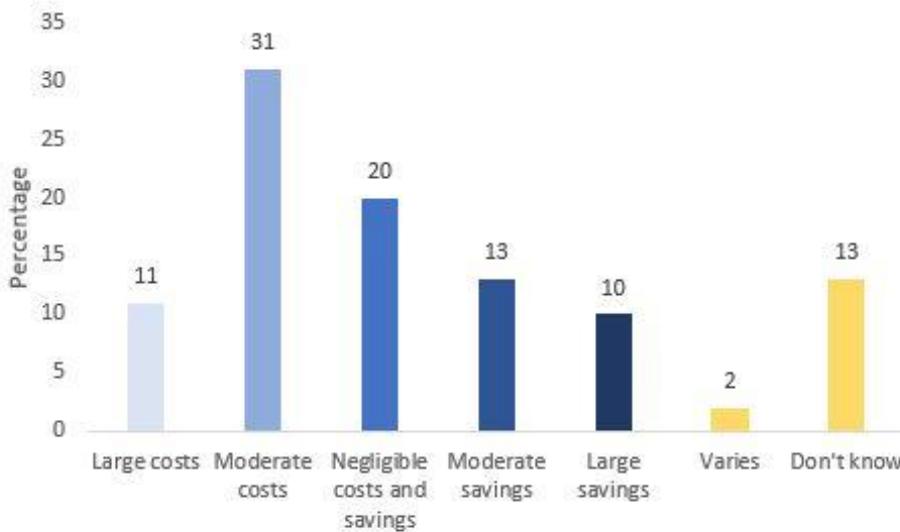


- Large savings: 0
- Varies: 2
- Don't know : 0

### Chest X-ray relative to no imaging



### Lung ultrasound relative to no imaging

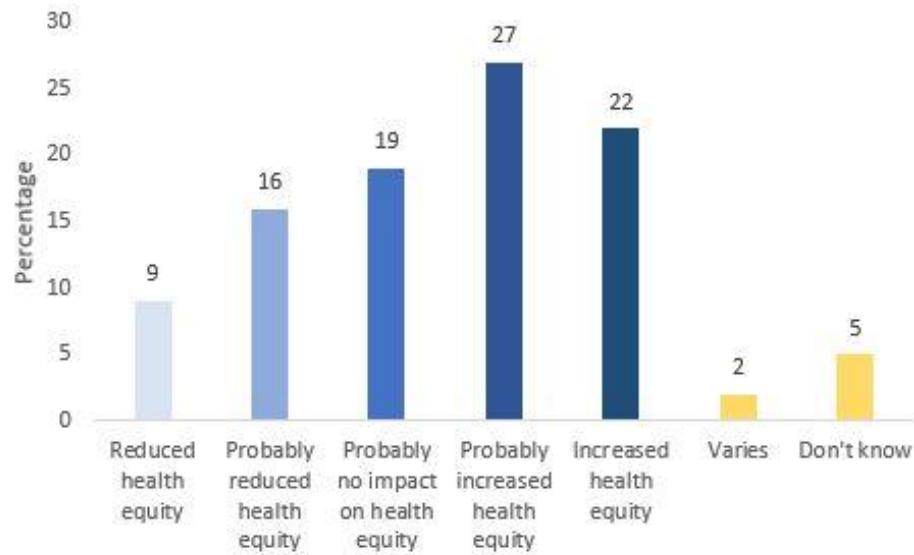


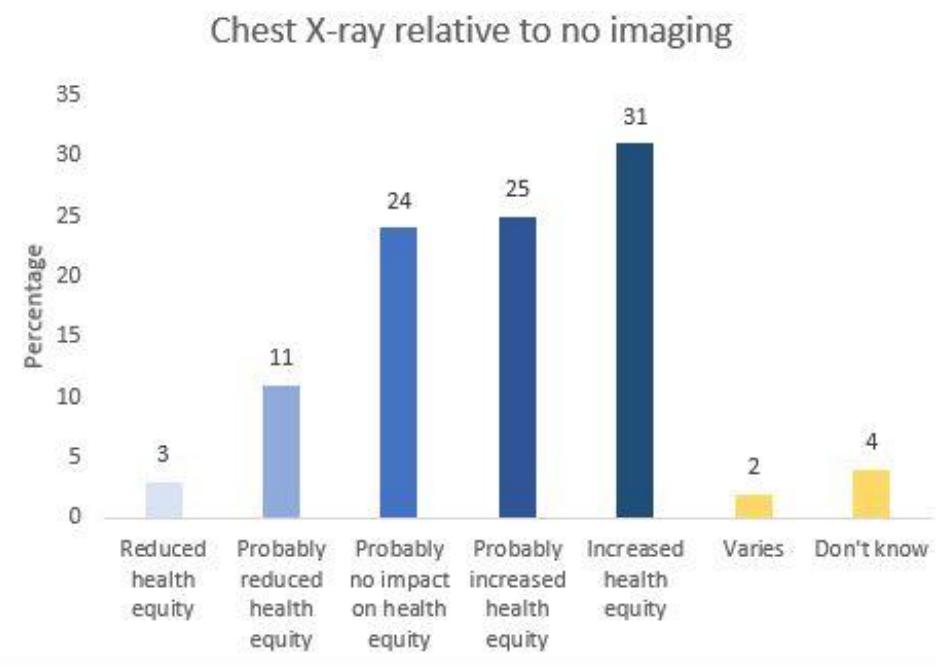
Respondents (n=124) included:

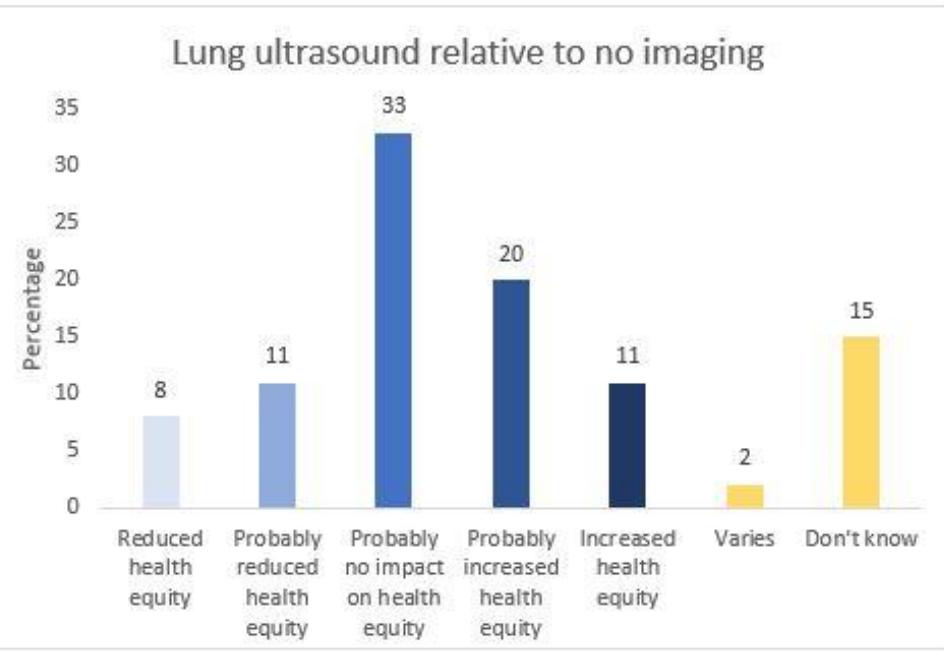
- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

•	Update	
<input type="radio"/> Large costs <input checked="" type="radio"/> Moderate costs <input type="radio"/> Negligible costs and savings <input type="radio"/> Moderate savings <input type="radio"/> Large savings <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
<b>Equity</b> What would be the impact on health equity?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	<ul style="list-style-type: none"> <li>● diversion of resources</li> <li>● Consider setting i.e. cities vs rural areas</li> <li>● people having to pay out of pocket</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Reduced: 2</li> <li>● Probably reduced: 8</li> <li>● Probably no impact : 1</li> <li>● Probably increased: 0</li> <li>● Increased: 1</li> <li>● Varies: 0</li> <li>● Don't know : 0</li> </ul>

### CT scan relative to no imaging







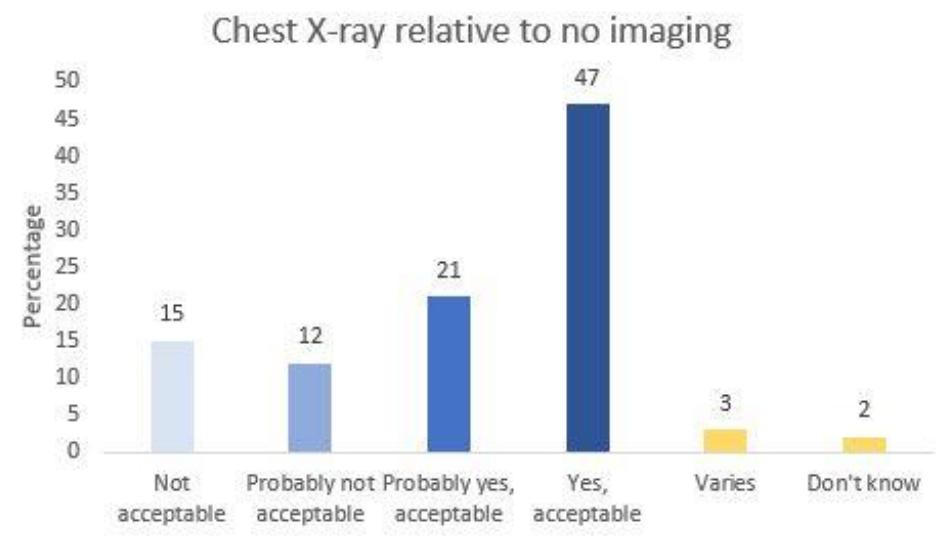
Respondents (n=124) included:

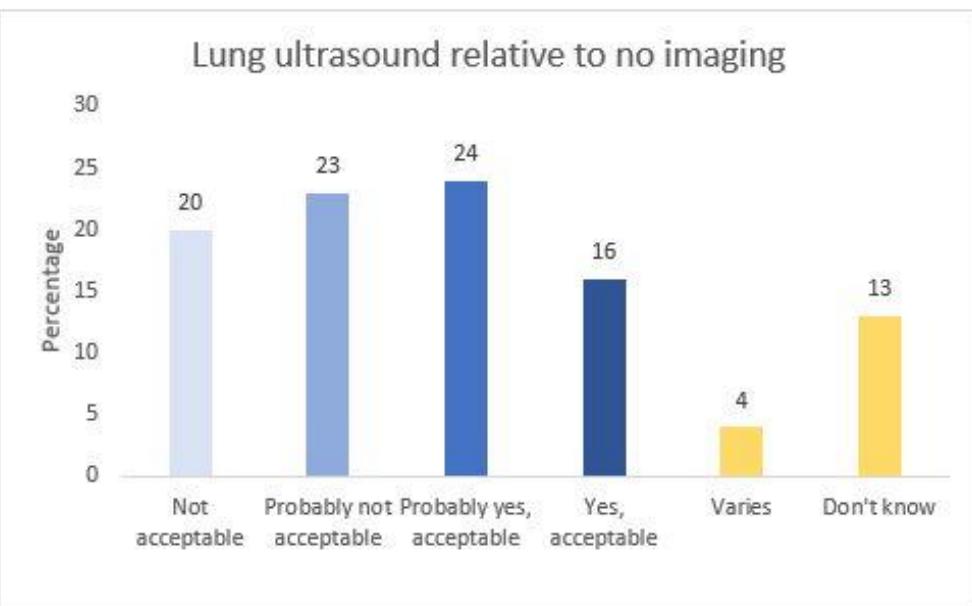
- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

•

Update

<ul style="list-style-type: none"> <li><input type="radio"/> Reduced</li> <li><input checked="" type="radio"/> Probably reduced</li> <li><input type="radio"/> Probably no impact</li> <li><input type="radio"/> Probably increased</li> <li><input type="radio"/> Increased</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>	This might vary by setting.														
<b>Acceptability</b> Is the intervention acceptable to key stakeholders?																
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS														
	Original	<ul style="list-style-type: none"> <li>• No</li> <li><input type="radio"/> Probably no</li> <li><input checked="" type="radio"/> Probably yes</li> <li><input type="radio"/> Yes</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul> <p><b>CT scan relative to no imaging</b></p> <table border="1"> <thead> <tr> <th>Acceptability Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Not acceptable</td> <td>15</td> </tr> <tr> <td>Probably not acceptable</td> <td>14</td> </tr> <tr> <td>Probably yes, acceptable</td> <td>31</td> </tr> <tr> <td>Yes, acceptable</td> <td>33</td> </tr> <tr> <td>Varies</td> <td>5</td> </tr> <tr> <td>Don't know</td> <td>2</td> </tr> </tbody> </table> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>• No : 0</li> <li>• Probably no : 0</li> <li>• Probably yes: 7</li> <li>• Yes: 3</li> <li>• Varies: 1</li> <li>• Don't know : 0</li> </ul>	Acceptability Category	Percentage	Not acceptable	15	Probably not acceptable	14	Probably yes, acceptable	31	Yes, acceptable	33	Varies	5	Don't know	2
Acceptability Category	Percentage															
Not acceptable	15															
Probably not acceptable	14															
Probably yes, acceptable	31															
Yes, acceptable	33															
Varies	5															
Don't know	2															





Respondents (n=124) included:

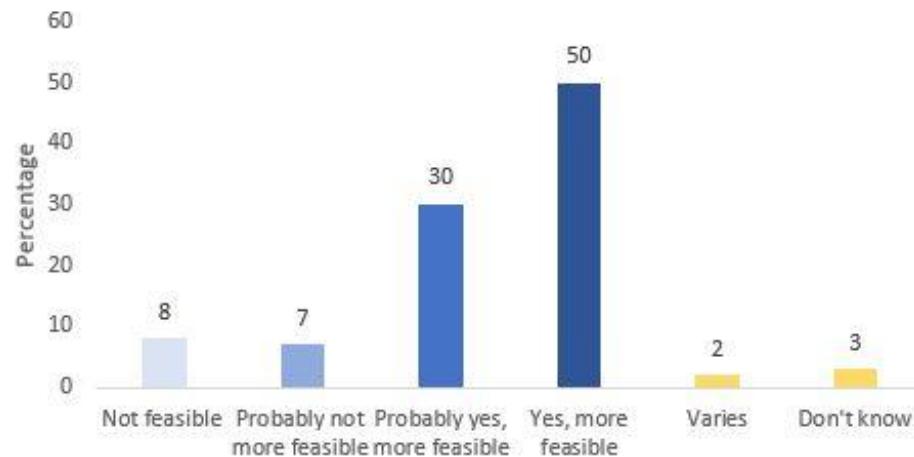
- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

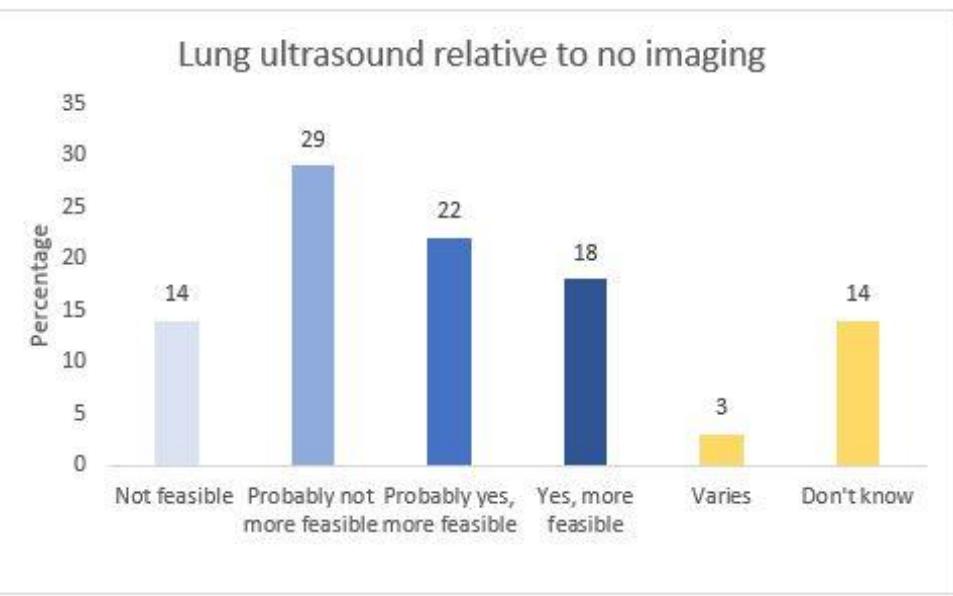
•

Update

<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>															
Feasibility Is the intervention feasible to implement?																
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS														
	Original															
<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<p style="text-align: center;"><b>CT scan relative to no imaging</b></p> <table border="1"> <thead> <tr> <th>Feasibility Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Not feasible</td> <td>13</td> </tr> <tr> <td>Probably not more feasible</td> <td>26</td> </tr> <tr> <td>Probably yes, more feasible</td> <td>29</td> </tr> <tr> <td>Yes, more feasible</td> <td>26</td> </tr> <tr> <td>Varies</td> <td>3</td> </tr> <tr> <td>Don't know</td> <td>3</td> </tr> </tbody> </table>	Feasibility Category	Percentage	Not feasible	13	Probably not more feasible	26	Probably yes, more feasible	29	Yes, more feasible	26	Varies	3	Don't know	3	<ul style="list-style-type: none"> <li>• Need to clean CT unit</li> <li>• Stop the non-urgent use of CT scan (issue of access and availability)</li> <li>• Availability of staff to interpret the scan (24/7)</li> <li>• Adapting the workflow in the CT room</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>• No : 0</li> <li>• Probably no : 0</li> <li>• Probably yes: 6</li> <li>• Yes: 3</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>
Feasibility Category	Percentage															
Not feasible	13															
Probably not more feasible	26															
Probably yes, more feasible	29															
Yes, more feasible	26															
Varies	3															
Don't know	3															

### Chest X-ray relative to no imaging





Respondents (n=124) included:

- members of the public (3%)
- patients (2%)
- physicians (16%)
- technicians (59%)
- other health professionals (4%)
- researchers (4%)
- policy-makers (4%)
- other (8%)

•

Update

<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
---	---	--

#### SUMMARY OF JUDGEMENTS

CRITERIA	ORIGINAL	IMPORTANCE FOR DECISION	UPDATE	IMPORTANCE FOR DECISION
DESIRABLE EFFECTS	Moderate		Moderate	
UNDESIRABLE EFFECTS	Small		Small	
CERTAINTY OF EVIDENCE	Very low		Low	
VALUES	Possibly important uncertainty or variability		Possibly important uncertainty or variability	
BALANCE OF EFFECTS	Probably favors the intervention		Probably favors the intervention	
RESOURCES REQUIRED	Moderate costs		Moderate costs	
EQUITY	Probably reduced		Probably reduced	
ACCEPTABILITY	Probably yes		Probably yes	
FEASIBILITY	Probably yes		Probably yes	

#### TYPE OF RECOMMENDATION

Strong recommendation against the intervention	Conditional recommendation against the intervention	Conditional recommendation for either the intervention or the comparison	<b>Conditional recommendation for the intervention</b>	Strong recommendation for the intervention
--	---	--	--	--

○	○	○	●	○
Update				
Strong recommendation against the intervention ○	Conditional recommendation against the intervention ○	Conditional recommendation for either the intervention or the comparison ○	Conditional recommendation for the intervention ●	Strong recommendation for the intervention ○

## CONCLUSIONS

Original

### Recommendation

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 (conditional recommendation, based on expert opinion)

### Remarks:

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:

- are at high risk of disease progression;
- have associated comorbidities (e.g. diabetes, hypertension, heart disease, obesity) or other chronic diseases which might decompensate and/or are aged over 60 years;
- 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;
- live in small homes, overcrowded households or densely-populated settings where isolation is very difficult to implement.
- represent an increased risk of dissemination within their community due to their occupational, social or other circumstances.

When choosing the imaging modalities, consider the following.

- Compared to chest CT, chest radiography appears to have lower sensitivity and might have higher specificity. Chest radiography is less resource intensive, is associated with lower radiation doses, is easier to repeat sequentially for monitoring disease progression, and can be performed with portable equipment at the point of care (which minimizes the risk of cross-infection related to patient transport).
- Chest CT has a relatively high sensitivity but a relatively low specificity and can be useful in patients with some pre-existing pulmonary diseases.
- Lung ultrasound has very low-certainty evidence supporting its diagnostic accuracy but might be helpful with the appropriate expertise as a supplemental or alternative modality (e.g. in pregnant women, children). Lung ultrasound can be done at the point of care but requires closer physical proximity of the operator to the patient for a longer period and requires specific infection prevention and control precautions.
- The differential diagnoses and potential complications for each specific case (e.g. CT angiography for pulmonary arterial thrombosis or thromboembolism, ultrasound for pleural effusions and heart conditions) should be considered when choosing imaging modality.

- Choice should be made through shared decision-making involving the referring physician, the radiologist and the patient whenever possible. If feasible, the patient should be provided with information regarding the imaging modality to be used and the likelihood of requiring subsequent imaging procedures.
- When there is a clinical deterioration, the systemic aspect of COVID-19 should be considered, in particular heart, brain, kidney and gastrointestinal localizations.

The voting results are:

- Strong recommendation against the intervention: 0
- Conditional recommendation against the intervention: 1
- Conditional recommendation for either the intervention or the comparison: 0
- Conditional recommendation for the intervention: 9
- Strong recommendation for the intervention: 2

Justification
•
Recommendation (#)
<p>For patients with suspected or confirmed COVID-19, not currently hospitalized and with mild symptoms, WHO <b>suggests using</b> chest imaging in addition to clinical and laboratory assessment to decide on hospital admission versus home discharge.</p> <p><i>(Conditional recommendation, based on low certainty evidence)</i></p> <p>(#) While this recommendation was judged to remain unchanged after the update of the review conducted before the publication of the second edition of the guide, the certainty of its evidence base was judged to be moderate. Therefore the corresponding section was updated accordingly as follows:</p> <p><i>(Conditional recommendation, based on <u>moderate</u> certainty evidence)"</i></p>

#### **Remarks:**

Imaging should be used as one element of the patient evaluation that otherwise includes an assessment of the severity of presentation and of the risk of progression ideally measured with a validated risk stratification tool.

Patients likely to benefit are those who:

- are judged to be at increased risk of disease progression based on risk stratification using a validation prediction tool;

- have associated comorbidities (e.g. diabetes, hypertension, heart disease, obesity) or other chronic diseases which might decompensate and/or are aged over 60 years;
- 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;
- live in small homes, overcrowded households or densely-populated settings where isolation is very difficult to implement.
- represent an increased risk of dissemination within their community due to their occupational, social or other circumstances.

When choosing the imaging modalities, consider the following:

- Chest CT can be useful in patients with some pre-existing pulmonary diseases. However, the absence of radiological signs of pneumonia cannot completely exclude a viral infection. Chest CT is less preferred in high prevalence settings as this might lead to its high utilization and diversion of resources from non-COVID-19 patients.
- Chest radiography is less-resource intensive, is associated with lower radiation doses, is easier to repeat sequentially for monitoring disease progression, and can be performed with portable equipment at the point of care (which minimizes the risk of cross-infection related to patient transport). The option of the chest radiography through a glass door may reduce the risk of transmission and the use of PPE.
- Lung ultrasound might be helpful with the appropriate expertise as a supplemental or alternative modality (e.g. in pregnant women, children). Lung ultrasound can be done at the point of care but requires closer physical proximity of the operator to the patient for a longer period and requires specific infection prevention and control precautions.
- The most appropriate imaging modality considering the differential diagnoses for each specific case (e.g. CT angiography for pulmonary thromboembolism, ultrasound for pleural effusions and heart conditions).
- Choice should be made through shared decision-making involving the referring physician, the radiologist and the patient whenever possible. If feasible, the patient should be provided with information regarding the imaging modality to be used and the likelihood of requiring subsequent imaging procedures.
- When there is a clinical deterioration, the systemic aspect of COVID-19 should be considered, in particular heart, brain, kidney and gastrointestinal localizations.

**Recommendation reached through consensus and without voting.**

**Justification**

**Subgroup considerations**

Original



• Update

#### Implementation considerations

##### Original

1. Implement the recommendations based on your equipment availability. Consider the resources needed (budget, health workforce, personal protective equipment, imaging equipment), the need to adapt the clinical workflow and the need to deprioritize other indications for imaging.
2. Consider performing RT-PCR tests of suspected cases within 24 hours and implement precautions until results are available.
3. Consider that home isolation may not be feasible in certain settings (e.g. overcrowded households, densely-populated cities).
4. If available, low-dose CT can be performed on adult patients. For paediatric patients, chest radiography would be favoured.
5. Consider the potential harms from exposure to ionizing radiation, in particular for pregnant women and children.
6. Favour the use of portable equipment for performing chest imaging in isolated rooms in the emergency department.
7. Consider the possibility of false negative imaging results in patients for whom chest imaging indicates no findings suspicious of COVID-19 (particularly during the first 2 days after symptom onset).
  - a. If discharged from the emergency department or other outpatient assessment setting, patients need to abide by the local public health measures (e.g. quarantine, social distancing) until definitive RT-PCR diagnosis is made.
  - b. If the patient is admitted, health care workers need to consider appropriate clinical precautions until a definitive RT-PCR diagnosis is made.
8. When performing chest radiography and chest CT, minimize radiation dose while maintaining diagnostic image quality (e.g. low-dose scanning protocols), and use digital imaging rather than film-screen equipment (16).
9. When performing chest radiography, consider using portable equipment, and if feasible, a unit dedicated to patients with COVID-19.
10. Ensure proper use of personal protective equipment by health care workers and proper disinfection of equipment and devices (see Annex 1).

11. Provide appropriate training of radiologists and technologists on infection prevention and control practices and ensure efficient management of typical imaging findings of COVID-19 through accepted local protocols.
12. Consider the transfer of images for remote reporting (teleradiology) as needed (e.g. settings where radiologists are not available for on-site reporting).
13. Set policy/pathway for use of imaging related to COVID-19 illustrated with flow charts, infographics and/or other decision-support tools locally developed and accepted.
14. Inform the patient about safety provisions for infection prevention and control (see Annex 1) as well as for radiation protection (16).
15. Make provisions to ensure that all patients get the imaging services they need without suffering financial hardship.

•

Update

Unchanged

#### Monitoring and evaluation

Original

- Monitor the number of requested chest imaging investigations related to COVID-19 and judge their adequacy.
- Monitor the impact of COVID-19-related chest imaging in different clinical scenarios on institutional and national resources (human and financial).
- Monitor the appropriate implementation of workflow and infection prevention and control measures (e.g. personal protective equipment).
- Monitor the number of cases of COVID-19 infections among hospital staff attributable to COVID-19-related chest imaging.
- Monitor the use of portable radiography equipment.
- Monitor the request of CT pulmonary angiography in suspected and confirmed COVID-19 patients.

•

Update

Unchanged

#### Research priorities

Original

- Conduct randomized controlled trials to compare the effects of using the different imaging modalities and using no imaging (in addition to clinical judgement) on clinical and health services outcomes of interest, for the questions addressed in this rapid advice guide.
- Evaluate access and health insurance coverage of chest imaging services related to COVID-19 in different settings.
- Study the role of artificial intelligence in chest imaging in different settings.
- Assess the incidence of COVID-19 infections among hospital staff attributable to chest imaging of patients with COVID-19 (e.g. in radiologists and radiographers).
- Evaluate the implementation of workflow developed for COVID-19-related chest imaging.
- Evaluate the safety and effectiveness of performing portable chest radiography, with and without RT-PCR testing, at home.
- Evaluate the impact of COVID-19-related imaging on institutional and national resources (human and financial).
- Evaluate the impact of COVID-19-related imaging on equity.
- Assess the values and preferences of different stakeholders for relevant chest imaging modalities in different settings.
- Evaluate the prognostic value of chest imaging findings during hospital admission regarding inpatient clinical outcomes (risk stratification), and duration of hospital stay.
- Evaluate the prognostic value of chest imaging findings upon discharge regarding post-discharge clinical outcomes (risk stratification) and readmission rates.
- Evaluate the correlation between radiological improvement and clinical improvement in patients with COVID-19.
- Assess the proportion of patients with COVID-19 infection who have pulmonary sequelae on follow-up imaging.
- Assess the value of different imaging modalities in assessing the short- and long-term complications of COVID-19.
- Evaluate the COVID-19 community transmission attributed to patients who are discharged based on negative findings in chest imaging.

- 

Update

Unchanged

#### KQ4 (PICO 4)

Should chest imaging vs. no chest imaging be used for patients with suspected or confirmed COVID-19 and moderate to severe symptoms; context of a decision to choose between admission to regular ward vs. ICU?

<b>POPULATION:</b>	Patients with suspected or confirmed COVID-19 and moderate to severe symptoms
<b>INTERVENTION:</b>	Chest imaging
<b>COMPARISON:</b>	No chest imaging
<b>MAIN OUTCOMES:</b>	1. Clinical outcomes

	<ul style="list-style-type: none"> <li>• Mortality</li> <li>• Respiratory failure</li> <li>• Multiorgan failure</li> <li>• Shortness of breath</li> <li>• Recovery</li> <li>• Adverse effects of imaging (e.g., exposure to radiation)</li> <li>• COVID-19 transmission to health workers</li> </ul> <p>2. Health systems outcomes</p> <ul style="list-style-type: none"> <li>• Service use, including: <ul style="list-style-type: none"> <li>○ Length of stay in Emergency Department</li> <li>○ Length of hospital stay</li> <li>○ Length of ICU stay</li> </ul> </li> <li>• Availability of care</li> <li>• Access to care</li> <li>• Quality of care</li> </ul>
SETTING:	Decision to choose between admission to regular ward vs. ICU
PERSPECTIVE:	Societal perspective
BACKGROUND:	
CONFLICT OF INTERESTS:	

#### ASSESSMENT

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<input type="radio"/> Trivial <input type="radio"/> Small <input checked="" type="radio"/> Moderate <input type="radio"/> Large <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• No study evaluated the effects of chest imaging on clinical outcomes</li> <li>• No study evaluated the effects of chest imaging on health systems outcomes</li> </ul>	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• Trivial: 0</li> <li>• Small: 0</li> <li>• Moderate: 6</li> <li>• Large: 4</li> <li>• Varies: 0</li> </ul>

		<ul style="list-style-type: none"> <li>• Don't know : 0</li> </ul>
<ul style="list-style-type: none"> <li>• Update</li> </ul>		
<ul style="list-style-type: none"> <li>○ Trivial</li> <li>○ Small</li> <li>● Moderate</li> <li>○ Large</li> <li>○ Varies</li> <li>○ Don't know</li> </ul>	<p><b>CT scanning</b></p> <ul style="list-style-type: none"> <li>• CT severity/extent of disease associated with mortality (3 studies) or mortality/ICU admission (1 study)</li> <li>• Adjusted HR 3.74 (1.10-12.77), AUROC 0.75-0.83</li> </ul> <p><b>CXR</b></p> <ul style="list-style-type: none"> <li>• CXR severity score associated with likelihood of hospital admission (adjusted OR 6.2, 95% CI 3.5-11).</li> <li>• Extent of lung involvement on CXR associated with intubation (adjusted OR 4.7 [1.8-13]); ICU, intubation, or death (AUROC 0.77 to 0.84) or intubation (HR 3.69 [2.25-6.07])</li> <li>• No association or negative association with length of stay (k=2)</li> </ul> <p><b>US</b></p> <ul style="list-style-type: none"> <li>• US B-lines associated with ICU admission (adjusted OR 1.6 [1.2-2.1]) and ARDS (adjusted OR 1.7 [1.3-2.3]) but no association with mortality; US severity score associated with Se of 0.81 and 0.59 for hospitalization (poor accuracy for death or intubation)</li> <li>• Nursing home (k=1): US severity score Se 0.58 (0.28-0.85) and Sp 0.64 (0.46-0.79) for mortality; AUROC 0.60 (0.42-0.79)</li> <li>• <b>No study provided evidence for the effects of chest imaging on health systems outcomes</b></li> </ul>	<ul style="list-style-type: none"> <li>● Extensive involvement of the lung as determined by CT is more likely to predict progression.</li> <li>● More inclined to CT patients at higher risk.</li> </ul>

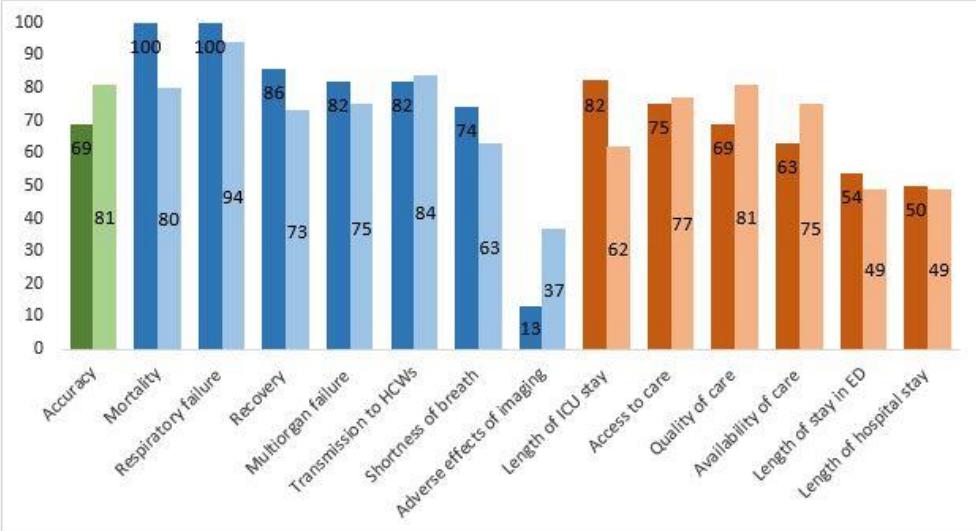
Undesirable Effects How substantial are the undesirable anticipated effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<input type="radio"/> Large <input type="radio"/> Moderate <input checked="" type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● No study evaluated the effects of chest imaging on clinical outcomes</li> <li>● No study evaluated the effects of chest imaging on health systems outcomes</li> </ul>	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Large: 0</li> <li>● Moderate: 2</li> <li>● Small: 6</li> <li>● Trivial: 1</li> <li>● Varies: 0</li> <li>● Don't know : 0</li> </ul>
●	Update	
<input type="radio"/> Large <input type="radio"/> Moderate <input checked="" type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● No study provided evidence for harms.</li> </ul>	
Certainty of evidence What is the overall certainty of the evidence of effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	

<ul style="list-style-type: none"> <li>● Very low</li> <li><input type="radio"/> Low</li> <li><input type="radio"/> Moderate</li> <li><input type="radio"/> High</li> <li><input type="radio"/> No included studies</li> </ul>		<ul style="list-style-type: none"> <li>● Very low for CT vs. no CT</li> <li>● Very low for CXR vs. no CXR</li> <li>● Very low for US vs. no US</li> </ul>
●	Update	
<ul style="list-style-type: none"> <li><input type="radio"/> Very low</li> <li>● Low</li> <li><input type="radio"/> Moderate</li> <li><input type="radio"/> High</li> <li><input type="radio"/> No included studies</li> </ul>		
<p><b>Values</b> Is there important uncertainty about or variability in how much people value the main outcomes?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<ul style="list-style-type: none"> <li><input type="radio"/> Important uncertainty or variability</li> <li>● Possibly important uncertainty or variability</li> <li><input type="radio"/> Probably no important uncertainty or variability</li> <li><input type="radio"/> No important uncertainty or variability</li> </ul>	<b>Rating of outcomes:</b>	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Important uncertainty or variability: 2</li> <li>● Possibly important uncertainty or variability: 7</li> <li>● Probably no important uncertainty or variability: 4</li> </ul>

Outcomes	Not important (%)		Important (%)		Critical (%)	
	GDG	Stakeholders	GDG	Stakeholders	GDG	Stakeholders
Accuracy	0	1	32	19	69	81
Mortality	0	6	0	16	100	80
Respiratory failure	0	4	0	4	100	94
Multorgan failure	0	5	19	22	82	75
Shortness of breath	0	6	27	33	74	63
Recovery	0	4	15	25	86	73
Adverse effects of imaging	44	24	44	40	13	37
Transmission to HCWs	7	3	13	14	82	84
Length of stay in ED	14	12	34	40	54	49
Length of hospital stay	13	8	38	44	50	49
Length of ICU stay	0	4	19	36	82	62
Availability of care	0	4	38	23	63	75
Access to care	0	4	25	21	75	77
Quality of care	7	3	25	18	69	81

**Critical outcomes:**



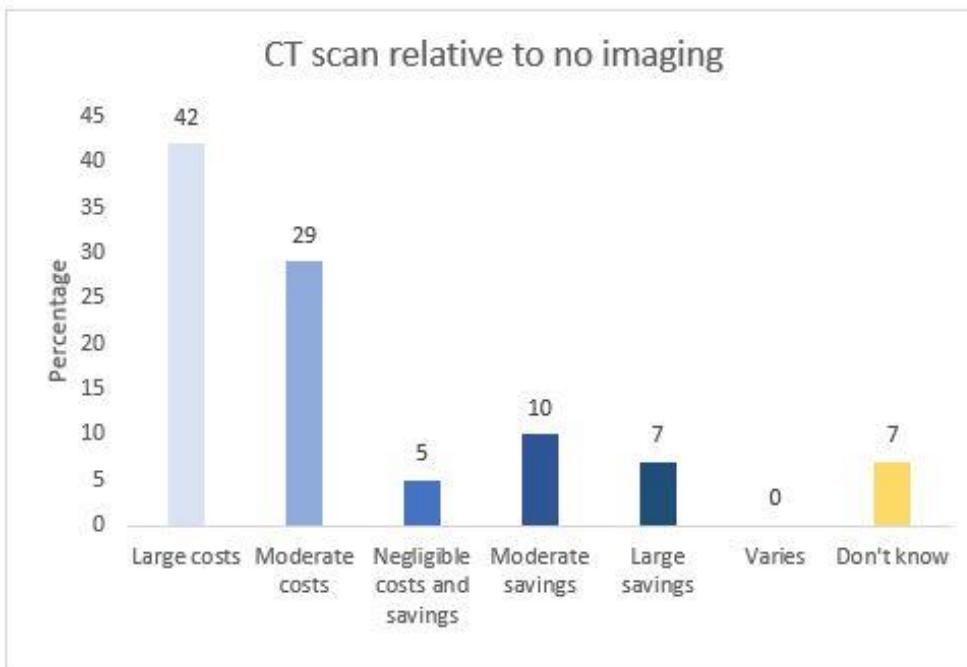
Outcome	GDG (%)	Stakeholders (%)
Accuracy	69	81
Mortality	100	80
Respiratory failure	100	94
Recovery	86	73
Multorgan failure	82	75
Transmission to HCWs	82	84
Shortness of breath	74	63
Adverse effects of imaging	13	37
Length of ICU stay	82	62
Access to care	75	77
Quality of care	69	81
Availability of care	63	75
Length of stay in ED	54	49
Length of hospital stay	50	49

- No important uncertainty or variability: 1

	<p>Green: accuracy of the diagnostic modality; blue: clinical outcomes; orange: health systems outcomes</p> <p>Dark color: GDG; light color: stakeholders</p> <p>Stakeholder respondents (n=249) included:</p> <ul style="list-style-type: none"> <li>•members of the public (3%)</li> <li>•patients (2%)</li> <li>•physicians (22%)</li> <li>•technicians (53%)</li> <li>•other health professionals (5%)</li> <li>•researchers (3%)</li> <li>•policy-makers (3%)</li> <li>•other (7%)</li> </ul>	
●	Update	
<ul style="list-style-type: none"> <li>○ Important uncertainty or variability</li> <li>● Possibly important uncertainty or variability</li> <li>○ Probably no important uncertainty or variability</li> <li>○ No important uncertainty or variability</li> </ul>	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
<p>Balance of effects</p> <p>Does the balance between desirable and undesirable effects favor the intervention or the comparison?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	

<ul style="list-style-type: none"> <li><input type="radio"/> Favors the comparison</li> <li><input type="radio"/> Probably favors the comparison</li> <li><input type="radio"/> Does not favor either the intervention or the comparison</li> <li><input checked="" type="radio"/> Probably favors the intervention</li> <li><input type="radio"/> Favors the intervention</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>		<p>The voting results are:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Favors the comparison: 0</li> <li><input type="radio"/> Probably favors the comparison: 0</li> <li><input type="radio"/> Does not favor either the intervention or the comparison: 1</li> <li><input checked="" type="radio"/> Probably favors the intervention: 6</li> <li><input type="radio"/> Favors the intervention : 4</li> <li><input type="radio"/> Varies: 0</li> <li><input type="radio"/> Don't know: 0</li> </ul>
•	Update	
<ul style="list-style-type: none"> <li><input type="radio"/> Favors the comparison</li> <li><input type="radio"/> Probably favors the comparison</li> <li><input type="radio"/> Does not favor either the intervention or the comparison</li> <li><input checked="" type="radio"/> Probably favors the intervention</li> <li><input type="radio"/> Favors the intervention</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>		
<p>Resources required</p> <p>How large are the resource requirements (costs)?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	

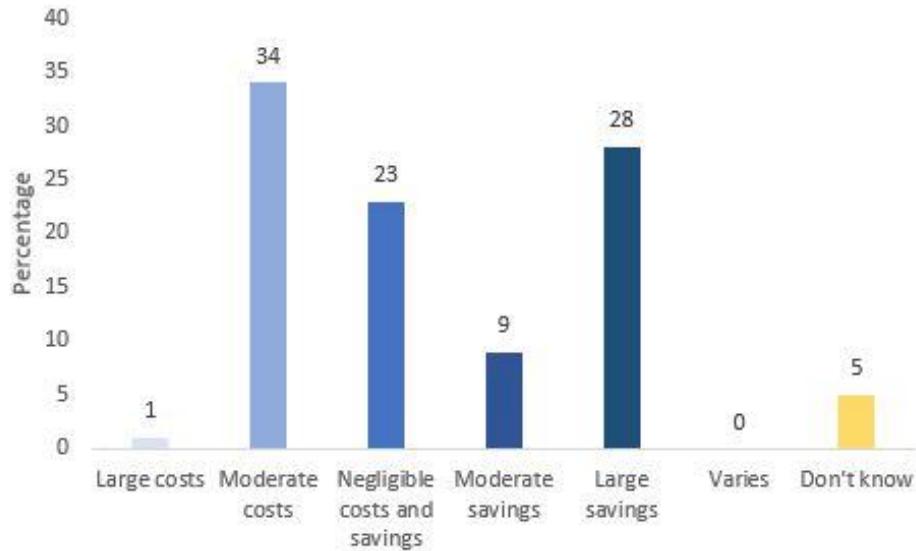
- Large costs
- Moderate costs
- Negligible costs and savings
- Moderate savings
- Large savings
- Varies
- Don't know

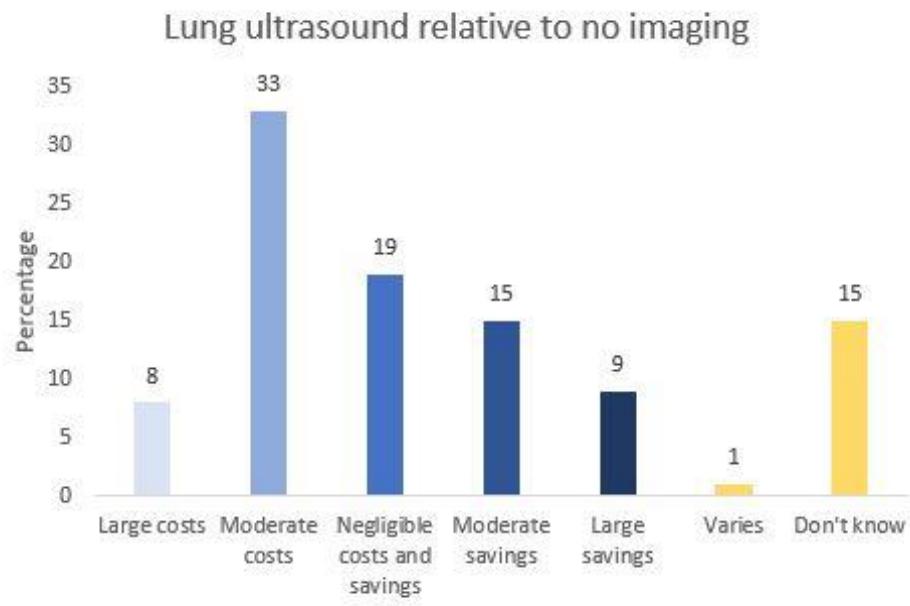


The voting results are:

- Large costs: 2
- Moderate costs: 8
- Negligible costs and savings: 0
- Moderate savings: 1
- Large savings: 0
- Varies: 0
- Don't know : 0

### Chest X-ray relative to no imaging

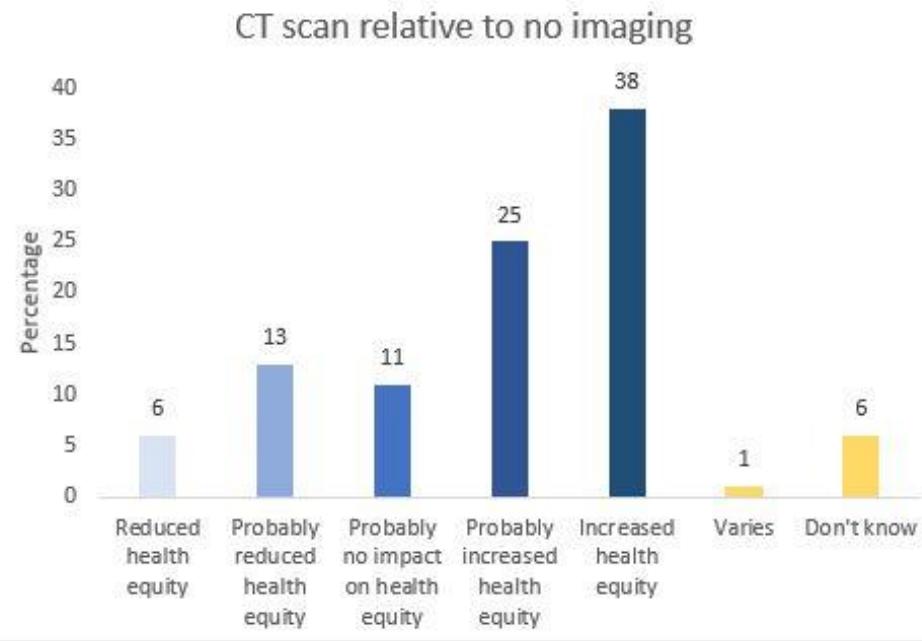


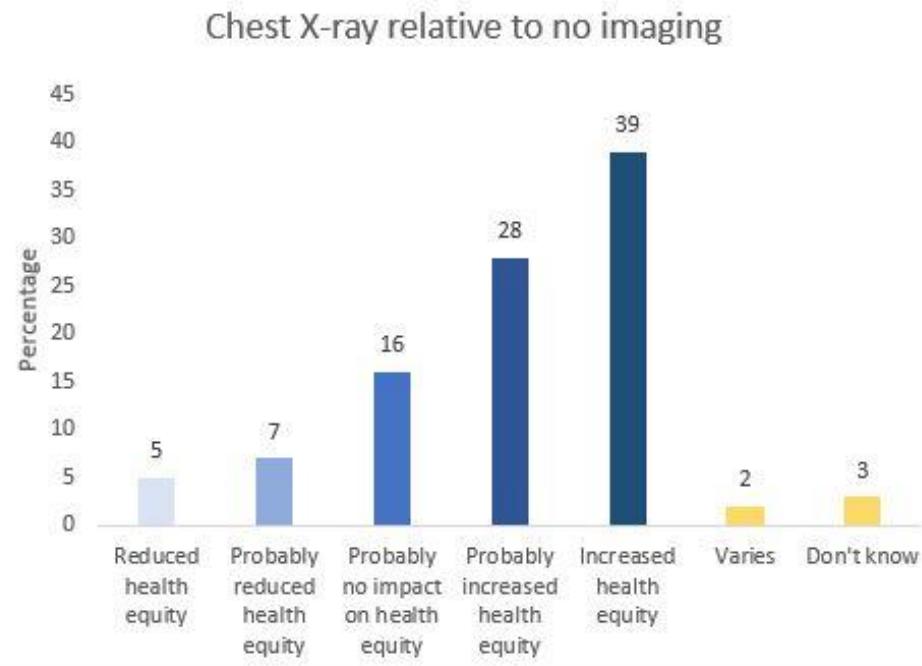


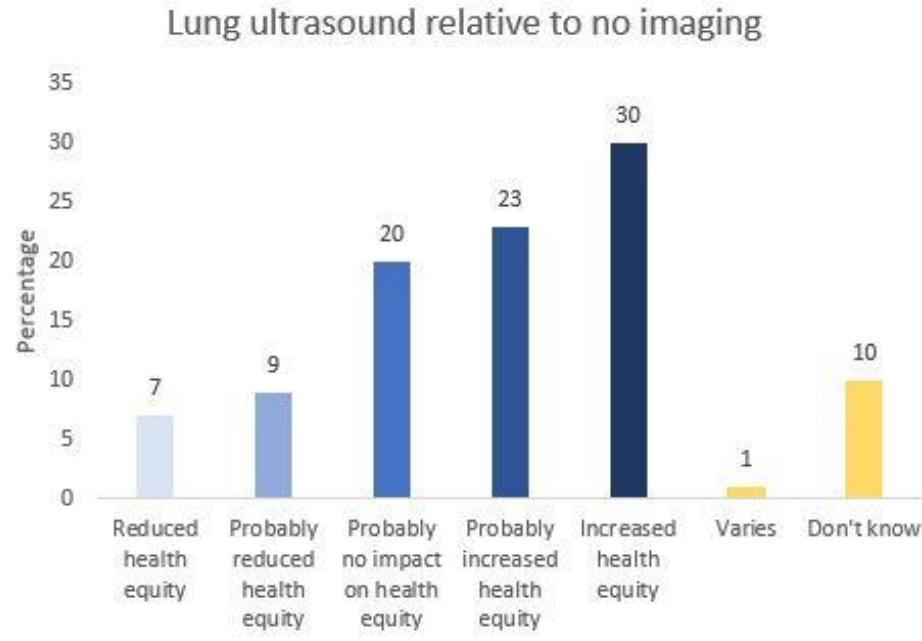
Respondents (n=93) included:

- members of the public (2%)
- patients (3%)
- physicians (14%)
- technicians (61%)
- other health professionals (4%)
- researchers (5%)
- policy-makers (3%)
- other (8%)

	•	Update	
<input type="radio"/> Large costs <input checked="" type="radio"/> Moderate costs <input type="radio"/> Negligible costs and savings <input type="radio"/> Moderate savings <input type="radio"/> Large savings <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>		
<b>Equity</b> What would be the impact on health equity?			
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS	
	Original		
<input type="radio"/> Reduced <input checked="" type="radio"/> Probably reduced <input type="radio"/> Probably no impact <input type="radio"/> Probably increased <input type="radio"/> Increased <input type="radio"/> Varies <input type="radio"/> Don't know		The voting results are: <ul style="list-style-type: none"> <li>● Reduced: 0</li> <li>● Probably reduced: 8</li> <li>● Probably no impact : 3</li> <li>● Probably increased: 0</li> <li>● Increased: 0</li> <li>● Varies: 0</li> <li>● Don't know : 0</li> </ul>	

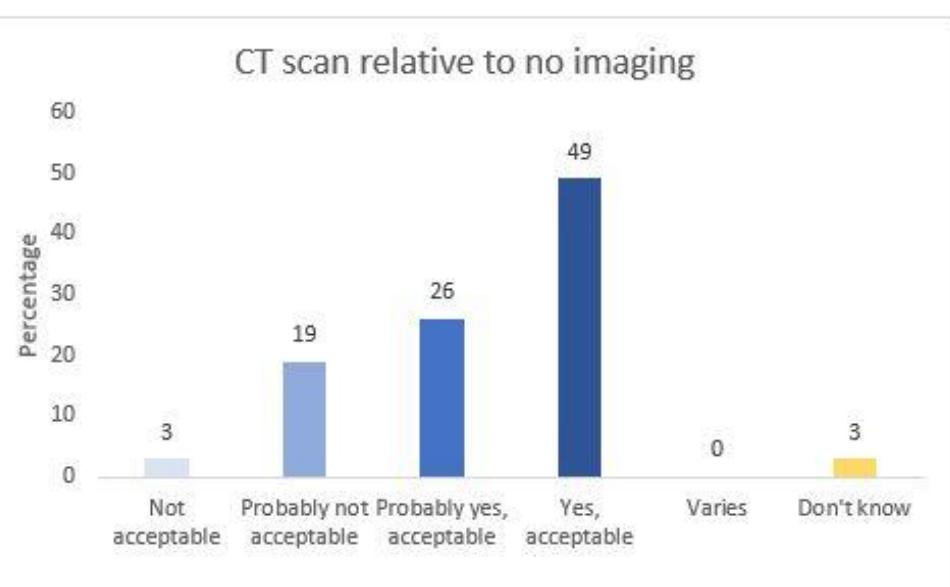


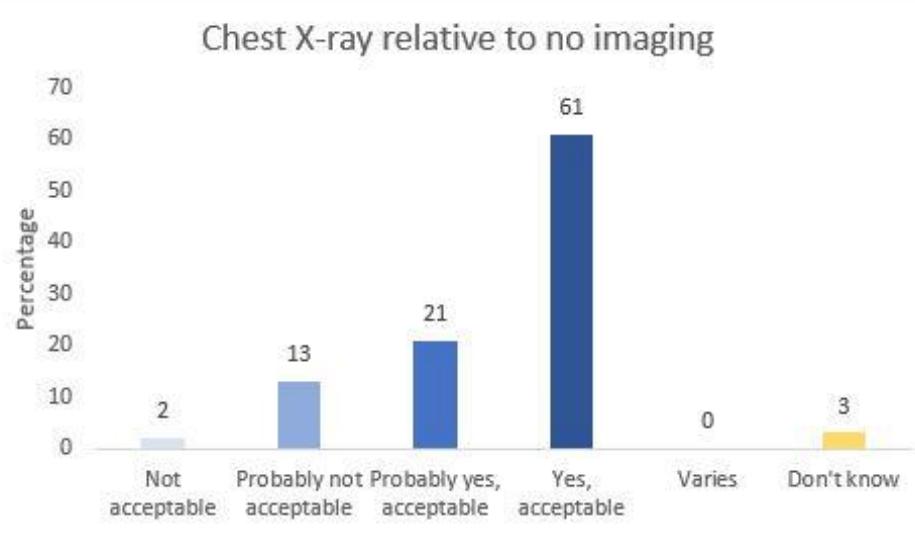


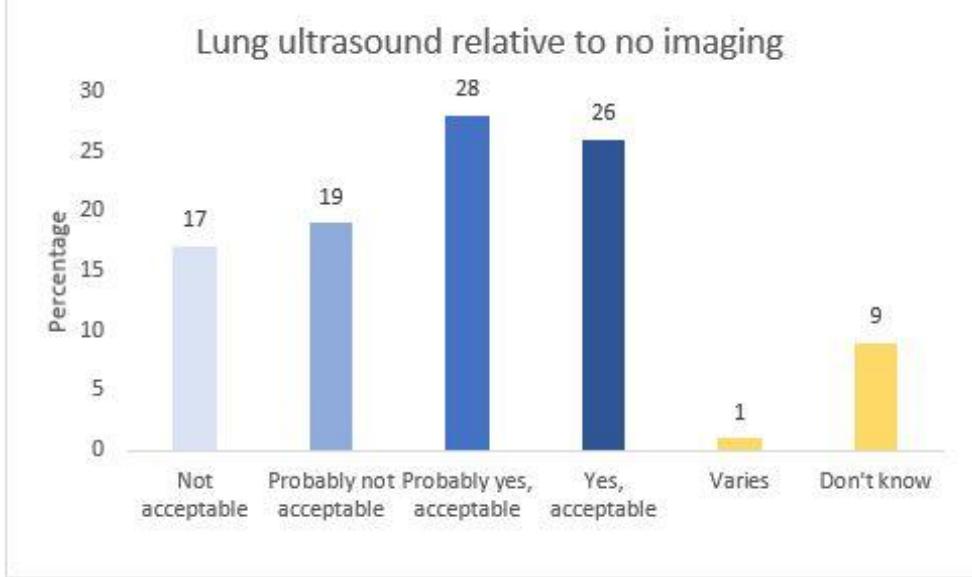


Respondents (n=93) included:

- members of the public (2%)
- patients (3%)
- physicians (14%)
- technicians (61%)
- other health professionals (4%)
- researchers (5%)
- policy-makers (3%)
- other (8%)

	Update															
<input type="radio"/> Reduced <input checked="" type="radio"/> Probably reduced <input type="radio"/> Probably no impact <input type="radio"/> Probably increased <input type="radio"/> Increased <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>															
<b>Acceptability</b> Is the intervention acceptable to key stakeholders?																
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS														
	Original	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• No : 0</li> <li>• Probably no : 1</li> <li>• Probably yes: 7</li> <li>• Yes: 2</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>  <table border="1"> <thead> <tr> <th>Acceptability Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Not acceptable</td> <td>3</td> </tr> <tr> <td>Probably not acceptable</td> <td>19</td> </tr> <tr> <td>Probably yes, acceptable</td> <td>26</td> </tr> <tr> <td>Yes, acceptable</td> <td>49</td> </tr> <tr> <td>Varies</td> <td>0</td> </tr> <tr> <td>Don't know</td> <td>3</td> </tr> </tbody> </table>	Acceptability Category	Percentage	Not acceptable	3	Probably not acceptable	19	Probably yes, acceptable	26	Yes, acceptable	49	Varies	0	Don't know	3
Acceptability Category	Percentage															
Not acceptable	3															
Probably not acceptable	19															
Probably yes, acceptable	26															
Yes, acceptable	49															
Varies	0															
Don't know	3															





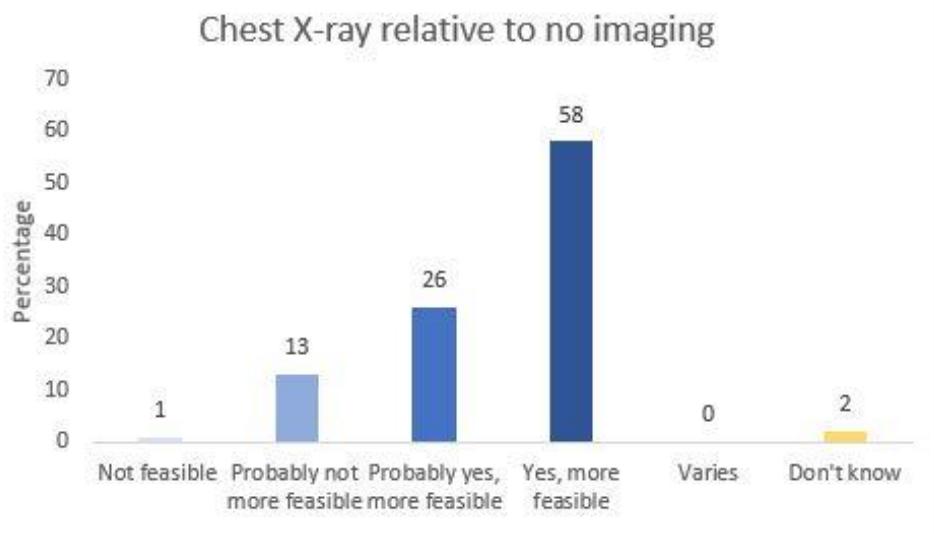
Respondents (n=93) included:

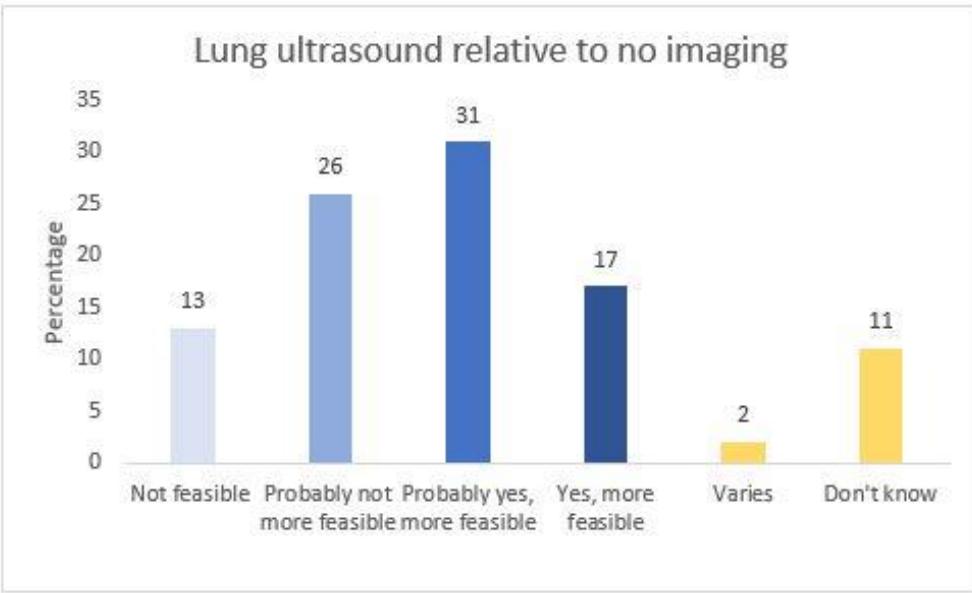
- members of the public (2%)
- patients (3%)
- physicians (14%)
- technicians (61%)
- other health professionals (4%)
- researchers (5%)
- policy-makers (3%)
- other (8%)

•

Update

<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>															
Feasibility Is the intervention feasible to implement?																
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS														
	Original															
<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<p style="text-align: center;"><b>CT scan relative to no imaging</b></p> <table border="1"> <thead> <tr> <th>Response Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Not feasible</td> <td>6</td> </tr> <tr> <td>Probably not more feasible</td> <td>24</td> </tr> <tr> <td>Probably yes, more feasible</td> <td>37</td> </tr> <tr> <td>Yes, more feasible</td> <td>27</td> </tr> <tr> <td>Varies</td> <td>3</td> </tr> <tr> <td>Don't know</td> <td>3</td> </tr> </tbody> </table>	Response Category	Percentage	Not feasible	6	Probably not more feasible	24	Probably yes, more feasible	37	Yes, more feasible	27	Varies	3	Don't know	3	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• No : 0</li> <li>• Probably no : 1</li> <li>• Probably yes: 9</li> <li>• Yes: 2</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>
Response Category	Percentage															
Not feasible	6															
Probably not more feasible	24															
Probably yes, more feasible	37															
Yes, more feasible	27															
Varies	3															
Don't know	3															





Respondents (n=93) included:

- members of the public (2%)
- patients (3%)
- physicians (14%)
- technicians (61%)
- other health professionals (4%)
- researchers (5%)
- policy-makers (3%)
- other (8%)

•

Update

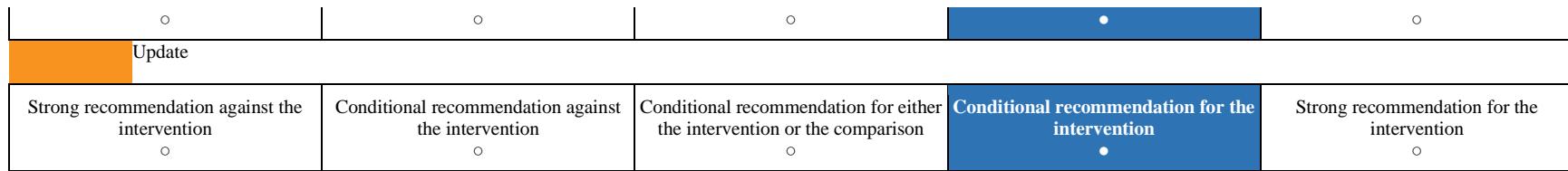
<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
---	---	--

#### SUMMARY OF JUDGEMENTS

CRITERIA	ORIGINAL	IMPORTANCE FOR DECISION	UPDATE	IMPORTANCE FOR DECISION
DESIRABLE EFFECTS	Moderate		Moderate	
UNDESIRABLE EFFECTS	Small		Small	
CERTAINTY OF EVIDENCE	Very low		Low	
VALUES	Possibly important uncertainty or variability		Possibly important uncertainty or variability	
BALANCE OF EFFECTS	Probably favors the intervention		Probably favors the intervention	
RESOURCES REQUIRED	Moderate costs		Moderate costs	
EQUITY	Probably reduced		Probably reduced	
ACCEPTABILITY	Probably yes		Probably yes	
FEASIBILITY	Probably yes		Probably yes	

#### TYPE OF RECOMMENDATION

Strong recommendation against the intervention	Conditional recommendation against the intervention	Conditional recommendation for either the intervention or the comparison	<b>Conditional recommendation for the intervention</b>	Strong recommendation for the intervention
--	---	--	--	--



## CONCLUSIONS

Original

### Recommendation

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 (Conditional recommendation, based on very low certainty evidence).

### Remarks:

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:

- are at higher risk of disease progression (e.g. with comorbidities);
- are not responding to supportive treatment (e.g. oxygen supplementation);
- present acute clinical deterioration not elucidated.

When choosing the imaging modalities, consider the following.

- Compared to chest CT, chest radiography appears to have lower sensitivity and might have higher specificity. Chest radiography is less resource intensive, is associated with lower radiation doses, is easier to repeat sequentially for monitoring disease progression, and can be performed with portable equipment at the point of care (which minimizes the risk of cross-infection related to patient transport).
- Chest CT has a relatively high sensitivity but a relatively low specificity and can be useful in patients with some pre-existing pulmonary diseases. However, the absence of radiological signs of pneumonia cannot completely exclude a viral infection.
- Lung ultrasound has very low-certainty evidence supporting its diagnostic accuracy but might be helpful with the appropriate expertise as a supplemental or alternative modality (e.g. in pregnant women, children, patients on mechanical ventilation). Lung ultrasound can be done at the point of care but requires closer physical proximity of the operator to the patient for a longer period and requires specific infection prevention and control precautions.
- The differential diagnoses and potential complications for each specific case (e.g. CT angiography for pulmonary arterial thrombosis or thromboembolism, ultrasound for pleural effusions and heart conditions) should be considered when choosing imaging modality.
- Choice should be made through shared decision-making involving the referring physician, the radiologist, and the patient whenever possible. If feasible, the patient should be provided with information regarding the imaging modality to be used and the likelihood of requiring subsequent imaging procedures.

- When there is a clinical deterioration, the systemic aspect of COVID-19 should be considered, in particular heart, brain, kidney and gastrointestinal localizations.

The voting results are:

- Strong recommendation against the intervention: 0
- Conditional recommendation against the intervention: 0
- Conditional recommendation for either the intervention or the comparison: 0
- Conditional recommendation for the intervention: 8
- Strong recommendation for the intervention: 3

Justification	Update
•	
Recommendation (#)	

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.

*(Conditional recommendation, based on low certainty evidence)*

(#) While this recommendation was judged to remain unchanged after the update of the review conducted before the publication of the second edition of the guide, the certainty of its evidence base was judged to be moderate. Therefore the corresponding section was updated accordingly as follows:

“(Conditional recommendation, based on moderate certainty evidence)”.

#### **Remarks:**

Imaging should be used as one element of the patient evaluation that otherwise includes an assessment of the severity of presentation and of the risk of progression ideally measured with a validated risk stratification tool.

Patients likely to benefit are those who:

- are at higher risk of disease progression (e.g. with comorbidities);
- are not responding to supportive treatment (e.g. oxygen supplementation);
- present acute clinical deterioration not elucidated.

When choosing the imaging modalities, consider the following.

- Chest CT can be useful in patients with some pre-existing pulmonary diseases. However, the absence of radiological signs of pneumonia cannot completely exclude a viral infection. Chest CT is less preferred in high prevalence settings as this might lead to its high utilization and diversion of resources from non-COVID-19 patients.
- Chest radiography is less-resource intensive, is associated with lower radiation doses, is easier to repeat sequentially for monitoring disease progression, and can be performed with portable equipment at the point of care (which minimizes the risk of cross-infection related to patient transport). The option of the chest radiography through a glass door may reduce the risk of transmission and the use of PPE.
- Lung ultrasound might be helpful with the appropriate expertise as a supplemental or alternative modality (e.g. in pregnant women, children). Lung ultrasound can be done at the point of care but requires closer physical proximity of the operator to the patient for a longer period and requires specific infection prevention and control precautions.
- The most appropriate imaging modality considering the differential diagnoses for each specific case (e.g. CT angiography for pulmonary thromboembolism, ultrasound for pleural effusions and heart conditions).
- Choice should be made through shared decision-making involving the referring physician, the radiologist and the patient whenever possible. If feasible, the patient should be provided with information regarding the imaging modality to be used and the likelihood of requiring subsequent imaging procedures.
- When there is a clinical deterioration, the systemic aspect of COVID-19 should be considered, in particular heart, brain, kidney and gastrointestinal localizations.

**Recommendation reached through consensus and without voting.**

#### Justification

#### Subgroup considerations

Original



## • Update

### Implementation considerations

#### Original

1. Implement the recommendations based on equipment availability. Consider the resources needed (budget, health workforce, personal protective equipment, imaging equipment), the need to adapt the clinical workflow, and the need to deprioritize other indications for imaging.
2. If available, low-dose chest CT can support the decision on regular ward admission versus ICU admission. Chest radiographs are preferred for follow-up in regular ward admission. Patients with rapid progression of COVID-19 pneumonia or diffuse lung damage need ICU admission.
3. Consider the possibility of false negative imaging results in patients for whom chest imaging indicates no findings suspicious of COVID-19 (particularly during the first 2 days after symptom onset).
4. Health care workers need to consider appropriate clinical precautions until the definitive RT-PCR diagnosis is made. Ensure proper use of personal protective equipment and proper disinfection of equipment and devices (see Annex 1).
5. When performing chest radiography and chest CT, minimize radiation dose while maintaining diagnostic image quality (e.g. low-dose CT protocols) and use digital imaging rather than film-screen equipment (16).
6. When performing chest radiography, consider using portable equipment, and if feasible, a unit dedicated to patients with COVID-19.
7. Consider the potential harm from exposure to ionizing radiation, in particular for pregnant women and children.
8. Provide appropriate training of radiologists and technologists on infection prevention and control practices and ensure efficient management of typical imaging findings of COVID-19 through accepted local protocols.
9. Consider the transfer of images for remote reporting (teleradiology) as needed (e.g. settings where radiologists are not available for on-site reporting).
10. Set policy/pathway for use of imaging related to COVID-19 illustrated with flow charts or diagrams locally developed and accepted.
11. If clinical condition permits, inform the patient about safety provisions for infection prevention and control (see Annex 1) as well as for radiation protection (16).
12. Make provisions to ensure that all patients get the imaging services they need without suffering financial hardship.

		Update
--	--	--------

Unchanged

		Monitoring and evaluation
		Original

- Monitor the number of requested chest imaging investigations related to COVID-19 and judge their adequacy.
- Monitor the impact of COVID-19-related chest imaging in different clinical scenarios on institutional and national resources (human and financial).
- Monitor the appropriate implementation of workflow and infection prevention and control measures (e.g. personal protective equipment).
- Monitor the number of cases of COVID-19 infections among hospital staff attributable to COVID-19-related chest imaging.
- Monitor the use of portable radiography equipment.
- Monitor the request of CT pulmonary angiography in suspected and confirmed COVID-19 patients.

		Update
--	--	--------

Unchanged

		Research priorities
		Original

- Conduct randomized controlled trials to compare the effects of using the different imaging modalities and using no imaging (in addition to clinical judgement) on clinical and health services outcomes of interest, for the questions addressed in this rapid advice guide.
- Evaluate access and health insurance coverage of chest imaging services related to COVID-19 in different settings.
- Study the role of artificial intelligence in chest imaging in different settings.
- Assess the incidence of COVID-19 infections among hospital staff attributable to chest imaging of patients with COVID-19 (e.g. in radiologists and radiographers).
- Evaluate the implementation of workflow developed for COVID-19-related chest imaging.
- Evaluate the safety and effectiveness of performing portable chest radiography, with and without RT-PCR testing, at home.
- Evaluate the impact of COVID-19-related imaging on institutional and national resources (human and financial).
- Evaluate the impact of COVID-19-related imaging on equity.
- Assess the values and preferences of different stakeholders for relevant chest imaging modalities in different settings.

- Evaluate the prognostic value of chest imaging findings during hospital admission regarding inpatient clinical outcomes (risk stratification), and duration of hospital stay.
- Evaluate the prognostic value of chest imaging findings upon discharge regarding post-discharge clinical outcomes (risk stratification) and readmission rates.
- Evaluate the correlation between radiological improvement and clinical improvement in patients with COVID-19.
- Assess the proportion of patients with COVID-19 infection who have pulmonary sequelae on follow-up imaging.
- Assess the value of different imaging modalities in assessing the short- and long-term complications of COVID-19.
- Evaluate the COVID-19 community transmission attributed to patients who are discharged based on negative findings in chest imaging.

- 

Update

- Conduct randomized controlled trials to compare the effects of using the different imaging modalities and using no imaging (in addition to clinical judgement) on clinical and health services outcomes of interest, for the questions addressed in this rapid advice guide.
- Evaluate access and health insurance coverage of chest imaging services related to COVID-19 in different settings.
- Study the role of artificial intelligence in chest imaging in different settings.
- Assess the incidence of COVID-19 infections among hospital staff attributable to chest imaging of patients with COVID-19 (e.g. in radiologists and radiographers).
- Evaluate the implementation of workflow developed for COVID-19-related chest imaging.
- Evaluate the safety and effectiveness of performing portable chest radiography, with and without virologic testing, at home.
- Evaluate the impact of COVID-19-related imaging on institutional and national resources (human and financial).
- Evaluate the impact of COVID-19-related imaging on equity.
- Assess the values and preferences of different stakeholders for relevant chest imaging modalities in different settings.
- Evaluate the prognostic value of chest imaging findings during hospital admission regarding inpatient clinical outcomes (risk stratification), and duration of hospital stay.
- Evaluate the prognostic value of chest imaging findings upon discharge regarding post-discharge clinical outcomes (risk stratification) and readmission rates.
- Evaluate the correlation between radiological improvement and clinical improvement in patients with COVID-19.
- Assess the proportion of patients with COVID-19 infection who have pulmonary sequelae on follow-up imaging.
- Assess the value of different imaging modalities in assessing the short- and long-term complications of COVID-19.
- Evaluate the COVID-19 community transmission attributed to patients who are discharged based on negative findings in chest imaging.

#### KQ 5 (PICO 5)

**Should chest imaging vs. no chest imaging be used for patients with suspected or confirmed COVID-19, currently hospitalized and moderate or severe symptoms; context of a decision to choose whether to escalate respiratory support?**

<b>POPULATION:</b>	Patients with suspected or confirmed COVID-19, currently hospitalized and moderate or severe symptoms
<b>INTERVENTION:</b>	Chest imaging
<b>COMPARISON:</b>	No chest imaging

<b>MAIN OUTCOMES:</b>	<ol style="list-style-type: none"> <li>1. Clinical outcomes           <ul style="list-style-type: none"> <li>• Mortality</li> <li>• Respiratory failure</li> <li>• Multiorgan failure</li> <li>• Shortness of breath</li> <li>• Recovery</li> <li>• Adverse effects of imaging (e.g., exposure to radiation)</li> <li>• COVID-19 transmission to health workers</li> </ul> </li>   <li>2. Health systems outcomes           <ul style="list-style-type: none"> <li>• Service use, including:               <ul style="list-style-type: none"> <li>◦ Length of stay in Emergency Department</li> <li>◦ Length of hospital stay</li> <li>◦ Length of ICU stay</li> </ul> </li> <li>• Availability of care</li> <li>• Access to care</li> <li>• Quality of care</li> </ul> </li> </ol>
<b>SETTING:</b>	Decision to choose whether to escalate respiratory support
<b>PERSPECTIVE:</b>	Societal perspective
<b>BACKGROUND:</b>	
<b>CONFLICT OF INTERESTS:</b>	

#### ASSESSMENT

Desirable Effects How substantial are the desirable anticipated effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	

<input type="radio"/> Trivial <input type="radio"/> Small <input checked="" type="radio"/> Moderate <input type="radio"/> Large <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>The systematic review team identified three studies that evaluated chest imaging in patients currently hospitalized with moderate or severe symptoms and suspected or confirmed COVID-19, for predicting mortality or admission to the ICU. The certainty of evidence was judged to be very low.</li> </ul>	The voting results are: <ul style="list-style-type: none"> <li>Trivial: 0</li> <li>Small: 1</li> <li>Moderate: 5</li> <li>Large: 3</li> <li>Varies: 1</li> <li>Don't know : 0</li> </ul>
<ul style="list-style-type: none"> <li>•</li> </ul>	Update	
<input type="radio"/> Trivial <input type="radio"/> Small <input checked="" type="radio"/> Moderate <input type="radio"/> Large <input type="radio"/> Varies <input type="radio"/> Don't know	<p><b>CT scanning</b></p> <ul style="list-style-type: none"> <li>Mortality: CT associated with AUROC 0.88 to 0.90, increased likelihood of mortality (per point, adjusted OR 1.54 [1.00-2.37])</li> <li>Mortality/ICU/intubation: HR 7.29 (1.37-38.68), adjusted OR 2.35 (1.24-4.46), adjusted OR 44.24 (8.61-227.36), adjusted HR (per point) 1.07 (0.99-1.15), AUROC 0.98 (0.95-1.00)</li> <li>One study found discrimination higher with model with clinical and radiological factors (AUROC 0.82-0.89) vs. clinical factors alone (AUROC 0.78-0.81)</li> <li>CT associated with risk of severe pneumonia, COVID-19 complication; one study no association with ICU admission</li> </ul> <p><b>CXR</b></p> <ul style="list-style-type: none"> <li>1 study found bilateral infiltrates (HR 2.5 [1.07-6.1]) and hilar congestion (HR 3.7 [1.07-10.2] associated with mortality)</li> <li>1 study reported imprecise estimates for CXR severity and ICU admission</li> </ul> <p><b>US</b></p> <ul style="list-style-type: none"> <li>1 study found US severity associated associated with increased likelihood of mortality (per point, HR 1.08 [1.02-1.16]) and intubation (per point, HR 11.5 [1.4-235])</li> </ul>	

	<ul style="list-style-type: none"> <li>• 1 study found US severity score not predictive or mortality</li> <li>• <b>No study provided evidence for the effects of chest imaging on health systems outcomes</b></li> </ul>	
--	--	--

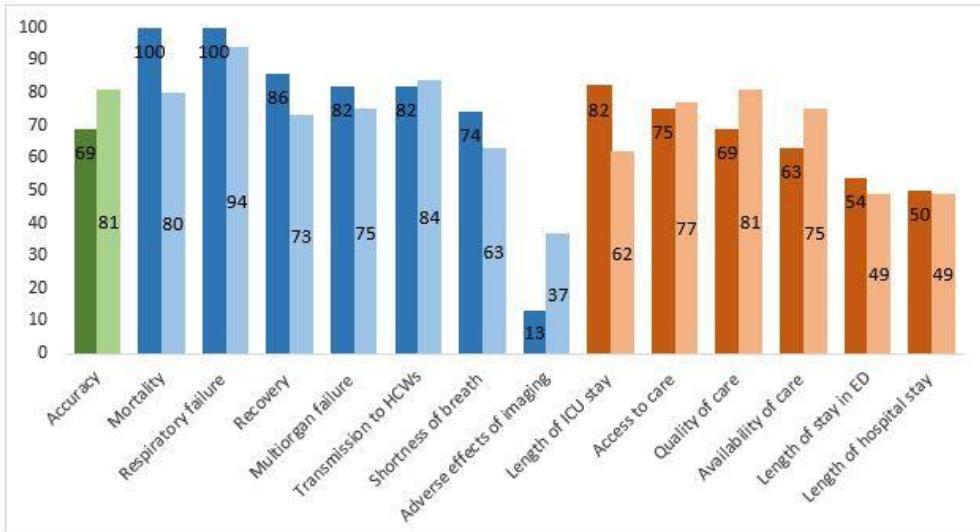
#### Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<input type="radio"/> Large <input type="radio"/> Moderate <input checked="" type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• The systematic review team identified three studies that evaluated chest imaging in patients currently hospitalized with moderate or severe symptoms and suspected or confirmed COVID-19, for predicting mortality or admission to the ICU. The certainty of evidence was judged to be very low.</li> </ul>	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• Large: 0</li> <li>• Moderate: 2</li> <li>• Small: 7</li> <li>• Trivial: 2</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>
•	Update	

<input type="radio"/> Large <input type="radio"/> Moderate <input checked="" type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● No study provided evidence for harms.</li> </ul>	
Certainty of evidence What is the overall certainty of the evidence of effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<input checked="" type="radio"/> Very low <input type="radio"/> Low <input type="radio"/> Moderate <input type="radio"/> High <input type="radio"/> No included studies		<ul style="list-style-type: none"> <li>● Very low for CT vs. no CT</li> <li>● Very low for CXR vs. no CXR</li> <li>● Very low for US vs. no US</li> </ul>
•	Update	

<ul style="list-style-type: none"> <li><input type="radio"/> Very low</li> <li><input checked="" type="radio"/> Low</li> <li><input type="radio"/> Moderate</li> <li><input type="radio"/> High</li> <li><input type="radio"/> No included studies</li> </ul>		<ul style="list-style-type: none"> <li><input checked="" type="radio"/> Low for CT vs. no CT</li> <li><input type="radio"/> Very low for CXR vs. no CXR</li> <li><input type="radio"/> Very low for US vs. no US</li> </ul>																																																																																																															
Values Is there important uncertainty about or variability in how much people value the main outcomes?																																																																																																																	
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS																																																																																																															
	Original																																																																																																																
<ul style="list-style-type: none"> <li><input type="radio"/> Important uncertainty or variability</li> <li><input checked="" type="radio"/> Possibly important uncertainty or variability</li> <li><input type="radio"/> Probably no important uncertainty or variability</li> <li><input type="radio"/> No important uncertainty or variability</li> </ul>	<p><b>Rating of outcomes:</b></p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Outcomes</th> <th colspan="2">Not important (%)</th> <th colspan="2">Important (%)</th> <th colspan="2">Critical (%)</th> </tr> <tr> <th>GDG</th> <th>Stakeholders</th> <th>GDG</th> <th>Stakeholders</th> <th>GDG</th> <th>Stakeholders</th> </tr> </thead> <tbody> <tr> <td>Accuracy</td><td>0</td><td>1</td><td>32</td><td>19</td><td>69</td><td>81</td></tr> <tr> <td>Mortality</td><td>0</td><td>6</td><td>0</td><td>16</td><td>100</td><td>80</td></tr> <tr> <td>Respiratory failure</td><td>0</td><td>4</td><td>0</td><td>4</td><td>100</td><td>94</td></tr> <tr> <td>Multorgan failure</td><td>0</td><td>5</td><td>19</td><td>22</td><td>82</td><td>75</td></tr> <tr> <td>Shortness of breath</td><td>0</td><td>6</td><td>27</td><td>33</td><td>74</td><td>63</td></tr> <tr> <td>Recovery</td><td>0</td><td>4</td><td>15</td><td>25</td><td>86</td><td>73</td></tr> <tr> <td>Adverse effects of imaging</td><td>44</td><td>24</td><td>44</td><td>40</td><td>13</td><td>37</td></tr> <tr> <td>Transmission to HCWs</td><td>7</td><td>3</td><td>13</td><td>14</td><td>82</td><td>84</td></tr> <tr> <td>Length of stay in ED</td><td>14</td><td>12</td><td>34</td><td>40</td><td>54</td><td>49</td></tr> <tr> <td>Length of hospital stay</td><td>13</td><td>8</td><td>38</td><td>44</td><td>50</td><td>49</td></tr> <tr> <td>Length of ICU stay</td><td>0</td><td>4</td><td>19</td><td>36</td><td>82</td><td>62</td></tr> <tr> <td>Availability of care</td><td>0</td><td>4</td><td>38</td><td>23</td><td>63</td><td>75</td></tr> <tr> <td>Access to care</td><td>0</td><td>4</td><td>25</td><td>21</td><td>75</td><td>77</td></tr> <tr> <td>Quality of care</td><td>7</td><td>3</td><td>25</td><td>18</td><td>69</td><td>81</td></tr> </tbody> </table> <p><b>Critical outcomes:</b></p>	Outcomes	Not important (%)		Important (%)		Critical (%)		GDG	Stakeholders	GDG	Stakeholders	GDG	Stakeholders	Accuracy	0	1	32	19	69	81	Mortality	0	6	0	16	100	80	Respiratory failure	0	4	0	4	100	94	Multorgan failure	0	5	19	22	82	75	Shortness of breath	0	6	27	33	74	63	Recovery	0	4	15	25	86	73	Adverse effects of imaging	44	24	44	40	13	37	Transmission to HCWs	7	3	13	14	82	84	Length of stay in ED	14	12	34	40	54	49	Length of hospital stay	13	8	38	44	50	49	Length of ICU stay	0	4	19	36	82	62	Availability of care	0	4	38	23	63	75	Access to care	0	4	25	21	75	77	Quality of care	7	3	25	18	69	81	<p>The voting results are:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Important uncertainty or variability: 2</li> <li><input checked="" type="radio"/> Possibly important uncertainty or variability: 7</li> <li><input type="radio"/> Probably no important uncertainty or variability: 4</li> <li><input type="radio"/> No important uncertainty or variability: 1</li> </ul>
Outcomes	Not important (%)		Important (%)		Critical (%)																																																																																																												
	GDG	Stakeholders	GDG	Stakeholders	GDG	Stakeholders																																																																																																											
Accuracy	0	1	32	19	69	81																																																																																																											
Mortality	0	6	0	16	100	80																																																																																																											
Respiratory failure	0	4	0	4	100	94																																																																																																											
Multorgan failure	0	5	19	22	82	75																																																																																																											
Shortness of breath	0	6	27	33	74	63																																																																																																											
Recovery	0	4	15	25	86	73																																																																																																											
Adverse effects of imaging	44	24	44	40	13	37																																																																																																											
Transmission to HCWs	7	3	13	14	82	84																																																																																																											
Length of stay in ED	14	12	34	40	54	49																																																																																																											
Length of hospital stay	13	8	38	44	50	49																																																																																																											
Length of ICU stay	0	4	19	36	82	62																																																																																																											
Availability of care	0	4	38	23	63	75																																																																																																											
Access to care	0	4	25	21	75	77																																																																																																											
Quality of care	7	3	25	18	69	81																																																																																																											



Green: accuracy of the diagnostic modality; blue: clinical outcomes; orange: health systems outcomes

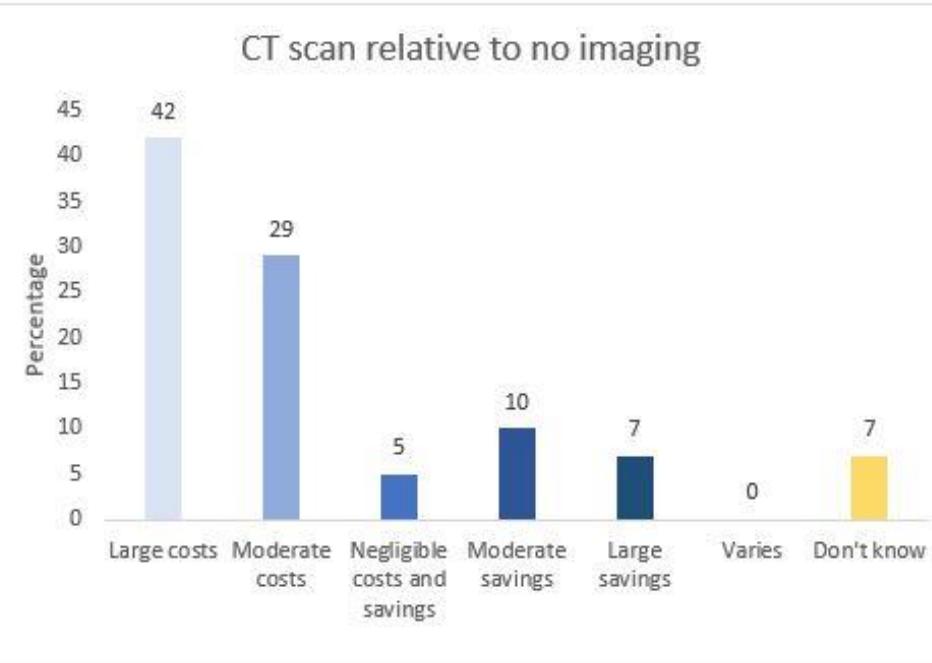
Dark color: GDG; light color: stakeholders

Stakeholder respondents (n=249) included:

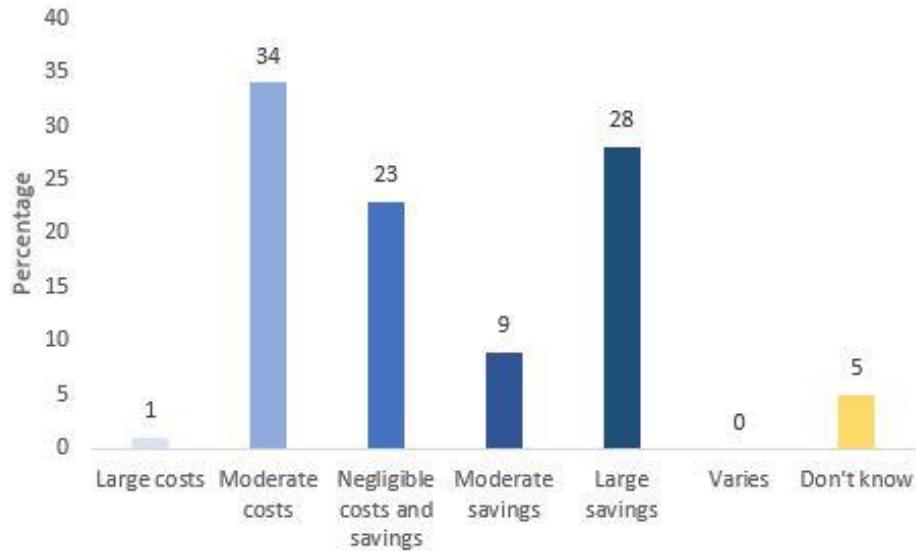
- members of the public (3%)
- patients (2%)
- physicians (22%)
- technicians (53%)
- other health professionals (5%)

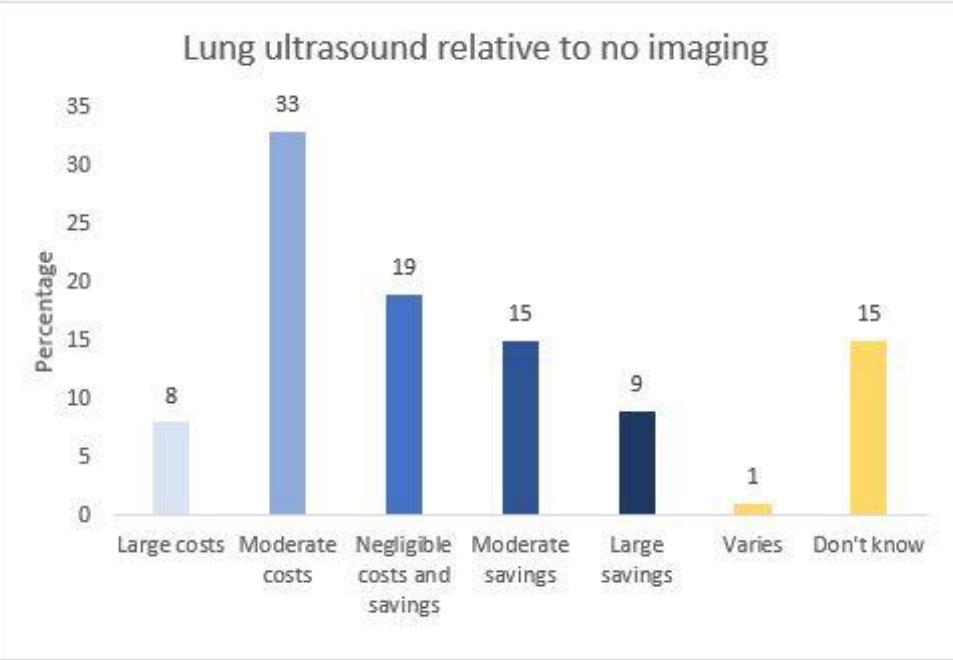
	<ul style="list-style-type: none"> <li>•researchers (3%)</li> <li>•policy-makers (3%)</li> <li>•other (7%)</li> </ul>	
•	Update	
<input type="radio"/> Important uncertainty or variability <input checked="" type="radio"/> Possibly important uncertainty or variability <input type="radio"/> Probably no important uncertainty or variability <input type="radio"/> No important uncertainty or variability	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>	
Balance of effects		
Does the balance between desirable and undesirable effects favor the intervention or the comparison?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<input type="radio"/> Favors the comparison <input type="radio"/> Probably favors the comparison <input type="radio"/> Does not favor either the intervention or the comparison <input checked="" type="radio"/> Probably favors the intervention <input type="radio"/> Favors the intervention <input type="radio"/> Varies <input type="radio"/> Don't know		<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• Favors the comparison: 0</li> <li>• Probably favors the comparison: 1</li> <li>• Does not favor either the intervention or the comparison: 1</li> <li>• Probably favors the intervention: 8</li> <li>• Favors the intervention : 1</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>
•	Update	

<ul style="list-style-type: none"> <li><input type="radio"/> Favors the comparison</li> <li><input type="radio"/> Probably favors the comparison</li> <li><input type="radio"/> Does not favor either the intervention or the comparison</li> <li><input checked="" type="radio"/> Probably favors the intervention</li> <li><input type="radio"/> Favors the intervention</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>		
<p>Resources required How large are the resource requirements (costs)?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <li><input type="radio"/> Large costs</li> <li><input checked="" type="radio"/> Moderate costs</li> <li><input type="radio"/> Negligible costs and savings</li> <li><input type="radio"/> Moderate savings</li> <li><input type="radio"/> Large savings</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>	Original	<p>The voting results are:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Large costs: 1</li> <li><input type="radio"/> Moderate costs: 8</li> <li><input type="radio"/> Negligible costs and savings: 0</li> <li><input type="radio"/> Moderate savings: 1</li> <li><input type="radio"/> Large savings: 0</li> <li><input type="radio"/> Varies: 1</li> <li><input type="radio"/> Don't know : 0</li> </ul>



### Chest X-ray relative to no imaging

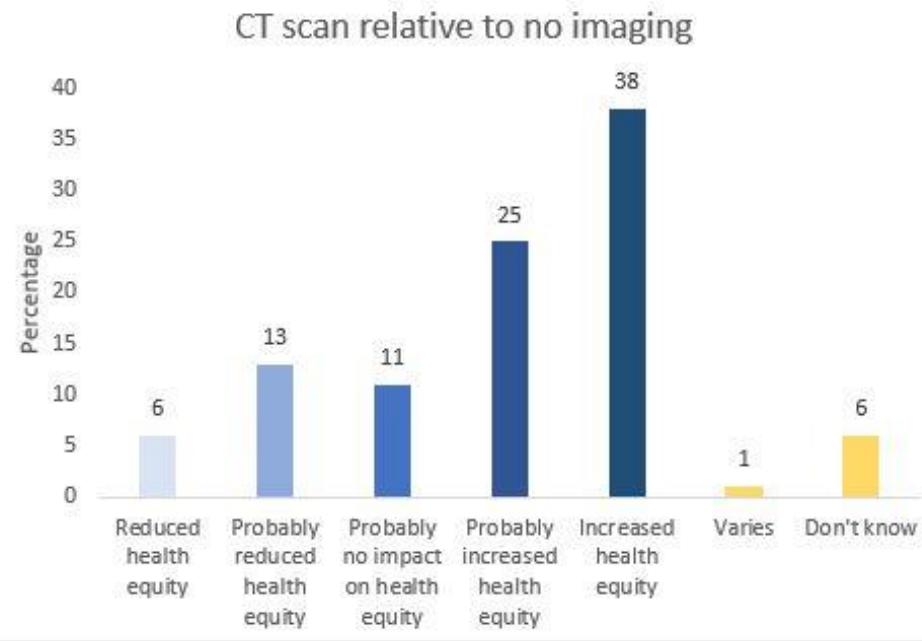


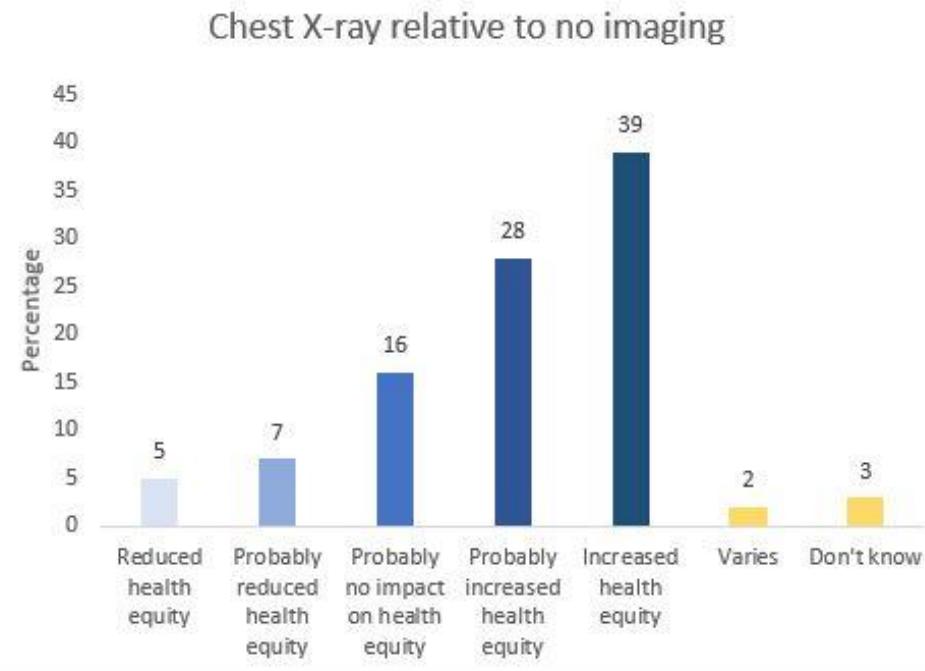


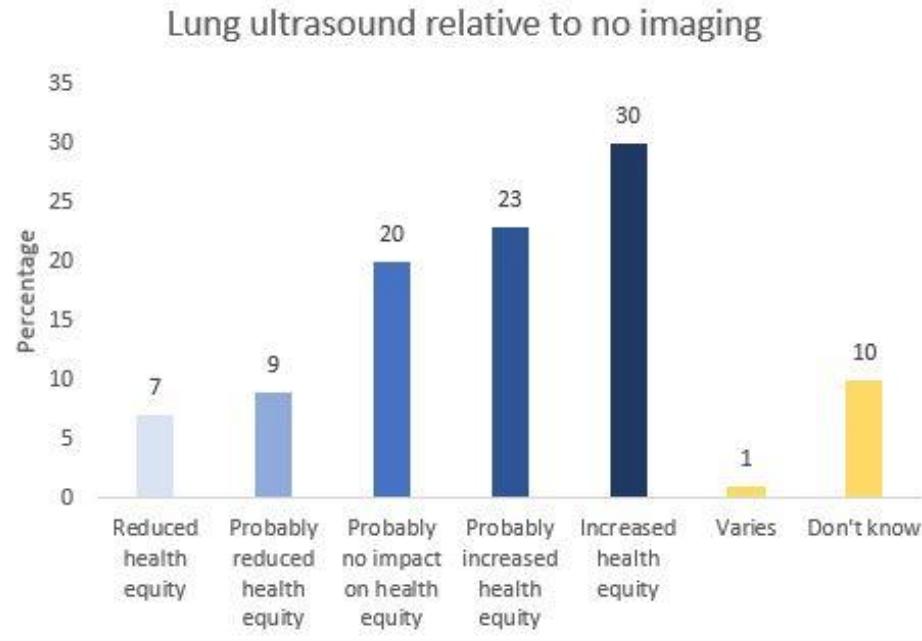
Respondents (n=93) included:

- members of the public (2%)
- patients (3%)
- physicians (14%)
- technicians (61%)
- other health professionals (4%)
- researchers (5%)
- policy-makers (3%)
- other (8%)

	• Update	
<input type="radio"/> Large costs <input checked="" type="radio"/> Moderate costs <input type="radio"/> Negligible costs and savings <input type="radio"/> Moderate savings <input type="radio"/> Large savings <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
<b>Equity</b> What would be the impact on health equity?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Reduced: 0</li> <li>● Probably reduced: 4</li> <li>● Probably no impact : 4</li> <li>● Probably increased: 2</li> <li>● Increased: 1</li> <li>● Varies: 0</li> <li>● Don't know : 0</li> </ul>
<input type="radio"/> Reduced <input checked="" type="radio"/> Probably reduced <input type="radio"/> Probably no impact <input type="radio"/> Probably increased <input type="radio"/> Increased <input type="radio"/> Varies <input type="radio"/> Don't know		



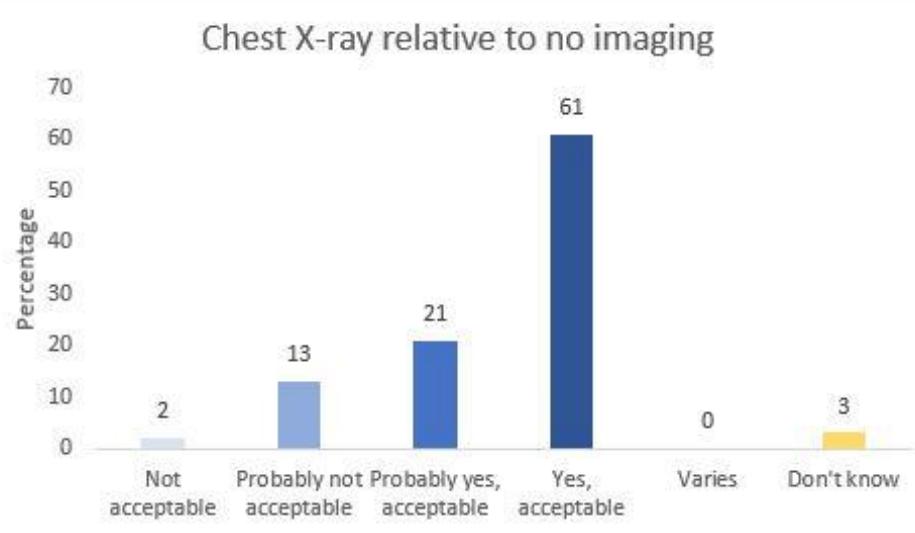


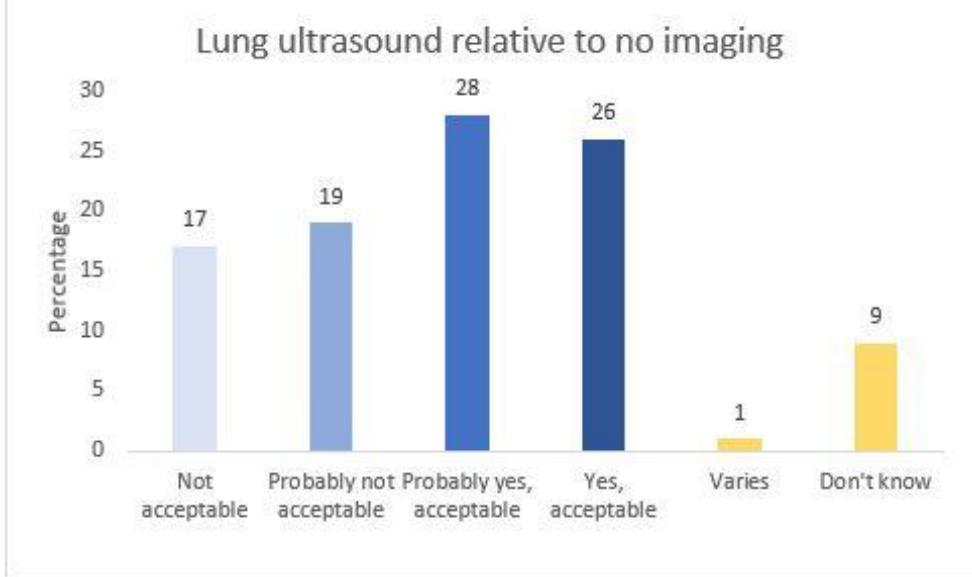


Respondents (n=93) included:

- members of the public (2%)
- patients (3%)
- physicians (14%)
- technicians (61%)
- other health professionals (4%)
- researchers (5%)
- policy-makers (3%)
- other (8%)

	Update															
<ul style="list-style-type: none"> <li><input type="radio"/> Reduced</li> <li><input checked="" type="radio"/> Probably reduced</li> <li><input type="radio"/> Probably no impact</li> <li><input type="radio"/> Probably increased</li> <li><input type="radio"/> Increased</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>															
<p><b>Acceptability</b> Is the intervention acceptable to key stakeholders?</p>																
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS														
	Original	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• No : 0</li> <li>• Probably no : 0</li> <li>• Probably yes: 7</li> <li>• Yes: 4</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>														
<ul style="list-style-type: none"> <li><input type="radio"/> No</li> <li><input type="radio"/> Probably no</li> <li><input checked="" type="radio"/> Probably yes</li> <li><input type="radio"/> Yes</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>	<table border="1"> <caption>CT scan relative to no imaging</caption> <thead> <tr> <th>Acceptability Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Not acceptable</td> <td>3</td> </tr> <tr> <td>Probably not acceptable</td> <td>19</td> </tr> <tr> <td>Probably yes, acceptable</td> <td>26</td> </tr> <tr> <td>Yes, acceptable</td> <td>49</td> </tr> <tr> <td>Varies</td> <td>0</td> </tr> <tr> <td>Don't know</td> <td>3</td> </tr> </tbody> </table>	Acceptability Category	Percentage	Not acceptable	3	Probably not acceptable	19	Probably yes, acceptable	26	Yes, acceptable	49	Varies	0	Don't know	3	
Acceptability Category	Percentage															
Not acceptable	3															
Probably not acceptable	19															
Probably yes, acceptable	26															
Yes, acceptable	49															
Varies	0															
Don't know	3															





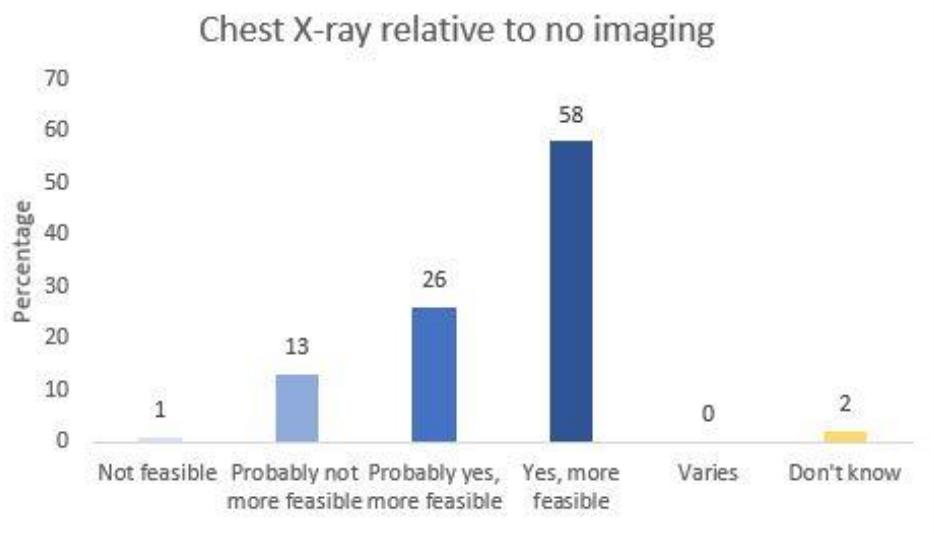
Respondents (n=93) included:

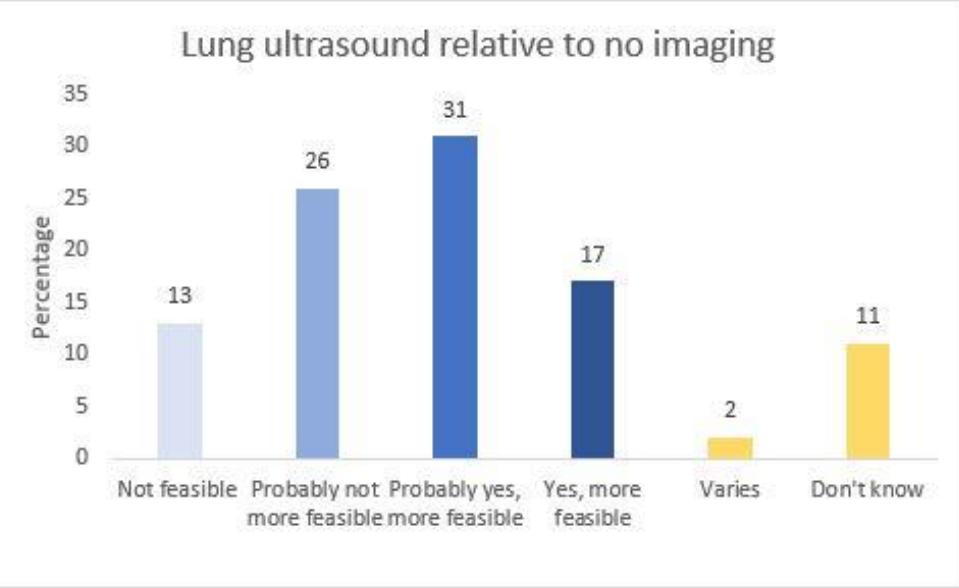
- members of the public (2%)
- patients (3%)
- physicians (14%)
- technicians (61%)
- other health professionals (4%)
- researchers (5%)
- policy-makers (3%)
- other (8%)

•

Update

<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>															
Feasibility Is the intervention feasible to implement?																
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS														
	Original															
<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<p style="text-align: center;"><b>CT scan relative to no imaging</b></p> <table border="1"> <thead> <tr> <th>Response Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Not feasible</td> <td>6</td> </tr> <tr> <td>Probably not more feasible</td> <td>24</td> </tr> <tr> <td>Probably yes, more feasible</td> <td>37</td> </tr> <tr> <td>Yes, more feasible</td> <td>27</td> </tr> <tr> <td>Varies</td> <td>3</td> </tr> <tr> <td>Don't know</td> <td>3</td> </tr> </tbody> </table>	Response Category	Percentage	Not feasible	6	Probably not more feasible	24	Probably yes, more feasible	37	Yes, more feasible	27	Varies	3	Don't know	3	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• No : 0</li> <li>• Probably no : 0</li> <li>• Probably yes: 8</li> <li>• Yes: 2</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>
Response Category	Percentage															
Not feasible	6															
Probably not more feasible	24															
Probably yes, more feasible	37															
Yes, more feasible	27															
Varies	3															
Don't know	3															





Respondents (n=93) included:

- members of the public (2%)
- patients (3%)
- physicians (14%)
- technicians (61%)
- other health professionals (4%)
- researchers (5%)
- policy-makers (3%)
- other (8%)

•

Update

<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
---	---	--

#### SUMMARY OF JUDGEMENTS

CRITERIA	ORIGINAL	IMPORTANCE FOR DECISION	UPDATE	IMPORTANCE FOR DECISION
DESIRABLE EFFECTS	Moderate		Moderate	
UNDESIRABLE EFFECTS	Small		Small	
CERTAINTY OF EVIDENCE	Very low		Low	
VALUES	Possibly important uncertainty or variability		Possibly important uncertainty or variability	
BALANCE OF EFFECTS	Probably favors the intervention		Probably favors the intervention	
RESOURCES REQUIRED	Moderate costs		Moderate costs	
EQUITY	Probably reduced		Probably reduced	
ACCEPTABILITY	Probably yes		Probably yes	
FEASIBILITY	Probably yes		Probably yes	

#### TYPE OF RECOMMENDATION

Strong recommendation against the intervention	Conditional recommendation against the intervention	Conditional recommendation for either the intervention or the comparison	<b>Conditional recommendation for the intervention</b>	Strong recommendation for the intervention
--	---	--	--	--

○	○	○	●	○
Update				
Strong recommendation against the intervention ○	Conditional recommendation against the intervention ○	Conditional recommendation for either the intervention or the comparison ○	Conditional recommendation for the intervention ●	Strong recommendation for the intervention ○

## CONCLUSIONS

Original
Recommendation

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 therapeutic management (conditional recommendation, based on very low certainty evidence).

### Remarks:

Imaging should be used as one element of patient evaluation that otherwise includes clinical and laboratory data. Patients likely to benefit are those who:

- are at high risk of disease progression;
- are not responding to treatment (oxygen supplementation);
- have presentations with clinical suspicion of pulmonary fibrosis, pulmonary artery thrombosis or thromboembolism

When choosing the imaging modalities consider the following.

- Compared to chest CT, chest radiography appears to have lower sensitivity and might have higher specificity. Chest radiography is less resource intensive, is associated with lower radiation doses, is easier to repeat sequentially for monitoring disease progression, and can be performed with portable equipment at the point of care (which minimizes the risk of cross-infection related to patient transport).
- Chest CT has a relatively high sensitivity but a relatively low specificity and can be useful in patients with some pre-existing pulmonary diseases. However, the absence of radiological signs of pneumonia cannot completely exclude a viral infection.
- Lung ultrasound has very low-certainty evidence supporting its diagnostic accuracy but might be helpful with the appropriate expertise as a supplemental or alternative modality (e.g. in pregnant women, children, patients with mechanical ventilation). Ultrasound can be useful when assessing for pleural complications and evaluating the condition of the heart. Lung ultrasound can be done at the point of care but requires closer physical proximity of the operator to the patient for a longer period and requires specific infection prevention and control precautions.
- The differential diagnoses and potential complications for each specific case (e.g. CT angiography for pulmonary artery thrombosis or thromboembolism, lung ultrasound for pleural effusions) should be considered when choosing imaging modality.
- Choice should be made through shared decision-making involving the referring physician, the radiologist and the patient whenever possible. If feasible, the patient should be provided with information regarding the imaging modality to be used and the likelihood of requiring subsequent imaging procedures.

- When there is a clinical deterioration, the systemic aspect of COVID-19 should be considered, in particular heart, brain, kidney and gastrointestinal localizations.

The voting results are:

- Strong recommendation against the intervention: 0
- Conditional recommendation against the intervention: 0
- Conditional recommendation for either the intervention or the comparison: 0
- Conditional recommendation for the intervention: 9
- Strong recommendation for the intervention: 0

#### Justification

- 

Update

#### Recommendation (#)

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 therapeutic management.

*(Conditional recommendation, based on low certainty evidence)*

(#) While this recommendation was judged to remain unchanged after the update of the review conducted before the publication of the second edition of the guide, the certainty of its evidence base was judged to be moderate. Therefore the corresponding section was updated accordingly as follows:

*“(Conditional recommendation, based on moderate certainty evidence)”*

#### Remarks:

Imaging should be used as one element of patient evaluation that otherwise includes clinical, laboratory and epidemiological data.

Patients likely to benefit are those who:

- are judged to be at increased risk of disease progression based on risk stratification using a validation prediction tool;
- are not responding to treatment (oxygen supplementation);
- have presentations with clinical suspicion of pulmonary fibrosis, pulmonary artery thrombosis or thromboembolism

When choosing the imaging modalities, consider the following:

- Chest CT can be useful in patients with some pre-existing pulmonary diseases. However, the absence of radiological signs of pneumonia cannot completely exclude a viral infection. Chest CT is less preferred in high prevalence settings as this might lead to its high utilization and diversion of resources from non-COVID-19 patients.
- Chest radiography is less-resource intensive, is associated with lower radiation doses, is easier to repeat sequentially for monitoring disease progression, and can be performed with portable equipment at the point of care (which minimizes the risk of cross-infection related to patient transport). The option of the chest radiography through a glass door may reduce the risk of transmission and the use of PPE.
- Lung ultrasound might be helpful with the appropriate expertise as a supplemental or alternative modality (e.g. in pregnant women, children). Lung ultrasound can be done at the point of care but requires closer physical proximity of the operator to the patient for a longer period and requires specific infection prevention and control precautions.
- The most appropriate imaging modality considering the differential diagnoses for each specific case (e.g. CT angiography for pulmonary thromboembolism, ultrasound for pleural effusions and heart conditions).
- Choice should be made through shared decision-making involving the referring physician, the radiologist and the patient whenever possible. If feasible, the patient should be provided with information regarding the imaging modality to be used and the likelihood of requiring subsequent imaging procedures.
- When there is a clinical deterioration, the systemic aspect of COVID-19 should be considered, in particular heart, brain, kidney and gastrointestinal localizations.

**Recommendation reached through consensus and without voting.**

Justification

Subgroup considerations

Original

- Update

## Implementation considerations

Original

1. Bedside lung ultrasound can be helpful to explain respiratory gas exchange deterioration and to detect pleural complication in ICU patients.
2. Portable equipment is preferred for follow-up of ICU patients. Bedside chest radiography can be helpful for dynamic evaluation of COVID-19 pneumonia and its complications. Resolution or progress of lung consolidation seen on a bedside chest radiograph can inform the therapeutic management. Chest imaging can inform management of pneumothorax or pneumomediastinum.
3. Daily chest radiographs in stable patients are not necessary and may increase the risk of viral transmission to health care workers.
4. When complications are suspected, in particular pulmonary arterial thrombosis or thromboembolism, contrast-enhanced CT may be considered, after weighing the potential risks and benefits.

•

Update

Unchanged

## Monitoring and evaluation

Original

- Monitor the number of requested chest imaging investigations related to COVID-19 and judge their adequacy.
- Monitor the impact of COVID-19-related chest imaging in different clinical scenarios on institutional and national resources (human and financial).
- Monitor the appropriate implementation of workflow and infection prevention and control measures (e.g. personal protective equipment).
- Monitor the number of cases of COVID-19 infections among hospital staff attributable to COVID-19-related chest imaging.
- Monitor the use of portable radiography equipment.
- Monitor the request of CT pulmonary angiography in suspected and confirmed COVID-19 patients.

•

Update

Unchanged

Research priorities	Original
---------------------	----------

- Conduct randomized controlled trials to compare the effects of using the different imaging modalities and using no imaging (in addition to clinical judgement) on clinical and health services outcomes of interest, for the questions addressed in this rapid advice guide.
- Evaluate access and health insurance coverage of chest imaging services related to COVID-19 in different settings.
- Study the role of artificial intelligence in chest imaging in different settings.
- Assess the incidence of COVID-19 infections among hospital staff attributable to chest imaging of patients with COVID-19 (e.g. in radiologists and radiographers).
- Evaluate the implementation of workflow developed for COVID-19-related chest imaging.
- Evaluate the safety and effectiveness of performing portable chest radiography, with and without RT-PCR testing, at home.
- Evaluate the impact of COVID-19-related imaging on institutional and national resources (human and financial).
- Evaluate the impact of COVID-19-related imaging on equity.
- Assess the values and preferences of different stakeholders for relevant chest imaging modalities in different settings.
- Evaluate the prognostic value of chest imaging findings during hospital admission regarding inpatient clinical outcomes (risk stratification), and duration of hospital stay.
- Evaluate the prognostic value of chest imaging findings upon discharge regarding post-discharge clinical outcomes (risk stratification) and readmission rates.
- Evaluate the correlation between radiological improvement and clinical improvement in patients with COVID-19.
- Assess the proportion of patients with COVID-19 infection who have pulmonary sequelae on follow-up imaging.
- Assess the value of different imaging modalities in assessing the short- and long-term complications of COVID-19.
- Evaluate the COVID-19 community transmission attributed to patients who are discharged based on negative findings in chest imaging.

•	Update
---	--------

- Conduct randomized controlled trials to compare the effects of using the different imaging modalities and using no imaging (in addition to clinical judgement) on clinical and health services outcomes of interest, for the questions addressed in this rapid advice guide.
- Evaluate access and health insurance coverage of chest imaging services related to COVID-19 in different settings.
- Study the role of artificial intelligence in chest imaging in different settings.
- Assess the incidence of COVID-19 infections among hospital staff attributable to chest imaging of patients with COVID-19 (e.g. in radiologists and radiographers).
- Evaluate the implementation of workflow developed for COVID-19-related chest imaging.
- Evaluate the safety and effectiveness of performing portable chest radiography, with and without virologic testing, at home.
- Evaluate the impact of COVID-19-related imaging on institutional and national resources (human and financial).
- Evaluate the impact of COVID-19-related imaging on equity.
- Assess the values and preferences of different stakeholders for relevant chest imaging modalities in different settings.
- Evaluate the prognostic value of chest imaging findings during hospital admission regarding inpatient clinical outcomes (risk stratification), and duration of hospital stay.

- Evaluate the prognostic value of chest imaging findings upon discharge regarding post-discharge clinical outcomes (risk stratification) and readmission rates.
- Evaluate the correlation between radiological improvement and clinical improvement in patients with COVID-19.
- Assess the proportion of patients with COVID-19 infection who have pulmonary sequelae on follow-up imaging.
- Assess the value of different imaging modalities in assessing the short- and long-term complications of COVID-19.
- Evaluate the COVID-19 community transmission attributed to patients who are discharged based on negative findings in chest imaging.

#### KQ 6 (PICO 7)

Should chest imaging be added to standard of care vs. not added be used for patients with COVID-19 whose symptoms resolved; context of a decision to choose between discharge home vs. no discharge home?

<b>POPULATION:</b>	Patients with COVID-19 whose symptoms resolved
<b>INTERVENTION:</b>	Chest imaging added to standard of care
<b>COMPARISON:</b>	Chest imaging not added to standard of care
<b>MAIN OUTCOMES:</b>	<ol style="list-style-type: none"> <li>1. Clinical outcomes           <ul style="list-style-type: none"> <li>• Mortality</li> <li>• Respiratory failure</li> <li>• Multiorgan failure</li> <li>• Shortness of breath</li> <li>• Recovery</li> <li>• Adverse effects of imaging (e.g., exposure to radiation)</li> <li>• COVID-19 transmission to health workers</li> </ul> </li> <li>2. Health systems outcomes           <ul style="list-style-type: none"> <li>• Service use, including:               <ul style="list-style-type: none"> <li>○ Length of stay in Emergency Department</li> <li>○ Length of hospital stay</li> <li>○ Length of ICU stay</li> </ul> </li> <li>• Availability of care</li> <li>• Access to care</li> <li>• Quality of care</li> </ul> </li> </ol>
<b>SETTING:</b>	Decision to choose between discharge home vs. no discharge home
<b>PERSPECTIVE:</b>	Societal perspective

## BACKGROUND:

### ASSESSMENT

#### Desirable Effects

How substantial are the desirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	<ul style="list-style-type: none"> <li>● Any benefit is reduced by the fact that the radiologic improvement lags behind the clinical improvement</li> <li>● Potential benefit is to assess for post COVID-19 sequelae</li> <li>● Might be used to assess the progression or regression of the radiologic findings</li> <li>● Lack of data for the association between radiological findings and rate of readmission</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Trivial: 4</li> <li>● Small: 7</li> <li>● Moderate: 4</li> <li>● Large: 1</li> <li>● Varies: 0</li> <li>● Don't know : 0</li> </ul>
•	Update	
○ Trivial ● Small ○ Moderate	● No study provided evidence for the effects of chest imaging on clinical outcomes	

<input type="radio"/> Large <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• No study provided evidence for the effects of chest imaging on health systems outcomes</li> </ul>	
Undesirable Effects How substantial are the undesirable anticipated effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<input type="radio"/> Large <input type="radio"/> Moderate <input checked="" type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• No study evaluated the effects of chest imaging on clinical outcomes</li> <li>• No study evaluated the effects of chest imaging on health systems outcomes</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of incidental findings</li> <li>• HCWs exposure</li> <li>• Harm of radiation</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>• Large: 2</li> <li>• Moderate: 6</li> <li>• Small: 7</li> <li>• Trivial: 1</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>
•	Update	
<input type="radio"/> Large <input type="radio"/> Moderate <input checked="" type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• No study provided evidence on harms.</li> </ul>	

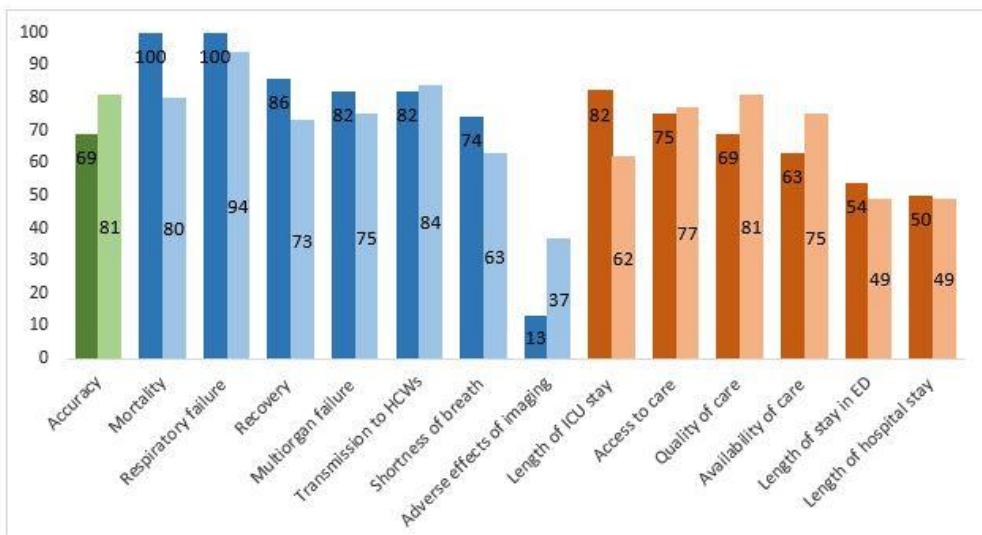
Certainty of evidence What is the overall certainty of the evidence of effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<ul style="list-style-type: none"> <li>● Very low</li> <li><input type="radio"/> Low</li> <li><input type="radio"/> Moderate</li> <li><input type="radio"/> High</li> <li><input type="radio"/> No included studies</li> </ul>		<ul style="list-style-type: none"> <li>● Very low for CT vs. no CT</li> <li>● Very low for CXR vs. no CXR</li> <li>● Very low for US vs. no US</li> </ul>
●	Update	
<ul style="list-style-type: none"> <li>● Very low</li> <li><input type="radio"/> Low</li> <li><input type="radio"/> Moderate</li> <li><input type="radio"/> High</li> <li><input type="radio"/> No included studies</li> </ul>		<ul style="list-style-type: none"> <li>● Very low for CT vs. no CT</li> <li>● Very low for CXR vs. no CXR</li> <li>● Very low for US vs. no US</li> </ul>
Values Is there important uncertainty about or variability in how much people value the main outcomes?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<input type="radio"/> Important uncertainty or variability	<b>Rating of outcomes:</b>	The voting results are:

- Possibly important uncertainty or variability
- Probably no important uncertainty or variability
- No important uncertainty or variability

Outcomes	Not important (%)		Important (%)		Critical (%)	
	GDG	Stakeholders	GDG	Stakeholders	GDG	Stakeholders
Accuracy	0	1	32	19	69	81
Mortality	0	6	0	16	100	80
Respiratory failure	0	4	0	4	100	94
Multorgan failure	0	5	19	22	82	75
Shortness of breath	0	6	27	33	74	63
Recovery	0	4	15	25	86	73
Adverse effects of imaging	44	24	44	40	13	37
Transmission to HCWs	7	3	13	14	82	84
Length of stay in ED	14	12	34	40	54	49
Length of hospital stay	13	8	38	44	50	49
Length of ICU stay	0	4	19	36	82	62
Availability of care	0	4	38	23	63	75
Access to care	0	4	25	21	75	77
Quality of care	7	3	25	18	69	81

- Important uncertainty or variability: 2
- Possibly important uncertainty or variability: 7
- Probably no important uncertainty or variability: 4
- No important uncertainty or variability: 1

#### Critical outcomes:



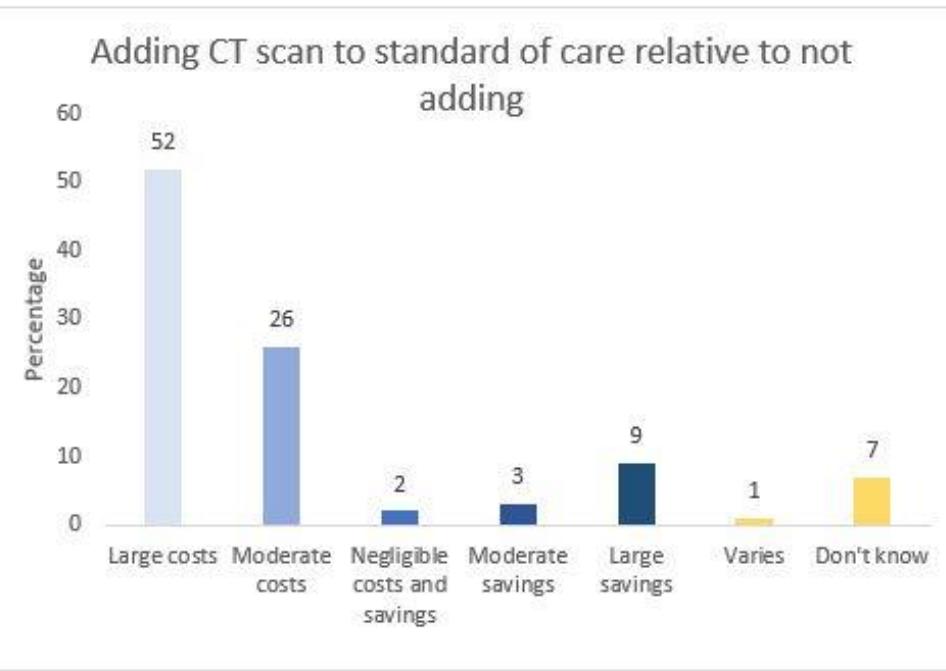
Green: accuracy of the diagnostic modality; blue: clinical outcomes; orange: health systems outcomes

Dark color: GDG; light color: stakeholders

	<p>Stakeholder respondents (n=249) included:</p> <ul style="list-style-type: none"> <li>•members of the public (3%)</li> <li>•patients (2%)</li> <li>•physicians (22%)</li> <li>•technicians (53%)</li> <li>•other health professionals (5%)</li> <li>•researchers (3%)</li> <li>•policy-makers (3%)</li> <li>•other (7%)</li> </ul>	
•	Update	
<input type="radio"/> Important uncertainty or variability <input checked="" type="radio"/> Possibly important uncertainty or variability <input type="radio"/> Probably no important uncertainty or variability <input type="radio"/> No important uncertainty or variability	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
<p>Balance of effects</p> <p>Does the balance between desirable and undesirable effects favor the intervention or the comparison?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	

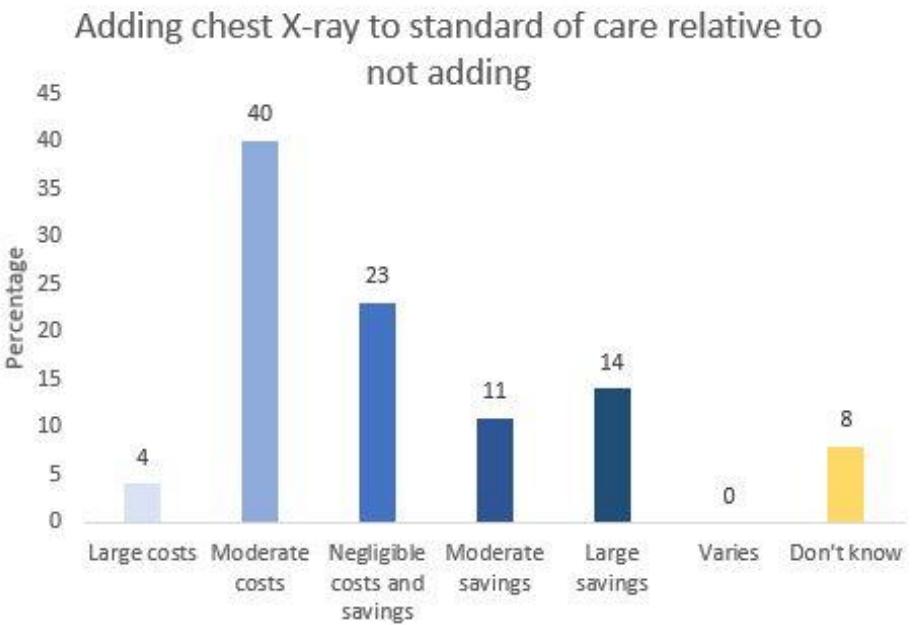
<ul style="list-style-type: none"> <li><input type="radio"/> Favors the comparison</li> <li><input checked="" type="radio"/> Probably favors the comparison</li> <li><input type="radio"/> Does not favor either the intervention or the comparison</li> <li><input type="radio"/> Probably favors the intervention</li> <li><input type="radio"/> Favors the intervention</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>		<p>The voting results are:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Favors the comparison: 4</li> <li><input type="radio"/> Probably favors the comparison: 8</li> <li><input type="radio"/> Does not favor either the intervention or the comparison: 0</li> <li><input type="radio"/> Probably favors the intervention: 2</li> <li><input type="radio"/> Favors the intervention : 1</li> <li><input type="radio"/> Varies: 0</li> <li><input type="radio"/> Don't know : 0</li> </ul>
•	Update	
<ul style="list-style-type: none"> <li><input type="radio"/> Favors the comparison</li> <li><input checked="" type="radio"/> Probably favors the comparison</li> <li><input type="radio"/> Does not favor either the intervention or the comparison</li> <li><input type="radio"/> Probably favors the intervention</li> <li><input type="radio"/> Favors the intervention</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>		
<p>Resources required</p> <p>How large are the resource requirements (costs)?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	

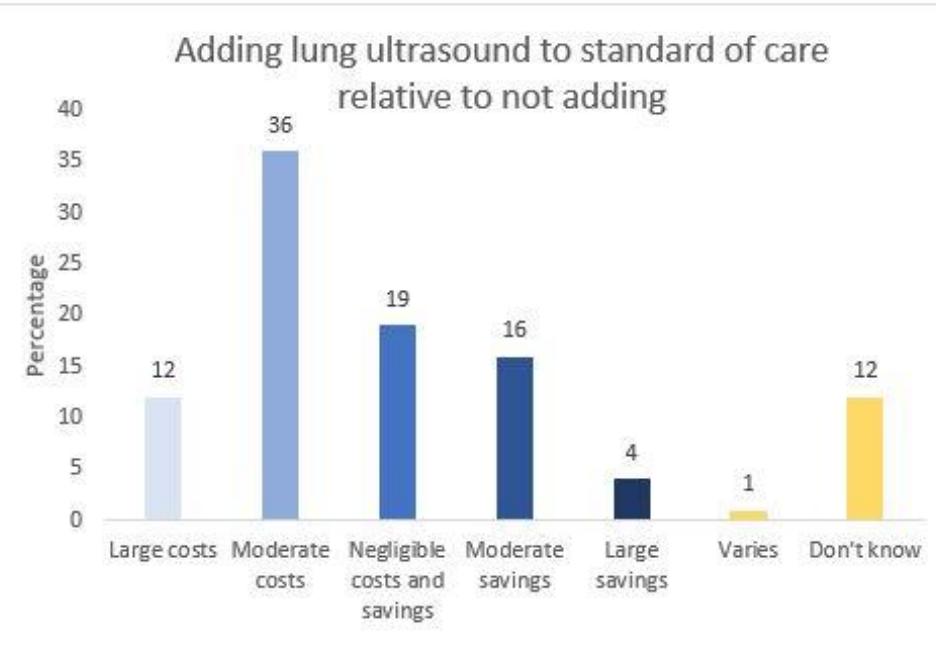
- Large costs
- Moderate costs
- Negligible costs and savings
- Moderate savings
- Large savings
- Varies
- Don't know



The voting results are:

- Large costs: 2
- Moderate costs: 10
- Negligible costs and savings: 0
- Moderate savings: 0
- Large savings: 0
- Varies: 1
- Don't know : 0

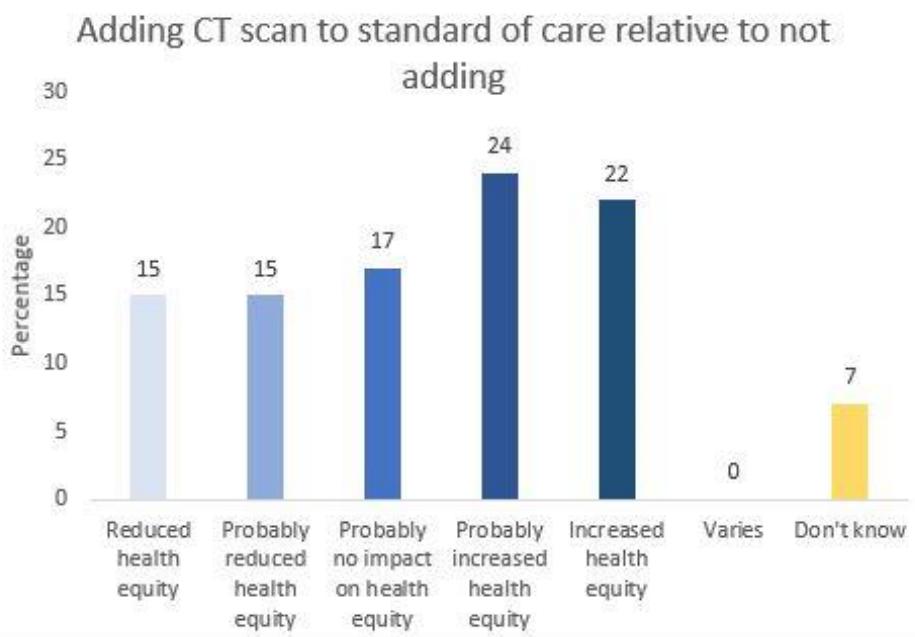


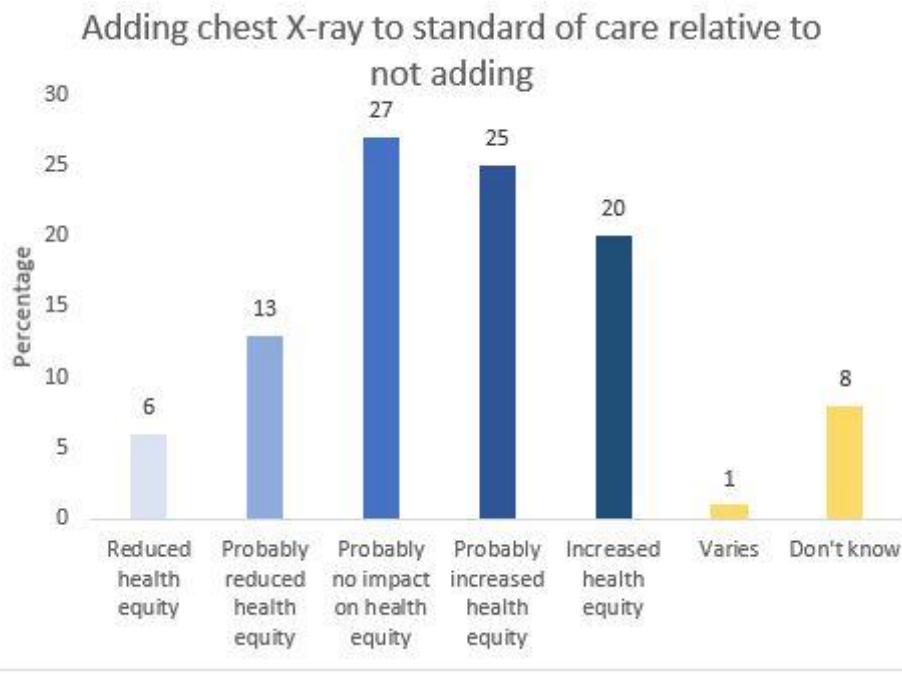


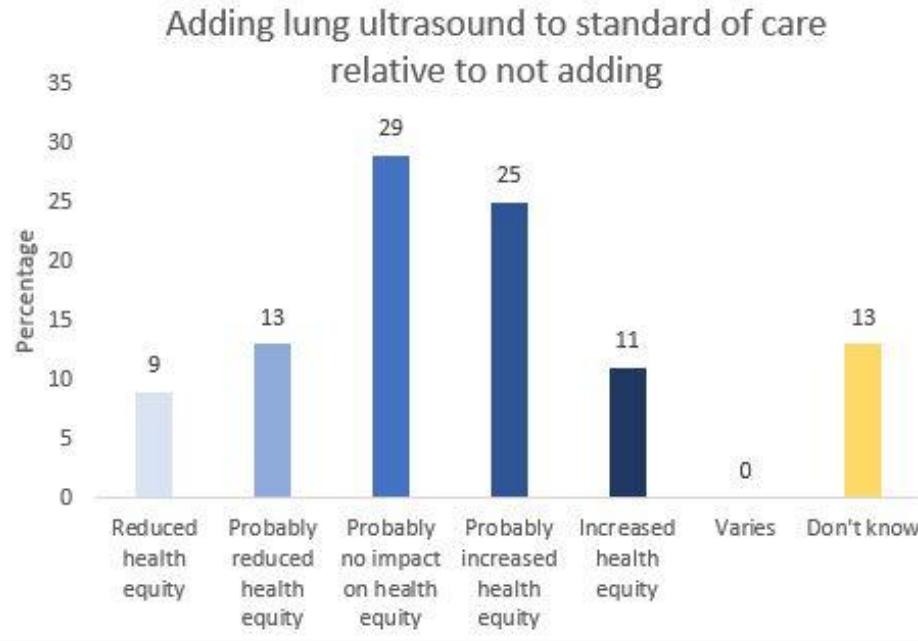
Respondents (n=90) included:

- members of the public (2%)
- patients (3%)
- physicians (18%)
- technicians (56%)
- other health professionals (4%)
- researchers (6%)
- policy-makers (3%)
- other (8%)

<ul style="list-style-type: none"> <li>•</li> </ul>	Update	
<ul style="list-style-type: none"> <li><input type="radio"/> Large costs</li> <li>● Moderate costs</li> <li><input type="radio"/> Negligible costs and savings</li> <li><input type="radio"/> Moderate savings</li> <li><input type="radio"/> Large savings</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
<b>Equity</b> What would be the impact on health equity?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
	Original	
<ul style="list-style-type: none"> <li><input type="radio"/> Reduced</li> <li>● Probably reduced</li> <li><input type="radio"/> Probably no impact</li> <li><input type="radio"/> Probably increased</li> <li><input type="radio"/> Increased</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>		The voting results are: <ul style="list-style-type: none"> <li>● Reduced: 0</li> <li>● Probably reduced: 9</li> <li>● Probably no impact : 2</li> <li>● Probably increased: 2</li> <li>● Increased: 0</li> <li>● Varies: 1</li> <li>● Don't know : 0</li> </ul>



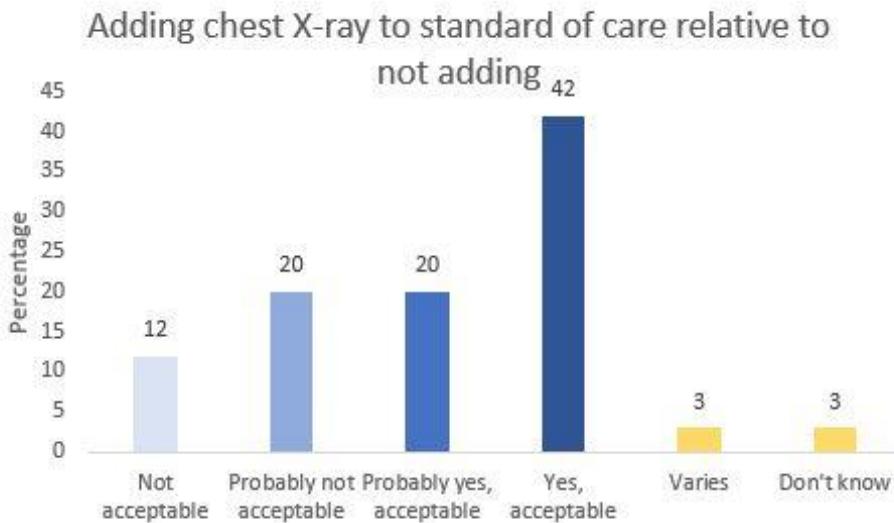


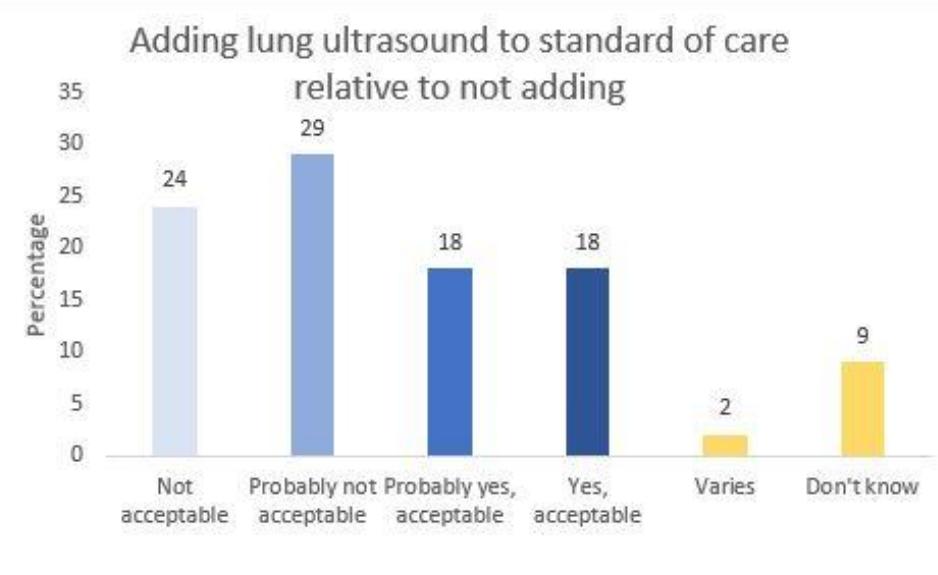


Respondents (n=90) included:

- members of the public (2%)
- patients (3%)
- physicians (18%)
- technicians (56%)
- other health professionals (4%)
- researchers (6%)
- policy-makers (3%)
- other (8%)

	Update															
<ul style="list-style-type: none"> <li><input type="radio"/> Reduced</li> <li><input checked="" type="radio"/> Probably reduced</li> <li><input type="radio"/> Probably no impact</li> <li><input type="radio"/> Probably increased</li> <li><input type="radio"/> Increased</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>															
Acceptability Is the intervention acceptable to key stakeholders?																
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS														
<ul style="list-style-type: none"> <li><input type="radio"/> No</li> <li><input type="radio"/> Probably no</li> <li><input checked="" type="radio"/> Probably yes</li> <li><input type="radio"/> Yes</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>	Original	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• No: 0</li> <li>• Probably no : 6</li> <li>• Probably yes: 7</li> <li>• Yes: 1</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>														
	<p style="text-align: center;"><b>Adding CT scan to standard of care relative to not adding</b></p> <table border="1"> <thead> <tr> <th>Acceptability Category</th><th>Percentage</th></tr> </thead> <tbody> <tr> <td>Not acceptable</td><td>21</td></tr> <tr> <td>Probably not acceptable</td><td>16</td></tr> <tr> <td>Probably yes, acceptable</td><td>30</td></tr> <tr> <td>Yes, acceptable</td><td>29</td></tr> <tr> <td>Varies</td><td>2</td></tr> <tr> <td>Don't know</td><td>2</td></tr> </tbody> </table>	Acceptability Category	Percentage	Not acceptable	21	Probably not acceptable	16	Probably yes, acceptable	30	Yes, acceptable	29	Varies	2	Don't know	2	
Acceptability Category	Percentage															
Not acceptable	21															
Probably not acceptable	16															
Probably yes, acceptable	30															
Yes, acceptable	29															
Varies	2															
Don't know	2															





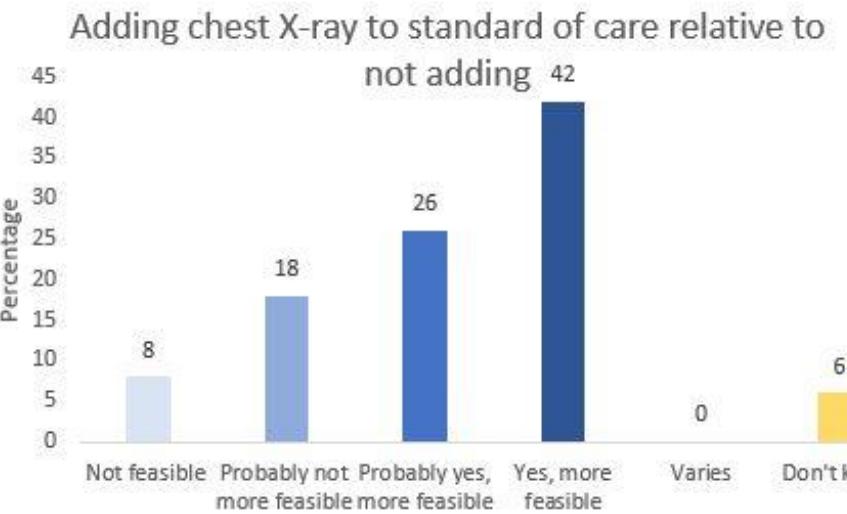
Respondents (n=90) included:

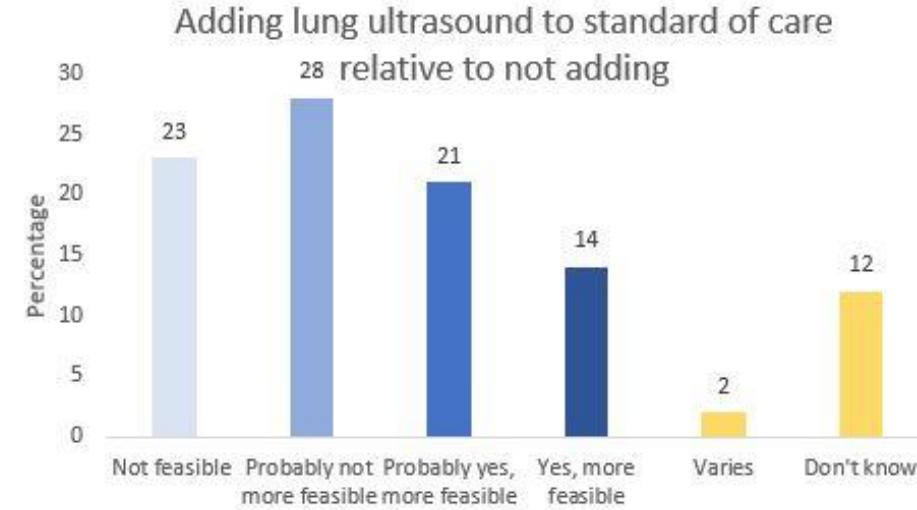
- members of the public (2%)
- patients (3%)
- physicians (18%)
- technicians (56%)
- other health professionals (4%)
- researchers (6%)
- policy-makers (3%)
- other (8%)

•

Update

<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• <b>No new data available.</b></li> </ul>															
Feasibility Is the intervention feasible to implement?																
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS														
	Original															
<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<p style="text-align: center;"><b>Adding CT scan to standard of care relative to not adding</b></p> <table border="1"> <thead> <tr> <th>Response Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Not feasible</td> <td>23</td> </tr> <tr> <td>Probably not more feasible</td> <td>21</td> </tr> <tr> <td>Probably yes, more feasible</td> <td>29</td> </tr> <tr> <td>Yes, more feasible</td> <td>19</td> </tr> <tr> <td>Varies</td> <td>1</td> </tr> <tr> <td>Don't know</td> <td>7</td> </tr> </tbody> </table>	Response Category	Percentage	Not feasible	23	Probably not more feasible	21	Probably yes, more feasible	29	Yes, more feasible	19	Varies	1	Don't know	7	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• No : 0</li> <li>• Probably no : 4</li> <li>• Probably yes: 8</li> <li>• Yes: 3</li> <li>• Varies: 0</li> <li>• Don't know : 0</li> </ul>
Response Category	Percentage															
Not feasible	23															
Probably not more feasible	21															
Probably yes, more feasible	29															
Yes, more feasible	19															
Varies	1															
Don't know	7															





Respondents (n=90) included:

- members of the public (2%)
- patients (3%)
- physicians (18%)
- technicians (56%)
- other health professionals (4%)
- researchers (6%)
- policy-makers (3%)
- other (8%)

•

Update

<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● <b>No new data available.</b></li> </ul>	
---	---	--

#### SUMMARY OF JUDGEMENTS

CRITERIA	ORIGINAL	IMPORTANCE FOR DECISION	UPDATE	IMPORTANCE FOR DECISION
DESIRABLE EFFECTS	Small		Small	
UNDESIRABLE EFFECTS	Small		Small	
CERTAINTY OF EVIDENCE	Very low		Very low	
VALUES	Possibly important uncertainty or variability		Possibly important uncertainty or variability	
BALANCE OF EFFECTS	Probably favors the comparison		Probably favors the comparison	
RESOURCES REQUIRED	Moderate costs		Moderate costs	
EQUITY	Probably reduced		Probably reduced	
ACCEPTABILITY	Probably yes		Probably yes	
FEASIBILITY	Probably yes		Probably yes	

#### TYPE OF RECOMMENDATION

Original	Strong recommendation against the intervention	Conditional recommendation against the intervention	Conditional recommendation for either the intervention or the comparison	Conditional recommendation for the intervention	Strong recommendation for the intervention
----------	--	---	--	---	--

	●				
Update					
Strong recommendation against the intervention ○	<b>Conditional recommendation against the intervention</b> ●	Conditional recommendation for either the intervention or the comparison ○	Conditional recommendation for the intervention ○	Strong recommendation for the intervention ○	

## CONCLUSIONS

Original
Recommendation

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 (conditional recommendation, based on expert opinion).

### Remarks:

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:

- have had a severe form of COVID-19;
- have pre-existing chronic lung disease.

When choosing the imaging modalities consider the following.

- Compared to chest CT, chest radiography appears to have lower sensitivity and might have higher specificity. Chest radiography is less resource intensive, is associated with lower radiation doses, is easier to repeat sequentially for monitoring disease recovery, and can be performed with portable equipment at the point of care or home.
- Chest CT has a relatively high sensitivity but a relatively low specificity and can be useful in patients with some pre-existing pulmonary diseases.

The voting results are:

- Strong recommendation against the intervention: 0
- Conditional recommendation against the intervention: 9
- Conditional recommendation for either the intervention or the comparison: 1
- Conditional recommendation for the intervention: 4
- Strong recommendation for the intervention: 0

## Justification

- 

Update

## Recommendation

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.

*(Conditional recommendation, based on expert opinion)*

### Remarks:

When imaging is used, it should be one element of the patient evaluation that otherwise includes clinical, laboratory and epidemiological data.

Patients likely to benefit from chest imaging are those who:

- have had a severe form of COVID-19;
- have pre-existing chronic lung disease.

When choosing the imaging modalities, consider the following:

- Chest CT can be useful in patients with some pre-existing pulmonary diseases. Chest CT is less preferred in high prevalence settings as this might lead to its high utilization and diversion of resources from non-COVID-19 patients.
- Chest radiography is less-resource intensive, is associated with lower radiation doses, is easier to repeat sequentially for monitoring disease progression, and can be performed with portable equipment at the point of care (which minimizes the risk of cross-infection related to patient transport). The option of the chest radiography through a glass door may reduce the risk of transmission and the use of PPE.

**Recommendation reached through consensus and without voting.**

Justification

Subgroup considerations

Original

- Update

Implementation considerations

Original

1. Consider radiological findings along with clinical and laboratory data.
2. Implement the recommendations based on equipment availability. Consider the resources needed (budget, health workforce, personal protective equipment, imaging equipment), the need to adapt the clinical workflow, and the need to deprioritize other indications for imaging.
3. Decision to discharge should be based more on clinical stability and two negative RT-PCR tests at least 24 hours apart.
4. Implement re-evaluation for patients who had severe form of the disease, to depict fibrotic changes.
5. Keep a record of the explorations carried out.

6. When performing chest radiography and chest CT, minimize radiation dose while maintaining diagnostic image quality (e.g. low-dose scanning protocols) and use digital imaging rather than film-screen equipment (16).
7. When performing chest radiography, consider using portable equipment, and if feasible, a COVID-19 dedicated unit.
8. Consider the potential harm from exposure to ionizing radiation, in particular for pregnant women and children.
9. Ensure proper use of personal protective equipment by health care workers and proper disinfection of equipment and devices (see Annex 1).
10. Provide appropriate training of radiologists and technologists on infection prevention and control practices and ensure efficient management of typical imaging findings of COVID-19 through accepted local protocols.
11. Consider the transfer of images for remote reporting (teleradiology) as needed (e.g. settings where radiologists are not available for on-site reporting).
12. Set policy/pathway for use of imaging related to COVID-19 illustrated with flow charts, infographics and/or other decision-support tools locally developed and accepted.
13. Provide information to patients about safety provisions adopted by the facility for infection prevention and control (see Annex 1) as well as for radiation protection (16).
14. Make provisions to ensure that all patients get the imaging services they need without suffering financial hardship.



Update

Unchanged

#### Monitoring and evaluation

Original

- Monitor the number of requested chest imaging investigations related to COVID-19 and judge their adequacy.
- Monitor the impact of COVID-19-related chest imaging in different clinical scenarios on institutional and national resources (human and financial).
- Monitor the appropriate implementation of workflow and infection prevention and control measures (e.g. personal protective equipment).
- Monitor the number of cases of COVID-19 infections among hospital staff attributable to COVID-19-related chest imaging.
- Monitor the use of portable radiography equipment.
- Monitor the request of CT pulmonary angiography in suspected and confirmed COVID-19 patients.



Update

Unchanged

Research priorities	
	Original
	<ul style="list-style-type: none"><li>• Conduct randomized controlled trials to compare the effects of using the different imaging modalities and using no imaging (in addition to clinical judgement) on clinical and health services outcomes of interest, for the questions addressed in this rapid advice guide.</li><li>• Evaluate access and health insurance coverage of chest imaging services related to COVID-19 in different settings.</li><li>• Study the role of artificial intelligence in chest imaging in different settings.</li><li>• Assess the incidence of COVID-19 infections among hospital staff attributable to chest imaging of patients with COVID-19 (e.g. in radiologists and radiographers).</li><li>• Evaluate the implementation of workflow developed for COVID-19-related chest imaging.</li><li>• Evaluate the safety and effectiveness of performing portable chest radiography, with and without RT-PCR testing, at home.</li><li>• Evaluate the impact of COVID-19-related imaging on institutional and national resources (human and financial).</li><li>• Evaluate the impact of COVID-19-related imaging on equity.</li><li>• Assess the values and preferences of different stakeholders for relevant chest imaging modalities in different settings.</li><li>• Evaluate the prognostic value of chest imaging findings during hospital admission regarding inpatient clinical outcomes (risk stratification), and duration of hospital stay.</li><li>• Evaluate the prognostic value of chest imaging findings upon discharge regarding post-discharge clinical outcomes (risk stratification) and readmission rates.</li><li>• Evaluate the correlation between radiological improvement and clinical improvement in patients with COVID-19.</li><li>• Assess the proportion of patients with COVID-19 infection who have pulmonary sequelae on follow-up imaging.</li><li>• Assess the value of different imaging modalities in assessing the short- and long-term complications of COVID-19.</li><li>• Evaluate the COVID-19 community transmission attributed to patients who are discharged based on negative findings in chest imaging.</li></ul>
•	Update

Unchanged

**Should periodic monitoring with chest imaging (including chest radiography, CT scan, lung ultrasound) vs. an alternative chest imaging modality or no chest imaging be used for individuals who have recovered from COVID-19?**

<b>POPULATION:</b>	Individuals who have recovered from COVID-19
<b>INTERVENTION:</b>	Periodic monitoring with chest imaging (including chest radiography, CT scan, lung ultrasound)
<b>COMPARISON:</b>	Alternative chest imaging modality or no chest imaging
<b>MAIN OUTCOMES:</b>	<p>Clinical outcomes of interest:</p> <ul style="list-style-type: none"> <li>• Mortality</li> <li>• Morbidity associated with COVID-19 related sequelae (pulmonary, cardiac)</li> <li>• Complications of imaging</li> </ul>
<b>SETTING:</b>	Long-term follow-up for the development of long term COVID-19 related sequelae (pulmonary, cardiac)
<b>PERSPECTIVE:</b>	Societal perspective
<b>BACKGROUND:</b>	
<b>CONFLICT OF INTERESTS:</b>	

**ASSESSMENT**

**Desirable Effects**

How substantial are the desirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<input type="radio"/> Trivial <input checked="" type="radio"/> Small <input type="radio"/> Moderate <input type="radio"/> Large <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>• No study evaluated the effects of chest imaging on clinical outcomes</li> <li>• No study evaluated the association between chest imaging findings following discharge and long-term clinical outcomes</li> </ul>	<p>Patient groups who might benefit from periodic follow-up imaging:</p> <ul style="list-style-type: none"> <li>• patients with persistent pulmonary symptoms (dyspnea, hypoxia, cough)</li> <li>• patients diagnosed with pulmonary embolism during their admission</li> </ul>

		<ul style="list-style-type: none"> <li>● patients diagnosed with post Acute respiratory distress syndrome (ARDS) during their admission</li> <li>● patients with COVID-19 with symptoms and/or signs of lung involvement at the time of hospital discharge</li> <li>● patients with abnormal imaging findings at discharge</li> <li>● patients with previous chronic lung and/or heart diseases, or other comorbidities (HIV, TB), immunocompromised patients</li> </ul> <p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Trivial: 1</li> <li>● Small: 6</li> <li>● Moderate: 1</li> <li>● Large: 1</li> <li>● Varies: 0</li> <li>● Don't know: 2</li> </ul>
--	--	---

#### Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<input type="radio"/> Large <input type="radio"/> Moderate <input checked="" type="radio"/> Small <input type="radio"/> Trivial <input type="radio"/> Varies <input type="radio"/> Don't know	<ul style="list-style-type: none"> <li>● No study evaluated the effects of chest imaging on clinical outcomes</li> </ul>	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>● Large: 1</li> <li>● Moderate: 2</li> <li>● Small: 8</li> <li>● Trivial: 0</li> <li>● Varies: 0</li> <li>● Don't know: 0</li> </ul>

Certainty of evidence What is the overall certainty of the evidence of effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <li>● Very low</li> <li><input type="radio"/> Low</li> <li><input type="radio"/> Moderate</li> <li><input type="radio"/> High</li> <li><input type="radio"/> No included studies</li> </ul>		<ul style="list-style-type: none"> <li>● Very low for chest imaging vs. no chest imaging</li> </ul>
Values Is there important uncertainty about or variability in how much people value the main outcomes?		
<ul style="list-style-type: none"> <li><input type="radio"/> Important uncertainty or variability</li> <li>● Possibly important uncertainty or variability</li> <li><input type="radio"/> Probably no important uncertainty or variability</li> <li><input type="radio"/> No important uncertainty or variability</li> </ul>	<p><i>Findings from the qualitative study</i></p> <p>Not valued when overused :</p> <ul style="list-style-type: none"> <li>● When clinically not indicated, it would be unethical to expose patients to unnecessary radiation</li> <li>● May lead to unnecessary findings</li> </ul> <p>Highly valued when appropriately indicated:</p> <ul style="list-style-type: none"> <li>● Monitor resolution</li> <li>● Monitor progression of long-term sequelae</li> <li>● Early detection of new diseases</li> <li>● Decreasing risk of mortality from opportunistic diseases</li> <li>● Academic reasons understanding the long-term sequelae of the virus infection</li> </ul>	

Balance of effects Does the balance between desirable and undesirable effects favor the intervention or the comparison?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <li><input type="radio"/> Favors the comparison</li> <li><input checked="" type="radio"/> Probably favors the comparison</li> <li><input type="radio"/> Does not favor either the intervention or the comparison</li> <li><input type="radio"/> Probably favors the intervention</li> <li><input type="radio"/> Favors the intervention</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>		
		<p>The voting results are:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Favors comparator: 3</li> <li><input type="radio"/> Probably favors comparator: 2</li> <li><input type="radio"/> Does not favor either comparator or intervention: 3</li> <li><input type="radio"/> Probably favors intervention: 3</li> <li><input type="radio"/> Favors intervention: 0</li> <li><input type="radio"/> Varies: 0</li> <li><input type="radio"/> Don't know: 0</li> </ul>
Resources required How large are the resource requirements (costs)?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <li><input type="radio"/> Large costs</li> <li><input checked="" type="radio"/> Moderate costs</li> <li><input type="radio"/> Negligible costs and savings</li> <li><input type="radio"/> Moderate savings</li> <li><input type="radio"/> Large savings</li> <li><input type="radio"/> Varies</li> <li><input type="radio"/> Don't know</li> </ul>		<p>The voting results are:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Large costs: 5</li> <li><input type="radio"/> Moderate costs: 6</li> <li><input type="radio"/> Negligible costs and savings: 0</li> <li><input type="radio"/> Moderate savings: 0</li> <li><input type="radio"/> Large savings: 0</li> <li><input type="radio"/> Varies: 0</li> <li><input type="radio"/> Don't know: 1</li> </ul>
Equity What would be the impact on health equity?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <li><input type="radio"/> Reduced</li> <li><input checked="" type="radio"/> Probably reduced</li> <li><input type="radio"/> Probably no impact</li> <li><input type="radio"/> Probably increased</li> <li><input type="radio"/> Increased</li> <li><input type="radio"/> Varies</li> </ul>	<p><i>Findings from the qualitative study</i></p> <p>Global/ between countries:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Access to imaging resources thus access to services</li> </ul>	<p>The voting results are:</p> <ul style="list-style-type: none"> <li><input checked="" type="radio"/> Reduced: 2</li> <li><input type="radio"/> Probably reduced: 6</li> <li><input type="radio"/> Probably no impact: 1</li> </ul>

<input type="radio"/> Don't know <input checked="" type="radio"/> Insured: health insurance coverage/ partial health insurance vs. non-insured <p>Within countries:</p> <ul style="list-style-type: none"> <li>• Private vs public and access to quality services</li> <li>• Urban vs rural</li> <li>• Non-COVID-19 patients</li> </ul>	<ul style="list-style-type: none"> <li>• Probably increased: 0</li> <li>• Increased: 2</li> <li>• Varies: 0</li> <li>• Don't know: 0</li> </ul>	
<p><b>Acceptability</b> Is the intervention acceptable to key stakeholders?</p>		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<input type="radio"/> No <input checked="" type="radio"/> Probably no <input type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<p><i>Findings from the qualitative study</i></p> <p><b>Providers' perspective:</b></p> <p>Current practice-buy-in:</p> <ul style="list-style-type: none"> <li>• Convergence on the perceived benefit of monitoring post-recovery</li> <li>• Monitoring using imaging is a common practice</li> <li>• General consensus that severity of the case and presentation after discharge that drive the testing</li> </ul> <p><b>Patients' perspective:</b></p> <p>Facilitators:</p> <ul style="list-style-type: none"> <li>• Trust their providers and do not question them</li> <li>• Informing them about the reasons they need to do the test</li> <li>• Being accustomed to the process of monitoring</li> </ul> <p>Barriers:</p> <ul style="list-style-type: none"> <li>• Affordability</li> <li>• Receiving too many calls and poor care coordination, it is too much to bear</li> <li>• Psychologically stressful</li> </ul>	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>• No: 1</li> <li>• Probably no: 5</li> <li>• Probably yes: 4</li> <li>• Yes: 0</li> <li>• Varies: 0</li> <li>• Don't know: 1</li> </ul>

	Despite what they went through, patients are still willing to undergo more testing. When probing, we identified the main factors influencing this positive attitude. Conversely, we found other reasons that make a few non-accepting.	
Feasibility Is the intervention feasible to implement?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	<p><i>Findings from the qualitative study</i></p> <p>Feasibility <b>improves</b> when one of the following conditions exists :</p> <ol style="list-style-type: none"> <li>1. Having a post-recovery COVID-19 unit and protocols</li> <li>2. Annexing it to an already existing monitoring system for other diseases</li> <li>3. Team to scale up the efforts</li> </ol> <p>The <b>challenges, some of which may vary by setting</b>, are:</p> <ol style="list-style-type: none"> <li>1. Severe cases are extremely deconditioned</li> <li>2. Lack of enough number of specialists</li> <li>3. Not enough dedicated staff responsible for tracing patients</li> <li>4. Back log in imaging appointment due to limited number of equipment (i.e. CT scan)</li> </ol>	<p>The voting results are:</p> <ul style="list-style-type: none"> <li>● No: 0</li> <li>● Probably no: 5</li> <li>● Probably yes: 5</li> <li>● Yes: 1</li> <li>● Varies: 0</li> <li>● Don't know: 0</li> </ul>

#### SUMMARY OF JUDGEMENTS

	JUDGEMENT						
DESIRABLE EFFECTS	Trivial	Small	Moderate	Large		Varies	Don't know
UNDESIRABLE EFFECTS	Large	Moderate	Small	Trivial		Varies	Don't know
CERTAINTY OF EVIDENCE	Very low	Low	Moderate	High			No included studies
VALUES	Important uncertainty or variability	Possibly important uncertainty or variability	Probably no important uncertainty or variability	No important uncertainty or variability			

	JUDGEMENT						
BALANCE OF EFFECTS	Favors the comparison	Probably favors the comparison	Does not favor either the intervention or the comparison	Probably favors the intervention	Favors the intervention	Varies	Don't know
RESOURCES REQUIRED	Large costs	Moderate costs	Negligible costs and savings	Moderate savings	Large savings	Varies	Don't know
EQUITY	Reduced	Probably reduced	Probably no impact	Probably increased	Increased	Varies	Don't know
ACCEPTABILITY	No	Probably no	Probably yes	Yes		Varies	Don't know
FEASIBILITY	No	Probably no	Probably yes	Yes		Varies	Don't know

#### TYPE OF RECOMMENDATION

Strong recommendation against the intervention ○	Conditional recommendation against the intervention ●	Conditional recommendation for either the intervention or the comparison ○	Conditional recommendation for the intervention ○	Strong recommendation for the intervention ○
---	--	---	--	---

#### CONCLUSIONS

##### Recommendation

In individuals who have recovered from COVID-19, the WHO **suggests not** scheduling chest imaging follow-up at the time of discharge for the development of long-term COVID-19 related sequelae.

##### Remarks:

The ultimate decision needs to take into account the clinical situation of the patient at the time of discharge (i.e., symptoms, signs and medical history).

##### The voting results are:

- Strongly against periodic monitoring: 2
- Conditionally against periodic monitoring: 6
- Conditionally for or against periodic monitoring: 2
- Conditionally for periodic monitoring: 1
- Strongly for periodic monitoring: 0

## Justification

## Subgroup considerations

## Implementation considerations

### *Findings from the qualitative study*

Practical considerations:

- Transportation cost and distance to centers are problematic for patients.
- Healthcare providers need to communicate with each other and ensure coordination of care.
- Some patients might need escort either because of sickness or older age (e.g., elderly living in nursing homes who are typically dependent on others).
- Provisions for protection of women, nursing women, and pregnant women need to be in place in radiology services.
- Dialysis patients may need to come early or leave late before or after dialysis for testing.

## Monitoring and evaluation

## Research priorities

World Health Organization  
Avenue Appia 20  
1211 Geneva 27  
Switzerland  
[www.who.int](http://www.who.int)

