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Recommendations for SARS-CoV-2/COVID-19 testing: a scoping review of current guidance

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ABSTRACT

Background Testing used in screening, diagnosis and follow-up of COVID-19 has been a subject of debate. Several organisations have developed formal advice about testing for COVID-19 to assist in the control of the disease. We collated, delineated and appraised current worldwide recommendations about the role and applications of tests to control SARS-CoV-2/COVID-19.

Methods We searched for documents providing recommendations for COVID-19 testing in PubMed, EMBASE, LILACS, the Coronavirus Open Access Project living evidence database and relevant websites such as TRIP database, ECRI Guidelines Trust, the GIN database, from inception to 21 September 2020. Two reviewers applied the eligibility criteria to potentially relevant citations without language or geographical restrictions. We extracted data in duplicate, including assessment of methodological quality using the Appraisal of Guidelines for Research and Evaluation-II tool.

Results We included 47 relevant documents and 327 recommendations about testing. Regarding the quality of the documents, we found that the domains with the lowest scores were 'Editorial independence' (Median=4%) and 'Applicability' (Median=6%). Only six documents obtained at least 50% score for the 'Rigour of development' domain. An important number of recommendations focused on the diagnosis of suspected cases (48%) and deisolation measures (11%). The most frequently recommended test was the reverse transcription-PCR (RT-PCR) assay (87 recommendations) and the chest CT (38 recommendations). There were 22 areas of agreement among guidance developers, including the use of RT-PCR for SARS-Cov-2 confirmation, the limited role of bronchoscopy, the use chest CT and chest X-rays for grading severity and the co-assessment for other respiratory pathogens.

Conclusion This first scoping review of recommendations for COVID-19 testing showed many limitations in the methodological quality of included guidance documents that could affect the confidence of clinicians in their implementation. Future guidance documents should incorporate a minimum set of key methodological characteristics to enhance their applicability for decision making.

Strengths and limitations of this study

- This scoping review focused on documents providing recommendations about COVID-19 testing, produced by global health agencies, scientific societies and government agencies worldwide.
- We applied the Appraisal of Guidelines for Research and Evaluation-II tool, to assess the quality of the documents providing recommendations about COVID-19 testing.
- We included the latest version of documents providing recommendations for adult populations, without language or publication status restrictions. Search is current up to 21 September 2020.
- We classified each recommendation according to its application, the index tests involved and the action recommended. We summarised the areas of agreement among developers about COVID-19 testing.

INTRODUCTION

COVID-19, a human respiratory disease pandemic caused by a new coronavirus (SARS-CoV-2) since March 2020, has been reported in 3 175 207 cases including 224 172 deaths worldwide.[1 2] Its peak quickly saturated the response capacity of healthcare organisations, even in high-performing systems, seriously affecting medical provision.[3] Effective infection control should rely on provision of tests. Initial strategies have focused on case identification and contact tracing, as in previous coronavirus epidemics,[4–6] although testing on a massive scale has also been suggested as a key public health strategy.[6–8] Testing all patients with suspected infection is the ideal method for infection control, but several countries have limited testing capacity unrealistic, and a prioritising process is applied.[3 9 10]

Testing used in screening, diagnosis and follow-up of COVID-19 has been a subject of debate. Besides symptoms and signs, tests,

such as nucleic acid amplification tests (NAATs), serology tests (including lgG and lgM) as well as imaging (chest CT, ultrasound and chest X-ray), have been considered for this condition.[11–13] However, there are variations in the evidence evaluating the properties of COVID-19 tests in different public health and clinical scenarios.[14–16] In a pandemic, there is a need for timely guidance to direct the testing of suspected, probable and confirmed COVID-19 cases. To efficiently use, available resources to control the spread of the disease, several organisations have developed formal advice about testing for COVID-19.[17–20] In this scoping review, we collated and categorised guidance about the role and applications of tests for SARS-CoV-2/COVID-19, to provide an overview of the current recommended testing strategies, as well as their quality following the criteria of a standardised tool to assess documents providing clinical guidance. While other reviews have focused on guidance about COVID-19 treatments[21 22] or selected populations,[23–25] this is the first scoping review summarising COVID-19 testing recommendations along with a comprehensive assessment of the quality of their development.

METHODS

We searched for guidance documents about the use of tests in the diagnosis and management of adult COVID-19 patients, without language or publication status restrictions. A document or report was eligible if it was self-declared as a guideline, guidance or protocol (using keywords such as 'practice guideline,' 'consensus,' 'guidance', 'position statement' and 'guideline'), and if it provided explicit recommendations about COVID-19 testing for adult healthier population. We included documents providing recommendations about the use of any test, including symptoms and signs of COVID-19, laboratory-based molecular tests, serology tests and imaging, and presented as sentences or paragraphs. Guidance documents exclusively focused on special populations (ie, patients with chronic obstructive pulmonary disease, critical care, pregnant women, cancer patients or children), specific settings (ie, workplaces, nursing homes), those developed for local use (ie, those developed by individual healthcare institutions), as well as other evidence synthesis documents no providing explicit recommendations (ie, rapid responses and rapid reviews) were excluded. A detailed structured question (Patients, Index Test, Outcome (PCO)) can be consulted in online supplemental appendix 1.

Data sources and searches

We searched guideline repositories and websites of government agencies, scientific societies and international organisations related to COVID-19 management, such as WHO, the Centers for Disease Control and Prevention (CDC), as well as manual searching of 28 websites (online supplemental appendix 2). In addition, we searched MEDLINE (Ovid SP, 1946 to 21 September 2020), Embase (Ovid SP, 1982 to 21 September 2020) and LILACS (iAH English) (BIREME, 1982 to 21 September 2020). We also search on the internet for documents from the 30 countries more affected by COVID-19 confirmed cases, as reported by WHO in the situation report #153[26] (online supplemental appendix 3). We did not apply any language or geographic restrictions. We used EndNote X9 software to create a database for the management of the search results.

Study selection and quality assessment

Two reviewers applied the eligibility criteria and extracted relevant data on main characteristics from potentially relevant documents, registering reasons for exclusion. An additional reviewer checked all the extracted information for accuracy (non-independent verification). For the quality assessment of included documents, two reviewers independently rated each document using the Appraisal of Guidelines, Research and Evaluation (AGREE)-II tool.[27] The AGREE-II tool is a validated tool for the assessment of the quality and reporting of practice guidelines.[28–30] In particular, this tools helps to stakeholders, clinicians and users in general in the evaluation of the quality of documents that are candidates for use in clinical practice, as well as those involved in policy-related decisions.[27] This tool consisted of 23 key items organised in six domains: scope and purpose, stakeholder involvement, the rigour of development, clarity of presentation, applicability, editorial independence and two overall evaluation items. Each item was graded using a scale of 7 points: from 1, meaning 'strongly disagree', to 7, meaning 'strongly agree'. The total was presented as a percentage of the maximum possible score for that domain (from 0% to 100%). For further analysis, we highlighted those recommendations belonging to documents with a score of ≥50% in domain 3 of the AGREE-II tool ('Rigour of Development'), as indication of a sound methodology in their development. This domain involves questions about the use of systematic methods in search of evidence, the comprehensive evaluation of the strength and limitations of eligible studies, the methods for formulating the final recommendations and their external review by experts, among other issues.[27] Discrepancies were resolved by a consensus.

Data extraction and data synthesis

For each eligible document, we extracted information about the country and region where the document was developed, the date of last update, the main institution developing the guidance, the methodologies to produce the guidance document and the recommendations, as well as the assessment of conflict of interest. All recommendations provided by the included guidance documents were extracted in an Excel spreadsheet. We classified each recommendation according to their application, following the disease pathway suggested by Cheng *et al*[31], as follow:

- Incubation period with screening asymptomatic patients and monitoring contacts: Those recommendations about the assessment of at-risk individuals without symptoms and their likelihood of a current SARS-Cov-2 infection, as well as those recommendations about contact tracing and monitoring of contacts of suspected, possible and confirmed cases of COVID-19.
- Symptomatic illness with testing of symptomatic cases: Those recommendations about the triage of symptomatic individuals with a reasonable likelihood of COVID-19.
- Symptomatic illness needing diagnosis: Those recommendations about the confirmation of COVID-19 disease in an individual infected with SARS-CoV-2 after triage testing.
- Symptomatic illness exploring competitive diagnosis: Those recommendations about rule-out competing diagnosis (ie, influenza-like illness) of symptomatic individuals with a reasonable likelihood of a SARS-Cov-2 infection/ COVID-19.
- Symptomatic illness grading disease severity: Those recommendations about the classification of confirmed cases and the assessment of severity to treatment decisions.
- Symptomatic illness monitoring and treatment modification: Those recommendations about the follow-up of confirmed COVID-19 case for further treatment modifications.
- Convalescence or deisolation discharge: Those recommendations about the end of deisolation or the hospital discharge of institutionalised patients.

We extracted the test(s) covered by each recommendation in a standardised format, as well as the direction of the recommendation (for/ against), and their strength (weak, strong), if available. We generated tables and figures summarising the role of tests during the COVID-19 testing, as well as the areas of consensus and recommendations supported by two or more documents. All descriptive analyses were performed in STATA V.16.0. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for scoping reviews.[32]

Patient and public involvement

Patients were not involved in this research.

RESULTS

Electronic searches yielded 4648 citations from Medline, Embase and LILACS databases. In addition, we obtained 4955 documents from other resources (figure 1). Our initial screening of titles and abstracts identified 230 documents for assessment in full text, of which 45 were excluded due to they did not provide recommendations for clinical practice, 33 documents did not provide recommendations about COVID-19 testing, 27 addressed patients with other main pathologies or settings excluded to our review, and 16 were previous versions of included documents (online supplemental appendix 4). Finally, 47 documents were included in evidence synthesis.[33–79]

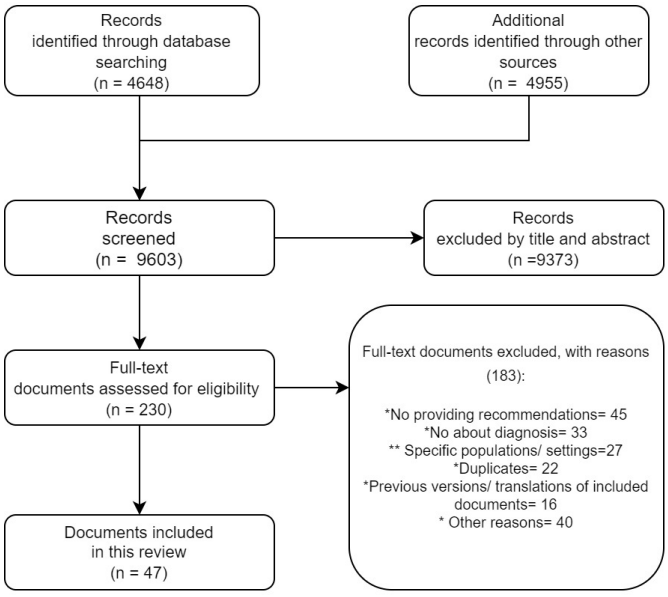

Figure 1 Flow diagram of document selection for the scoping review of guidance on SARS-CoV-2/COVID-19 testing. Additional records identified through other sources: TRIP database=3876 records; members of the International Society of antimicrobial chemotherapy=89 records; Canadian Medical Association (CMA) infobase/Clinical Practice Guidelines (CPGs). Database (CPGs)=151 records; who resources=164 records; Fisterra=38 records; other sources=637 records.

Characteristics and quality of included guidance documents

Most of the included documents (n=28, 59%) were published *de novo* or have an updated version from May to September 2020 (table 1). Thirty-five documents were developed by institutions in America (n=15), Europe (n=10) and Asia (n=10). A considerable number of documents were developed by scientific societies alone (n=21, 44%), while nine were produced by global/international health institutions, such as WHO and local/regional CDCs (19%), and 16 remaining documents were developed by government agencies and Ministries of Health (34%). Fourteen documents reported a methodology to their development, including a search of primary evidence and experts meetings,[35 36 43 44 46 52 57 58 63 67 68 71 74 77] while 12 of them added a specific method to develop the recommendations, mostly based on expert consensus.[35 36 43 44 46 57 58 63 67 68 71 74] Five documents explicitly stated that they followed the existing WHO/CDC guidelines to produce their own recommendations.[34 37 49 56 65] Fifteen documents did not present the recommendation in a clear format, such as a bullet list or a table; instead, they present the recommended actions in paragraphs along with other epidemiological information.[36 40 45 47 49 53 60 64 65 72 73 75–78] In addition, only 19 documents reported the assessment of conflict of interest among the members of the expert panel producing the recommendations.[35 37 42 44–48 52 57 58 60 62–64 67 68 74 79] Five

Table 1 Characteristics of the documents included in the scoping review of guidance on SARS-CoV-2/COVID-19 testing

Characteristic of documents or recommendations		Frequency
Date last version/ update	March 2020 or earlier	11
	April to May 2020	18
	June to July 2020	7
	August to September 2020	11
Country/region	America	15
	Europe	10
	Asia	10
	Africa	2
	International	10
Developer	Global health agencies (ie, WHO and CDCs)	9
	Government agencies and Ministries of Health	16
	Scientific Societies	21
Scenarios of recommendations' application	Incubation: screening asymptomatic patients/ monitoring contacts	15
	Symptomatic illness: screening symptomatic cases	6
	Symptomatic illness: diagnosis	157
	Symptomatic illness: competitive diagnosis	31
	Symptomatic illness: staging/grading severity	36
	Symptomatic illness: monitoring	28
	Convalescence: deisolation/discharge	39
	Other applications	15

CDC, Centers for Disease Control and Prevention.

documents providing only recommendations about selected settings, mostly about deisolation.[38 39 57 59 66]

Regarding the quality of included documents, we found that the domains with the highest scores were 'Scope and purpose' (Median=50%; IQR=32–61) and 'Clarity of presentation' (Median=49%; IQR=33–67) (online supplemental appendix 5). Domains with the lowest scores were 'Editorial independence' (Median=4%; IQR=0–43) and 'Applicability' (Median=6%; IQR=0–21). Only six documents obtained at least 50% score for the 'Rigour of development' domain.[35 36 44 46 63 67] Twelve documents obtained at least 50% scores for at least three AGREE-II domains.[35–37 44 46 49 57 58 63 64 67 71] (online supplemental appendix 5).

Characteristics of the recommendations

We included 47 documents providing 327 recommendations about the diagnosis of COVID-19 cases (table 1). One hundred and fifty-seven recommendations were focused on the diagnosis of suspected cases (48%), while 39 sentences addressed deisolation measures of confirmed cases (11%). Forty-eight recommendations were against the use of a test in a specific setting (14%). The strength of recommendations was reported in 62 statements (strong 33; weak 29).

The test most frequently recommended was the reverse transcription-PCR (RT-PCR) assays (87 recommendations), followed by chest CT (38 recommendations), and chest ultrasounds (22 recommendations). The test was not described or was no clearly reported in 48 recommendations (ie, 'COVID-19 testing', 'laboratory testing'). In addition, 79 recommendations reported tests for the investigation of competitive diagnoses, monitoring of disease and assessment of severity, such as blood counts, biomarkers, cultures and kidney and liver functions, among others.

An overview of the recommendations collated according to their role and application is presented as follow. Full text of all recommendations and areas of agreement with supporting documents can be consulted in online supplemental appendix 6.

Recommendations about incubation period (screening of asymptomatic and monitoring of contacts)

We identified 14 recommendations about the screening of asymptomatic patients and monitoring the contacts of confirmed cases, provided by four global health agencies,[58 63 71 78] five scientific societies,[35 42–44 70 78] and one government agency.[37] RT-PCR assays were recommended for testing of suspected cases, including those asymptomatic individuals in close contact with confirmed COVID-19 patients.[37 44 58] One document developed by a scientific society recommends against the use of RT-PCR in asymptomatic patients with a low probability of being infected.[44] Two documents recently published by global health agencies suggest the use of COVID-19 rapid antigen tests in cases of known exposure, even if individuals are asymptomatic.[71 78] In addition, two documents do not recommend the use of imaging (unclear which test) for the assessment of asymptomatic individuals.[43 63] We identified three areas of agreement among developers, supported by two documents with Domain 3/AGREE II tool score ≥50%,[44 63] regarding the role of RT-PCR assays and antigen-based tests (in favour) and chest imaging (against) in this setting (table 2).

Recommendations about symptomatic illness: screening symptomatic cases

We identified seven recommendations about case finding of symptomatic patients derived from six documents, including one global health agency,[58 71] four scientific societies[35 44 60 62] and one government agency.[69] Recommended test for the initial assessment of symptomatic

Table 2 Testing of SARS-CoV-2/COVID-19: areas of consensus by developers

			Global health agencies	Scientific societies	Government institutions
Incubation	Monitoring contacts-asymptomatic individuals	RT-PCR as the recommended test for investigation of asymptomatic and close contact	59	45a	38
		Imaging is not routinely indicated as a screening test for COVID-19 in asymptomatic individuals	64*	44	
		COVID-19 rapid antigen tests as alternative tests in cases of known exposure, even if individuals are asymptomatic	72, 79		
Symptomatic illness	Screening symptomatic patients	Use of SARS-CoV-2 NAAT tests (including RT-PCR) as the recommended test for these cases	59, 72	45*, 36a	
		Chest CT should not be performed as a screening test in patients for possible COVID-19		61, 63	
	Diagnosis	Use of RT-PCR as the recommended test for these cases	56, 59, 73	5, 36 *, 38, 43, 45*, 52, 55, 71, 78, 65, 76	37*, 41, 50, 51, 53, 54, 57, 69, 66, 75, 77, 74
		General examination: including (but not limited to): physical examinatio, blood gas analysis/oxygen saturation, liver and kidney functions, complete blood count, among others		52, 55, 78, 65	37*, 50, 54, 57
		Use of antibody-based (serological) tests for the diagnosis of acute COVID-19 is not recommended	59, 73, 62	71, 68*, 36*	37*, 51, 54, 66, 69, 75, 70, 74
		Repeat RT-PCR testing in cases where a patient with high suspicious of infection have an initial negative or undetermined results	73	36*, 45*, 55, 61	38, 75
		Specimen collection: respiratory tract samples, especially nasopharyngeal samples	56, 59, 73, 79	55, 36*, 45*, 47*, 71, 78	38, 41, 42, 50, 54, 57, 74, 75
		Restricted use of bronchoscopy for collection of specimens		36*, 46, 47, 49, 52, 55, 80, 65	
	Competitive diagnosis	Collection of blood cultures for assessment of other agents causing pneumonia or sepsis	59	55, 36*, 43, 78	37*, 50, 51, 54, 70
		Assessment of alternative respiratory infections, depending of local epidemiology	59, 73	35, 36, 43, 65, 78	42, 50, 51, 54, 74
		Does not rule out COVID-19 in patients having positive findings for other pathogens and vice versa	59, 73		74, 51
	Staging/grading severity	Use of chest CT and/or chest X-rays for hospital admission, diagnosis of pneumonia and related complications indicative of severity (such as acute respiratory distress syndrome (ARDS), pulmonary embolism)	64*, †	36*, 43, 44, 55, 57, 60, 61, 63	37*, 50
	Monitoring	Chest CT is recommended as follow-up test in cases of clinical deterioration and to detect complications	64*, †	36*, 60	50, 66
		Limited role of chest X-rays, especially for daily use in stable patients		44, 63, 61	
		Monitoring of hospitalised patients with additional tests, including (but not limited to) vital signs measurement, oxygenation levels, acid-base balance assessment, D-dimer levels and ECG, among others.		43, 46, 55	
Convalescence	De-isolation/discharge	Absence of clinical symptoms in the last 24–72 hours as a criteria for discharging patients from isolation	59, 39, 56	35, 36*, 52, 57	41, 57, 67

Continued

Table 2 Continued

			Global health agencies	Scientific societies	Government institutions
Other	Active/Passive surveillance	The role of serological tests in surveillance studies	40, 73	36*	69, 50

*Document with a score of 50% or more for the 'Rigour of development' domain.
†Index test included in the 'chest imaging' category. Two or more expert panels supported the areas of consensus detailed above. Due to information on COVID-19, virus is rapidly evolving, some of these actions would be modified when new evidence become available.
NAAT, nucleic acid amplification test; RT-PCR, reverse transcription-PCR.

individuals include the RT-PCR assays, rapid antigen tests and SARS-CoV-2 NAAT in general; this advice is supported by four documents, two of them with domain 3/AGREE II tool score ≥50%.[35 44 58 71] Two documents developed by scientific societies do not recommend the use of Chest CT in the routinely screening of these patients[60 62] (table 2).

Recommendations about symptomatic illness: diagnosis

We identified 157 recommendations about ruling in/ruling out COVID-19 provided by 42 documents included in this scoping review. RT-PCR assays was the index test more recommended for the diagnosis of SARS-CoV-2 infection (56 recommendations), supported by three documents with Domain 3/AGREE II tool score ≥50 %, among others.[35 36 44] One document clarifies that a single positive PCR result is proof of infection, and there is no need for a second test in these cases.[73] Twenty-one recommendations about RT-PCR assays addressing technical issues, including the sampling specimen and the positivity criteria (ie, target genes). Seven documents recommend a second RT-PCR assessment when there are high suspicious of infection and initial negative results, two of these documents with domain 3/AGREE II tool score ≥50%.[35 37 44 54 60 72 74] Sampling specimen more recommended involving respiratory tract samples, especially nasopharyngeal samples.[34 35 37 40 41 44 46 49 53 55 56 58 69 70 72–74 77 78]

Fourteen documents recommend against the use of serological tests for the assessment of acute infection,[36 50 53 58 65 67–70 72–74] reserving their role for late cases.[35 61] This recommendation is supported by three documents with domain 3/AGREE II tool score ≥50 %, among others.[35 36 67] Support about the use of chest CT in this setting is unclear, with five documents supporting their use in selected cases, for example, lack of availability of molecular tests,[33 41 47 51 62 65] while other two documents clearly do not recommend their use.[49 54] In addition, eight documents suggest a restricted use of bronchoscopy (two of them with domain 3/AGREE II tool score ≥50 %), for example, for intubated patients.[35 45 46 48 51 54 64 79]

We found a considerable number of recommendations which failed in the reporting of the index test (ie, COVID-19 tests, chest imaging), and then there was no possible their classification in these analyses. Other areas of consensus are shown also in table 2.

Recommendations about symptomatic illness: competitive diagnosis

We identified 31 recommendations about the assessment of competitive diagnosis derived from 17 documents, mainly scientific societies.[34–36 41 42 45 48–50 53 54 58 64 69 72 73 77] Twenty-eight recommendations state the need for exploration of alternative respiratory infections, such as influenza, tuberculosis or bacterial pneumonia, supported by two documents with domain 3/AGREE II tool score ≥50 %, among others.[35 36] Areas of agreement include the collection of blood cultures for assessment of other agents causing respiratory infections,[34–36 42 49 50 53 58 69 77] the assessment of other potential aetiologies depending on local epidemiology, such as *Streptococcus pneumoniae*, *Haemophilus influenzae* and *Mycobacterium tuberculosis*,[34 41 42 49 50 53 58 64 72 73 77] as well as the follow-up of COVID-19 diagnosis even if other infections are confirmed (table 2).[50 58 72 73]

Recommendations about symptomatic illness: staging/grading severity

We identified 36 recommendations about staging/grading the severity of COVID-19 patients provided by 12 documents (three of them with domain-3/AGREE-II tool score ≥50%), most of them produced by scientific societies.[35 36 41–43 49 54 56 59 60 62 63] Twenty-two recommendations addressed the role of imaging tests, including chest CT in the evaluation of disease extent (ie, signs of pulmonary oedema, acute respiratory distress syndrome (ARDS), pleural effusions, need for ventilation)[36 42 49 54 56 59 60 62] and lung X-rays for the identification of lung lesions.[35 36 42 43 62] One document suggest the use of Chest X-rays as an alternative in resource-constrained scenarios, based on information current in April 2020.[43] Three documents, including one developed by a global health agency, recommend the use of chest imaging (unclear tests) in addition to other clinical and laboratory tests (table 2).[35 43 63] One additional document recommend against the request of additional examinations in the absence of vital signs altered or risk factors.[35]

Recommendations about symptomatic illness: monitoring and therapeutic management

We identified 28 recommendations about monitoring/follow-up of patients derived from 12

documents.[35 42 43 45 49 54 59 60 62–65] Chest CT imaging is recommended as a follow-up test by five documents, three of them with Domain-3/AGREE-II Tool score ≥50%.[35 49 59 65] An additional three documents are against the use of daily chest x-ray in stable patients,[43 62] restricting its use to severe cases.[60] One document provides five recommendations about the use of RT-PCR in the virological monitoring of COVID-19 patients.[42] Other index tests involved in the monitoring of patients include vital signs measurement, oxygenation levels, acid-base balance assessment, D-dimer levels and ECG, according to three documents developed by scientific societies.[42 45 54] Areas of agreement supported by two or more documents are shown in table 2.

Recommendations about convalescence: deisolation/discharge

We identified 39 recommendations about de-isolation/discharge from hospitalisation, derived from 18 documents: 4 developed by global/international health agencies,[38 55 58 63] 6 by scientific societies[34 35 42 43 51 70] and the remaining by government agencies.[37 40 41 56 57 66 73 74] Absence of clinical symptoms in the last 24–72 hours (ie, fever and/or respiratory symptoms) are a common issue for most of the documents addressing hospital discharge/deisolation.[34 35 38 40 51 55 56 58 66 70 74] RT-PCR negative results (including double negative results) are recommended by six documents, most of them developed before May 2020,[37 38 40 42 51 55] while four documents, including one developed by a global health agency, stated that this test is not required for all cases.[35 58 73 74] Duration of the quarantine is highly heterogeneous and based on several criteria; most common recommendations for asymptomatic or mild patients ranged from 10[58 74] to 14 days.[35 57 70 73]

Other recommendations

We identified 15 recommendations about other issues, provided by ten documents, most of them developed by global health and government agencies.[35 37 39 44 49 68 71 72 74 78]

Those recommendations addressed the unclear role of antigen-based tests in other scenarios outside diagnosis of symptomatic patients,[39 71 74 78] and the role of serological tests in surveillance studies,[35 39 49 68 72] among others. Full information is provided in online supplemental appendix 4.

DISCUSSION

In this scoping review of recommendations about COVID-19 testing, we identified 47 guidance documents containing 327 recommendations for different stages of the disease, including SARS-Cov-2 detection, assessment of another competitive diagnosis, staging and monitoring of symptomatic cases and deisolation discharge of hospitalised patients. Our review included documents produced by global healthcare organisations (ie, WHO, CDCs), scientific societies and government agencies (such as Ministries of Health) from several countries around the world. Although we included the last version of all documents to warrant the currency of the recommendations, we still found documents developed earlier at the beginning of the pandemic (before March 2020), which could have an impact in the content of the recommendations provided by these groups. The recommendations are current at the time our searches were conducted. Future updates may change the recommendations if new evidence about COVID-19 testing emerges. Despite these limitations, it was possible to map the role of well-known tests such as RT-PCR assays, imaging and serological tests in the comprehensive assessment of COVID-19. We found a predominant role for the NAAT (ie, RT-PCR test) in several stages of the disease. Besides, we identified the role of imaging tests to grade the severity of the disease. As a summary of the numerous recommendations provided by the different developers, we identified areas of consensus for testing actions in different disease stages. These areas included the use of RT-PCR for SARS-Cov-2 detection, the limited role of bronchoscopy, and the use of chest CT and chest x-rays for grading severity, among other recommended actions. Due to information on COVID-19 virus is rapidly evolving, some of these actions would be modified when new evidence become available.

The quality of the development of these documents was assessed by a standardised and well developed tool (AGREE-II tool), which evaluate key elements to warrant the transparency, adequacy and applicability of all recommended actions in the clinical setting. Unfortunately, we found several constraints during the development of these recommendations reflected in the AGREE-II scores. Most of the documents did not report the steps taken to develop either the full document or the recommendations; for those reporting a methodology, only a small fraction (6 out of 14 documents) obtained a score of at least 50% in the AGREE-II/domain 3 ('Rigour of development'), all of them developed after April 2020. Additional key issues addressed by the AGREE-II tool, such as the Editorial independence (to confirm that the formulation of recommendations was not biased with competing interests), also received lowest scores.

This scoping review was based on a comprehensive search and assessment of the literature about COVID-19 testing. Despite that some documents developed their recommendations with unclear methods, we were able to identify several areas of agreement for COVID-19 testing among all included studies; most of these areas are supported by documents whose reported a systematic search of the literature, a fair evaluation of the strengths and limitation of the evidence, and a clear methodology to reach consensus around the recommended actions, according to the AGREE-II tool. We also performed a regular update of searches and updated our findings to reflect the current recommended practice in this field. However, our review has some limitations. We mostly relied on the search of guideline repositories, documents linked to scientific societies and publications in indexed journals to inform this scoping review. We considered that this

strategy would identify documents with greater support given by experts and professional societies. Although we conducted a specific search of guidance developed by experts based on the 30 countries more affected by the pandemic, it is possible that some such guidelines could be missing. Official agencies were probably not prepared to release their advice to governments in a sensitive political atmosphere. In addition, some guidance documents developed by other countries not currently included in our scoping review were excluded, due to they did not provide recommendations for the diagnosis of COVID-19, focus their efforts in recommendations about treatments (see figure 1 for these exclusions).

Our scoping review also is limited to the assessment of adult healthier population, excluding the evaluation of special populations, including people in high-risk of having COVID-19. While a broader scope would have been of greater interest for readers, the multiplicity of sources and the particularities of recommendations are important constraints in order to warrant the comprehensiveness of a systematic review. We decided to be cautious in this issue, and rather prefer to reflect a comprehensive and complete overview of testing recommendations to be applied to the general population.

When we used the AGREE-II tool to assess the quality of all included documents, we did not expect full compliance in all domains, but we did consider that a minimum of key characteristics would be fulfilled in documents providing formal recommendations for testing.[80] Unfortunately, we noted many deficiencies, a feature that was disturbing, given that the severity of the pandemic demanded the highest level of rigour despite the pressure of time. The lack of reporting concerning critical issues like conflict of interest, judgements about evidence quality, and the methods to formulate recommendations, reduce the confidence stakeholders have when implementing the recommended action in daily practice. Development of formal clinical practice guidelines is a time-consuming task but with prioritisation and resource allocation quality need not be compromised. Even if the reason for these shortcomings was the need to provide quick guidance in response to the COVID-19 emergency, readers should be aware that there are quality standards expected in rapid guidelines.[81]

Timely and accurate testing is a key element for the control of COVID-19.[82 83] This, to our knowledge, is the first scoping review focusing on recommendations exclusively for COVID-19 testing, with information current until 21 September 2020. However, as new evidence about COVID-19 testing emerges, the recommended actions would need updating and a living systematic review could offer the best approach for addressing this issue timely.

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