COVID-19 Scientific Advisory Group Rapid Response Report

Key Research Question:

For patients with suspected/confirmed COVID-19 in the community, are there predictive risk tools or tests (e.g., Roth test; oxygen saturation where possible) that can assist in deciding who is at risk of clinical deterioration and should be assessed in the emergency department? (Updated June 15, 2020)

Context

- After further review of the evidence (as of June 5, 2020), one tool, the CRB-65 is being explored for the assessment of community acquired pneumonia in primary care, in conjunction with COVID-19 but has ***not*** been used in a remote assessment setting where care has been delivered virtually during the pandemic.
- Anecdotally, there remains reports of primary care providers using non-validated tools (i.e., Roth Score, heart rate apps) to assess patients through virtual care (e.g., telephone assessments) for evidence of clinical deterioration (e.g., hypoxia, shortness of breath, increased heart rate) despite mixed evidence.
- As the evidence base around COVID-19 grows, robust and reliable predictive tools to stratify risk for the development of severe COVID-19 illness are deemed critical.
- The review was not limited to any specific populations, but would likely be most applicable to ambulatory adult populations with suspected or confirmed COVID-19.

Key Messages from the Evidence Summary

- In patients with suspected or confirmed COVID-19, the presence of dyspnea (i.e., shortness of breath) appears to be the most common and prevalent symptom for assessing potential decompensation in mild-to-moderate cases in primary care settings. Decompensating patients with increasing dyspnea need to be assessed for a rapid decrease in oxygen saturation and should present to the emergency department.
- There are also reports of COVID patients being significantly hypoxic in the absence of symptoms of dyspnea or signs of respiratory distress. Checking SpO2 will be important as a component of the patients' assessment.
- One tool, the CRB-65[1] has been explored and used for the assessment of community acquired pneumonia in primary care (with some caveats), but has ***not*** been used in remote assessment setting where care has been delivered virtually during the pandemic and has not been validated for COVID-19 pneumonitis. While the preliminary results are promising, these clinical prediction rules have yet to be thoroughly validated results and may be used for the assessment of patients with suspected COVID-19, but with some caution.
- There remains minimal existing evidence to support the use of non-validated tests such as the Roth Score. Emerging literature suggests the Roth Score is not sufficient to accurately identify a patient with hypoxia, especially when conducted in a virtual setting.

[1] The CRB-65 is a modified version of the CURB-65 tool for assessing severity of community-acquired pneumonia, with the main difference being the lack of urea measurement in the CRB-65 assessment.

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- Self-monitoring devices that measure heart-rate, respiratory rate and oxygen saturation in patients with symptoms suggestive of COVID infection (e.g., using Smartphone apps) are not recommended for use without appropriate clinical monitoring. Published studies are potentially biased due to small sample sizes and improper interpretation of the majority of statistical findings.
- Recommendations to guide which patients should be assessed in the emergency department will be largely based on clinical judgement of the primary care provider and knowledge of patient's baseline status, age, social situation and comorbidities (e.g., heart disease, COPD, immunocompromised status) which place patients at higher risk for complications.
- As COVID-19 evolves, the accumulation of relevant clinical and other health information (i.e., administrative data, electronic health records) will likely lead to the development of robust risk prediction models, resulting in increased success of assessment strategies and tools to help support clinicians in predicting which patients may be at higher risk of deteriorating and thus admittance to ED.

Committee Discussion

There was consensus with the key findings and recommendations. There was agreement that there were no validated tools to predict hypoxia – or impending clinical deterioration – but that if patients were becoming more dyspneic, they should be sent for assessment (generally the emergency department) where oxygen saturation measurement could be performed. Clinical judgement, including an understanding of the patient's baseline status, including their age and comorbidities were emphasized as critical, understanding that the risk of hospitalization is higher in older patients and those with comorbidities. Structured questions, as noted within this report, including a focus on change in symptoms, were felt to have a role in the clinical assessment. All agreed that the Roth score should not be used on its own, given that is it not validated, can misclassify patients, and its measurement is often misunderstood. However, in the absence of validated tools, its use could be considered as one component within a broader clinical evaluation of dyspnea that includes consideration of trajectory of symptoms and patient characteristics such as age and comorbid conditions.

Pragmatic Considerations

There are no validated predictive risk tools or tests to identify COVID 19 patients at risk of clinical deterioration. Therefore, based on this lack of validated tools, the following pragmatic considerations are proposed:

1. Given that patients with suspected or confirmed COVID-19 can present with a multitude of symptoms (e.g., fever, cough, shortness of breath), assessing clinical deterioration in mild to moderate disease can be challenging in a primary care environment where virtual assessments are increasingly being used. Increasing dyspnea (i.e., shortness of breath) appears to be the most common indicator of potential decompensation in mild-to-moderate cases, but is likely neither sensitive nor specific to identify COVID-19. Primary care providers should consider facilitating in person assessment of patients including a measurement of oxygen saturation and other vital signs through outreach if available, or sending patients with worsening dyspnea to the emergency department or urgent assessment clinics where oxygen saturation and other vital signs can be measured.
2. The use of repeated clinical assessment (virtual or in person) including structured questions, and review of critical information contained within available electronic medical records (EMR) such as patient history and problem lists, appears the most feasible and effective way to assess

suspected or confirmed COVID-19 patients for clinical deterioration. The symptoms should be clearly documented, allowing an assessment of change over time.

3. The Roth Score is not validated amongst COVID-19 patients and there is mixed evidence around whether it should be used for virtual assessment in primary care or community settings. However, in the absence of objective measurement (i.e., if the patient is being assessed over the phone or via video monitor) use of the Roth Score could be considered as one component within a broader clinical evaluation of dyspnea that includes consideration of trajectory of symptoms and patient characteristics such as age and comorbid conditions. If the Roth Score is used it must be combined with other forms of clinical evaluation, given no validated tools exist to predict hypoxia.

Research Gaps

Following an updated review of the evidence (as of June 5, 2020) and as COVID-19 evolves, the accumulation of relevant clinical and other health information (i.e., administrative data, electronic health records) will likely lead to the development of a robust risk prediction model, resulting in increased success of assessment strategies and tools to help support clinicians in predicting which patients may be at higher risk of deteriorating and thus admittance to ED. It is recommended updated reviews on this topic should be carried out frequently to assess new and emerging models and tools which may be useful to examine the question of interest.

Existing clinical scores have not been validated in COVID-19 patients, so any locally developed structured assessments should be optimally structured in such a way that data can be gathered to inform future assessments.

The Roth score, if used as part of the clinical assessment and in person assessment, should employ the standardized protocol and when possible be recorded with other information (including oxygen saturation) to allow preliminary assessment of its performance in identifying patients who require in hospital support.

Summary of Evidence

There remains a wide variety of widely available resources (guidelines, clinical pathways) which document risk markers that can be used to assess clinical deterioration (i.e., from mild to moderate to severe) in community settings (Beeching 2020; NHS 2020; National COVID-19 Clinical Evidence Taskforce 2020)*.* Studies have found dyspnea (also termed shortness of breath) was more prevalent in severe cases and indeed, in some studies, dyspnea was a marker of severe disease (Greenhalgh 2020; Heneghan 2020; Michelen 2020). When considering what differentiates those who progress from moderate to severe COVID-19, the presence of dyspnea in severe COVID-19 was 44.2% compared to those with non-severe COVID-19 (5.7%) (Greenhalgh 2020). It remains a reasonable focus for potential decompensation in mild-to-moderate cases but needs to be combined with other clinical assessment. There are multiple anecdotal reports of patients being significantly hypoxemic in the absence of symptoms of dyspnea or signs of respiratory distress - the so called "Happy Hypoxemic". This may result from any lung disease which causes a limited amount of shunt, while preserving the remainder of the lung (e.g., lobar consolidation or atelectasis).

For those with mild illness, hospitalization is not required unless there is concern about rapid deterioration. Patients with mild COVID-19 should be counselled about the signs and symptoms of worsening disease. If they develop symptoms like difficulty breathing, pain or pressure in the chest, confusion, drowsiness, or weakness, they should seek follow-up care (Tamblyn et al 2020). Presently there is no statistically significant nor clear clinical differentiation between mild and moderate COVID-19

(Greenhalgh 2020). Mild or moderate cases were generally defined based on less severe clinical symptoms (i.e., low grade fever, cough, discomfort) with no evidence of pneumonia and not requiring admission to ICU (Michelen 2020). Unfortunately much of this literature, due to the rapidly evolving nature of COVID-19 is not peer-reviewed and is based on clinical judgement and experiences from front-line health care workers.

COVID-19 is changing the face of health care delivery. Primary care and community providers are increasingly turning to virtual care (i.e., telephone and video) options to care for both suspected and confirmed COVID-19 patients. The vast majority of tools being utilized to assess clinical deterioration in these patient groups involve clinical judgement and decision-support tools (i.e., structured questions, decision trees/algorithms) (AHS 2020, Beeching 2020; NHS 2020; National COVID-19 Clinical Evidence Taskforce 2020). As highlighted above, a symptom that may predict probable clinical deterioration in patients is dyspnea, which may be correlated with hypoxia. However given that resources to measure oxygen saturation (i.e., saturation monitor) in the community vary widely and in most cases are very limited, there are reports around the use of alternate tests such as the Roth Score (Greenhalgh, 2020) for assessment of acute breathlessness.

The Roth Score is a tool for quantifying the level of breathlessness, which has been proposed to correlate to the level of hypoxia. It combines maximal count reached (starting from 1 to 30 in one's native language) during a single exhalation and the time taken to reach the maximum count (the second score is called the "counting time") (Greenhalgh 2020). Under the conditions in which it was validated (in non-COVID patients with relatively high SpO_2 readings >92%), the Roth Score will wrongly classify one hypoxic patient in five as normal**.** In addition, the Roth score is frequently abnormal in patients who are not hypoxic (Greenhalgh 2020). Greenhalgh et al speculate, in the context of a COVID pandemic, this may lead to such patients being sent to a hospital unnecessarily, thereby exposing them to the risk of contagion. The Roth score has not been validated in patients with COVID-19 and is not sufficient to accurately classify people as hypoxic or not on the basis of an 8-second counting test (Greenhalgh 2020). The evidence indicates the use of this test virtually to assess clinical deterioration in suspected or confirmed COVID-19 patients, should be considered with caution and in conjunction with a full clinical assessment utilizing the electronic medical record (EMR) to its full capacity (i.e., patient history, problem lists). Based on an updated review of the evidence (as of June 5, 2020), there remains no updated information related to the Roth score, thus recommendations from the initial review remain.

In the initial review, it was noted one of the main challenges of the aforementioned tests is that they have not been validated for use outside of acute care. Results now suggest one tool, the CRB-65 (for Pneumonia) has been explored and used within primary care but has not been used in remote assessment setting where care has been delivered virtually during the COVID-19 pandemic (McNally et al 2010). The CRB-65 score is a clinical prediction rule that grades the severity of community-acquired pneumonia in terms of 30-day mortality. In a systematic review of its efficacy in community settings, the authors concluded that the CRB-65 performs well across all risk groups (low, intermediate, high) in the acute care settings; there was a slight tendency to overpredict mortality across all risk groups when it is used in the community setting , and while the preliminary results are promising, these clinical prediction rules have yet to be thoroughly validated, and therefore their use in clinical practice is more uncertain relative to acute care, so some caution should be undertaken in this context (for more information: https://www.cebm.net/covid-19/rapid-diagnosis-of-community-acquired-pneumonia-for-clinicians/)

There is also mixed and limited evidence on the use of self-monitoring devices that purport to measure vital signs such as heart-rate, respiratory rate and oxygen saturation in patients with symptoms suggestive of COVID infection (Whiting, 2020). We identified one systematic review of 14 studies (n=381) (De Ridder et al 2018) and three additional studies (n=108, 101 and 30) (Tayfur and Afacan 2019; Coppetti et al 2017; Chan et al 2019) of heart rate monitoring using smartphone apps. However, a recent review of these studies by the Oxford rapid evidence synthesis suggested that "it is not physically possible to measure SpO2 using current smartphone technology" (Whiting 2020) these articles were excluded from this review given that heart rate alone is not an indicator of oxygenation status. The scientific basis for the use of smartphone apps for this purpose is questionable and we would not recommend their use for measuring oxygen saturation. Furthermore, these findings should be interpreted with caution due to the very small number of studies available.

As an alternative, Greenhalgh (2020) reports a rapid survey of 50 clinicians who regularly assess COVID-19 patients by telephone in which the following 4 questions were endorsed as useful for assessment:

1. Ask the patient to describe the problem with their breathing in their own words, and assess the ease and comfort of their speech. Ask open-ended questions and listen to whether the patient can complete their sentences.
   "How is your breathing today?"

2. Align with NHS111 symptom checker, which asks three questions (developed through user testing but not evaluated in formal research):
   "Are you so breathless that you are unable to speak more than a few words?"
   "Are you breathing harder or faster than usual when doing nothing at all?"
   "Are you so ill that you've stopped doing all of your usual daily activities?"

3. Focus on change. A clear story of deterioration is more important than whether the patient currently feels short of breath. Ask questions like
   "Is your breathing faster, slower or the same as normal?"
   "What could you do yesterday that you can't do today?"
   "What makes you breathless now that didn't make you breathless yesterday?"

4. Interpret the breathlessness in the context of the wider history and physical signs. For example, a new, audible wheeze and a verbal report of blueness of the lips in a breathless patient are concerning.

Judson et al (2020) report on a patient self-triage tool integrated into an electronic health record system. The authors created a patient portal-based COVID-19 self-triage and self-scheduling tool (using a series of branched logic reasoning in relation to a symptom checker) and made it available to all primary care patients at a large academic health system in the United States. This self-triage and self-scheduling tool was designed and implemented in under two weeks. During the first 16 days of use, it was completed 1129 times by 950 unique patients. Of completed sessions, 315 (28%) were by asymptomatic patients, and 814 (72%) were by symptomatic patients. Symptomatic patient triage dispositions were as follows: 193 emergent (24%), 193 urgent (24%), 99 non-urgent (12%), 329 self-care (40%). Sensitivity for detecting emergency-level care was 87.5% (95% CI 61.7-98.5%). After patients' self-triage, they were connected with the appropriate level of care via direct scheduling or telephone hotline.

The tool was designed to “do no harm”: to have high sensitivity to detect emergency-level illness, and high specificity when recommending self-care, both of which were greater than 85%. Despite designing the tool with this conservative approach, the most frequent triage disposition was self-care. The majority of these patients did not make further contact with our health system during the subsequent weeks following the assessment. This tool may have therefore prevented unnecessary encounters, though it is unclear how many patients may have been harmed if the tool falsely predicted that self-care was sufficient. Eliminating unnecessary in-person visits has the potential to prevent patient exposure to pathogens en route to clinic visits and in waiting rooms, reduce personal protective use by clinic staff and liberate front-line staff to care for sicker patients. This type of self-triage tool has the potential to facilitate patient triage and preventing unnecessary visits during the COVID-19 pandemic. However, robust validation studies are required, that follow patients to complete resolution or at minimum clear improvement. Further, a sensitivity of 85% for severe cases is likely to be considered low, given the potential for adverse outcomes, including death.

Health jurisdictions around the world have noted the development of prediction based models to stratify risk for the development of severe COVID-19 illness would be a critical tool for all providers (Dagan et al 2020). Since initial review (April 2020), a significant amount of data around the world has accumulated on the outcome of COVID-19 patients, including an ever growing list of risk factors for severe disease and mortality. However, while being straightforward and simple to use, such an extensive list of singular criteria tends to be too inclusive, classifying a large proportion of the population as high-risk individuals (Dagan et al 2020). There have been a number of published/pre-published literature in late April/May 2020 that have explored potential relationships among various patient variables (i.e., demographic variables, clinical signs, laboratory and imaging data) in order to develop a valid and reliable model that will predict when patients are potentially at risk for complications.

Wynants et al (2020) conducted a systematic review of these prediction models for COVID-19 and only found three studies that were designed to predict hospital admission due to pneumonia as a proxy for COVID-19, and ten other prognostic models that were created to predict the need for hospital admission, and the development of severe disease or death in COVID-19 patients. However, most of these models are of limited quality with the authors describing them as "poorly reported, at high risk of bias, and their reported performance is probably optimistic". Results from these studies indicate a patient’s age and their comorbidities remain major risk factors for developing a complication after COVID-19 exposure. However, age and comorbidities are not enough to make precise predictions about who is high-risk for poor outcomes nor are they enough to develop a tool for community providers.

Presently most of the published and “pre-published” literature around COVID-19 has relied on data coming out of the hardest hit regions (China, Italy, Spain, New York City, England) suggesting the following common characteristics that are consistently identified in the ‘severe-to-critical’ cohort (e.g. males >70 years of age, with one or more comorbidities). However, that data also suggests some underlying conditions which appear to be vulnerable in one health jurisdiction may *not* necessarily be the same “at risk” cohort in another regions. As such, a number of publications have noted the need to pursue their own risk stratification tools as the Centre for Disease Control’s criteria has been described as overly-inclusive, identifying nearly 50% of certain populations (e.g., Dagan et al 2020 notes this would encompass 41% of Israel’s population). This will require different research groups and disciplines to collectively use electronic health records and other administrative data sources to create more consistent, transparent and validated definitions for underlying conditions vulnerable to COVID-19

syndrome (Banerjee et al 2020). As COVID-19 evolves, the accumulation of robust complete and comprehensive clinical data such as administrative data sources and other health information will likely lead to the development of a risk prediction model, resulting in increased success of assessment strategies and tools to help support clinicians in predicting which patients may be at higher risk of deteriorating and thus require admittance to ED.

Evidence from existing policies and guidelines

The NHS in England has released a primary care and community response (NHS London 2020) resource pack for use during COVID-19 which approximates guidelines and outlines a detailed clinical pathway to help health teams in categorizing patients with COVID-19 symptoms in the community. There are specific recommendations for remote assessment/telephone triage of suspected COVID-19 patients which stratifies each clinical presentation into mild, moderate and severe symptoms. Screening the patient begins with the question of basic symptoms of COVID-19 (Fever >37.8? New or continuous cough?) The secondary questions tackle the severity of the illness, including:

- “How is your breathing today?”
- “Do you have an oximeter at home or have you noticed any blue discolouration of your lips?”
- “Are you so breathless that you are unable to speak more than a few words? “
- “Are you more breathless than usual on walking or climbing stairs?
- “Do you feel dizzy, faint or have a headache?”
- “When was the last time you went to the toilet and passed urine?”
- Ask about other symptoms of severity e.g. collapse, chest pain, signs of sepsis, confusion?

This resource also includes additional information of how to prioritize patients who may be at increased risk of severe illness with COVID-19 or at risk of rapid clinical deterioration. The following list of conditions should be considered when triaging patients including:

- aged 70 or older (regardless of medical conditions)
- individuals who have been previously hospitalized
- under 70 with an underlying health condition
    - chronic (long-term) respiratory diseases, such as asthma, chronic obstructive pulmonary disease (COPD), emphysema or bronchitis
    - chronic heart disease, such as heart failure
    - chronic kidney disease
    - chronic liver disease, such as hepatitis
    - chronic neurological conditions, such as Parkinson’s disease, motor neuron disease, multiple sclerosis (MS) or cerebral palsy
    - diabetes
    - problems with your spleen – for example, sickle cell disease or if you have had your spleen removed
    - morbid obesity
    - those who may be immunocompromised (e.g., patient with cancer undergoing chemotherapy)

Similarly, Alberta Health Services (AHS), Calgary and area Primary Care Networks and a team that included specialists from Respirology, General Internal Medicine and Infectious Disease, AHS Provincial Primary Health Care program, and members of the Calgary Zone Specialist LINK task group developed this pathway to help support family physicians to care for their patients with presumed or

confirmed COVID-19 (AHS COVID-19 Primary Care Pathway 2020). This group notes that rapid deterioration is most common during week 2 from symptom onset and provides specification (see the pathway link in references) to help providers stratify patients into different risk categories (high risk, average risk, lower risk). A breathing assessment questionnaire similar to those listed in this report is also provided.

Evolving Evidence (if applicable)

- New evidence is emerging on this topic rapidly.
- It is recommended updated reviews on this topic should be carried out frequently (every 5-6 months) to assess new and emerging risk prediction models and assessment tools which may be useful to examine the question of interest.

Date question received by advisory group: April 13, 2020

Date report submitted to committee: April 16, 2020

Date of first assessment: April 20, 2020

(If applicable) Date of re-assessment: June 15, 2020

Authorship & Committee Members

This review was written by Ceara Cunningham and Charles Cook and scientifically reviewed by Brandie Walker, Lee Green (external reviewer), Linda Slocombe (external reviewer), Kerry McBrien (external reviewer), Brian Holroyd (external reviewer) and Shawna Pandya (external reviewer). The full Scientific Advisory Group was involved in discussion and revision of the document: Lynora Saxinger (co-chair), Braden Manns (co-chair), John Conly, Alexander Doroshenko, Shelley Duggan, Nelson Lee, Elizabeth MacKay, Andrew McRae, Jeremy Slobodan, James Talbot, and Nathan Zelyas.

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Appendix

List of Abbreviations

AHS- Alberta Health Services

COPD- Chronic Obstructive Pulmonary Disease

ED- Emergency Department

EMR- Electronic Medical Record

ICU- Intensive Care Unit

MS- Multiple Sclerosis

NEWS2 – National Early Warning Scale 2

Literature Search Details

The literature search was conducted by Xurong (Rachel) Zhao from the AHS Knowledge Resource Service. Database and Search Engines: OVID MEDLINE, LitCovid, PubMed, TRIP PRO, WHO Global research on coronavirus (database), BMJ Best practice, Centre for Evidence Based Medicine (CEBM), Cambridge Coronavirus Free Access Collection, Cochrane, medRxiv, Google and Google Scholar. The citation tracking method was also applied in Google Scholar.

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) 1946 to April 13, 2020 # Searches Results

#	Searches	Results
1	exp Coronavirus/ or exp Coronavirus Infections/ or coronaviru*.mp. or "corona virus*".mp. or ncov*.mp. or n-cov*.mp. or COVID-19.mp. or COVID19.mp. or COVID-2019.mp. or COVID2019.mp. or SARS-COV-2.mp. or SARSCOV-2.mp. or SARSCOV2.mp. or SARSCOV19.mp. or Sars-Cov-19.mp. or SarsCov-19.mp. or SARSCOV2019.mp. or Sars-Cov-2019.mp. or SarsCov-2019.mp. or "severe acute respiratory syndrome cov 2".mp. or "2019 ncov".mp. or "2019ncov".mp.	22650
2	primary health care/	76280
3	Remote Consultation/	4694
4	Telemedicine/	21779
5	General Practice/ or Family Practice/	74651
6	General Practitioners/	7692
7	(primary care or primary health care or primary healthcare or remote consultation* or teleconsultation* or general practi* or family doctor* or family physician* or mobile health or telemedicine or telehealth or ehealth or mhealth or phon* or virtual* or e-visit*).kf,tw.	431360

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8	or/2-7	493632
9	1 and 8	265
10	limit 9 to (english language and yr="2020 -Current")	125

LitCovid

“primary care” or “primary health care” or “primary healthcare” or “remote consultation” or teleconsultation or “general practice” or “general practitioner” or “family doctor” or “family

Knowledge Resource Service

“physician” or “mobile health” or telemedicine or telehealth or ehealth or mhealth or “virtual care”

TRIP PRO / Google / Google Scholar

(“primary care” or “primary health care” or “primary healthcare” or “remote consultation” or teleconsultation or “general practice” or “general practitioner” or “family doctor” or “family physician” or “mobile health” or telemedicine or telehealth or ehealth or mhealth or “virtual care”) AND (coronaviru* OR "corona virus" OR ncov* OR n-cov* OR COVID-19 OR COVID19 OR COVID-2019 OR COVID2019 OR SARS-COV-2 OR SARSCOV-2 OR SARSCOV2 OR SARSCOV19 OR SARS-COV-19 OR SARSCOV-19 OR SARSCOV2019 OR SARS-COV-2019 OR SARSCOV-2019 OR "severe acute respiratory syndrome cov 2" OR "severe acute respiratory syndrome coronavirus*" OR "2019 ncov" OR 2019ncov OR Hcov*) from:2020

PubMed

Search: (primary health care[MeSH Terms] or emote Consultation[MeSH Terms] or Telemedicine[MeSH Terms] or General Practice[MeSH Terms] or Family Practice[MeSH Terms] or General Practitioners[MeSH Terms] or primary care[Title/Abstract] or primary health care[Title/Abstract] or primary healthcare[Title/Abstract] or remote consultation*[Title/Abstract] or teleconsultation*[Title/Abstract] or general practi*[Title/Abstract] or family doctor*[Title/Abstract] or family physician*[Title/Abstract] or mobile health[Title/Abstract] or telemedicine[Title/Abstract] or telehealth[Title/Abstract] or ehealth[Title/Abstract] or mhealth[Title/Abstract] or phon*[Title/Abstract] or virtual*[Title/Abstract] or evisit*[Title/Abstract]) AND (((wuhan[tw] AND (coronavirus[tw] OR corona virus[tw])) OR coronavirus*[ti] OR COVID*[tw] OR nCov[tw] OR 2019 ncov[tw] OR novel coronavirus[tw] OR novel corona virus[tw] OR covid-19[tw] OR SARS-COV-2[tw] OR Severe Acute Respiratory Syndrome Coronavirus 2[tw] OR coronavirus disease 2019[tw] OR corona virus disease 2019[tw] OR new coronavirus[tw] OR new corona virus[tw] OR new coronaviruses[all] OR novel coronaviruses[all] OR "Severe Acute Respiratory Syndrome Coronavirus 2"[nm] OR 2019 ncov[tw] OR nCov 2019[tw] OR SARS Coronavirus 2[all]) AND (2019/12[dp]:2020[dp])) Filters: in the last 1 year

Table 1. Inclusion and exclusion criteria for results of the literature search

Inclusion Criteria	Exclusion Criteria
- Guidelines and credible academic writing on primary care and community management on triaging patients for presentation to emergency department COVID-19 patients. - Systematic reviews of risk prediction tools examining Covid-19 clinical characteristics and outcomes. - Individual studies reporting on application of risk stratification tools to Covid-19 or similar patient groups.	- News pieces. - Cast studies or series. - Animal studies. - Studies focused on triaging COVID-19 patients in hospital settings or focused responses/pathways for specialist groups. - Studies focused on highly specialized populations who are seen by specialists groups (e.g. patients with cancer diagnoses, populations with high HIV rates, children, pregnant persons).

Figure 1: PRISMA Diagram

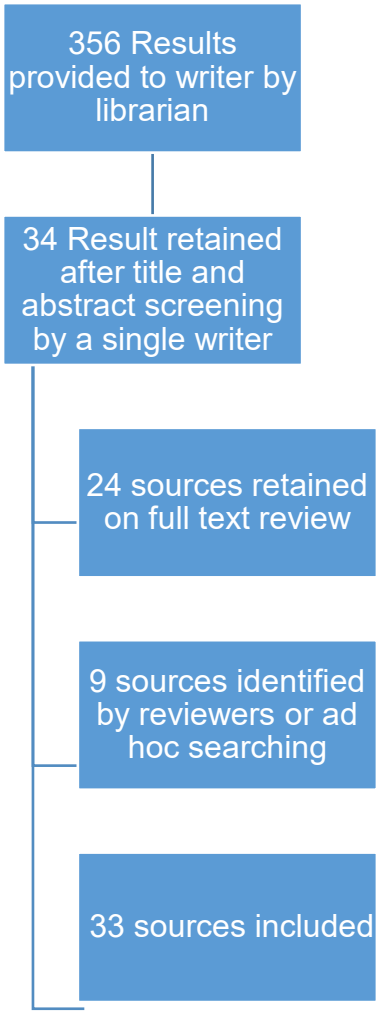

Table 2. Summary of quality assessment results for articles included in this review

	Reference	Quality Appraisal Criteria
1.	Alberta Health Services, 2020	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: BMJ Best Practice ☒ Other: Rapid Review 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
2.	Alberta Health Services, 2020	☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☒ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☐ Other: Review 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☐ Yes | ☒ No (discard)
3.	Banerjee et al, 2020	1) ☒ Peer-reviewed: <Observational> ☐ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: NHS England and NHS Improvement ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
4.	Beeching, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☒ Guideline: BMJ Best Practice ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
5.	BMJ, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint

		☐ Guideline: ☒ Other: Guideline (graphic) 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
6.	Centre for Evidence Practice, 2020	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: ☒ Other: Guidelines/Protocols 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
7.	Chan et al 2019	1) ☒ Peer-reviewed: <specify study type> ☐ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: ☒ Other: Guidelines/Protocols 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
8.	Dagan et al, 2020	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☒ Letter, commentary, editorial, preprint ☐ Guideline: NHS England and NHS Improvement ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
9.	England, N.H.S., 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☒ Guideline: NHS England and NHS Improvement ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)

10.	Canadian Cardiovascular Society, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☒ Guideline: Canadian Cardiovascular Society ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
11.	Greenhalgh, 2020	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☒ Other: Review- Are there any evidenced based ways of assessing dyspnea (breathlessness) by telephone or video? (CEBM) 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
12.	Greenhalgh, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☒ Other: Review- NEWS (orNEWS2) score when assessing possible COVID-19 patients in primary care? 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
13.	Greenhalgh, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☒ Other: Review- Should the Roth score be used in the remote assessment of patients with possible COVID-19? (CEBM) 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)

14.	Health Protection Scotland, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☒ Guideline: National Services Scotland/Public Health Scotland ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
15.	Heneghan, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☒ Other: Review- COVID-19: Differentiating viral from bacterial pneumonia (CEBM) 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
16.	Heneghan, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☒ Other: Review-COVID-19: Rapidly managing pneumonia in older people during a pandemic (CEBM) 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
17.	Judson, 2020.	1) ☒ Peer-reviewed: Descriptive ☐ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
18.	Michelen, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed

		☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☒ Other: Review (CEBM) 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
19.	Ministry of Health Ontario, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☒ Guideline: Ministry of Health Ontario ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
20.	National COVID-19 Clinical Evidence Taskforce, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☒ Guideline: National COVID-19 Clinical Evidence Task Force (Australia) ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
21.	National Institute for Health and Care Excellence, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: COVID-19 rapid guideline: Managing suspected or confirmed pneumonia in adults in the community. National Institute for Health Care and Excellence (UK) ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
22.	National Institute for Health and Care	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint

	Excellence, 2020.	☒ Guideline: COVID-19 rapid guideline: Managing symptoms (including at the end of life) in the community. National Institute for Health Care and Excellence (UK) ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
23.	Nunan et al, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☒ Other: Rapid review (CEBM) 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
24.	Oxford Centre for Evidence-Based Medicine	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☒ Other: Rapid review (CEBM) 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
25.	Razai, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☒ Guideline: BMJ ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
26.	Tamblyn, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☒ Guideline: Government of Canada ☐ Other: <specify> 2a) Are there clear research questions or a clearly identified issue?

		☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
27.	Tarassenko, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☒ Other: Review (CEBM) 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
28.	Tayfur & Afacan, 2019	1) ☒ Peer-reviewed: <specify study type> ☐ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☐ Other: Review (National Institute for Health Research/University of Bristol) 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
29.	Whiting, 2020.	1) ☐ Peer-reviewed: <specify study type> ☒ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☒ Other: Review (National Institute for Health Research/University of Bristol) 2a) Are there clear research questions or a clearly identified issue? ☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
30.	Wynants et al, 2020	☐ Peer-reviewed: <specify study type> ☐ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☒ Other: Predictive modeling using secondary data sources 2a) Are there clear research questions or a clearly identified issue?

		☒ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
31.	Copetti et al, 2017	☒ Peer-reviewed: <Observational> ☐ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☐ Other: Predictive modeling using secondary data sources 2a) Are there clear research questions or a clearly identified issue? ☐ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
32.	De Ridder et al, 2018	☒ Peer-reviewed: <Observational> ☐ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☐ Other: Predictive modeling using secondary data sources 2a) Are there clear research questions or a clearly identified issue? ☐ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)
33.	McNally et al, 2010	☒ Peer-reviewed: <Systematic Review> ☐ Not peer-reviewed ☐ Letter, commentary, editorial, preprint ☐ Guideline: <Specify source > (AHS, PHAC, WHO, Reputable research group, other) ☐ Other: Predictive modeling using secondary data sources 2a) Are there clear research questions or a clearly identified issue? ☐ Yes | ☐ No (discard) 2b) Is the collected data or presented evidence (incl. expert opinion) appropriate to address the research questions or issue? ☒ Yes | ☐ No (discard)

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