

COVID-19 Scientific Advisory Group Rapid Response Report

Key Research Questions:

1. For patients with suspected or confirmed COVID-19 who are assessed in the emergency department, are there clinical features that reliably indicate need for admission or safety for discharge?

1a. Is there a risk prediction tool, or if not, what is the strongest predictors of the need for admission?

1b. When and what laboratory and imaging investigations are indicated?

1c. Is there a role for an observation period for probable or confirmed COVID-19 patients who have mild hypoxia or require minimal (<2 LPM) oxygen?

Context

- The question and sub-questions come from emergency clinicians and related to the work of the Emergency Strategic Clinical Network to create patient risk stratification guidelines and management information. The questions were reformulated for clarity.
- Anecdotally “walk tests” for oxygen saturation are being used internationally in emergency departments for prognosis of COVID-19 patients.
- NEWS2, CURB-65 and Brescia Scales have been proposed for use as risk prediction tools in Alberta.
- The review is limited to adult, non-pregnant patients with confirmed/suspected COVID-19

Key Messages from the Evidence Summary

- No single laboratory investigation or imaging modality has independent prognostic value for COVID-19 disease. Chest radiographs and CT scans are discussed in the literature for prognosis of seriously ill COVID-19 patients, but lack sufficient specificity and sensitivity for screening. For otherwise healthy patients who are clinically stable, specific investigations may not be indicated in the ED.
- No risk stratification tools to guide admission decisions are validated for COVID-19. Published novel prognostic models and clinical pathways for COVID-19 outcomes are at high risk of bias and may not be generalizable outside their population of origin.
- Admission decisions for COVID-19 patients will largely be driven by the need for supplemental oxygen. Medical comorbidities and advanced age are risk factors for higher severity of illness

requiring hospital admission, or progression to mortality. These, and situational factors such as housing stability and available supports, should be considered in admission decisions.

- No literature on the utility of observation periods, or their optimal duration was identified.

Committee Discussion

The committee reached consensus on the key messages and recommendations, specifically for the lack of current validated risk prediction tools for admission / emergency department discharge criteria. Admission decisions will be driven largely by the need for supplemental oxygen or factors that may put a patient with mild disease at risk for sudden deterioration out of hospital. The committee was in general agreement that no specific investigations are indicated for patients with mild disease. There are no laboratory or imaging findings that—by themselves—are reliable indicators for the need for admission.

Recommendations

1. No investigations are absolutely necessary or indicated for COVID-19 ED patients who are otherwise clinically well, unless required to exclude an alternative diagnosis.
2. While some laboratory or imaging findings are associated with poor outcomes, no single investigation or risk prediction tool should drive admission/discharge decisions.
3. In the absence of validated tools to identify patients requiring admission to hospital, patients who are not hypoxemic or exhibiting signs or symptoms of severe dyspnea, hemodynamic instability or cognitive impairment are likely suitable for discharge from the ED. Factors such as advanced age, frailty, cardiopulmonary or renal comorbidities, or lack of social supports/a stable home environment may be considered in admission/discharge decisions. Patients who are discharged home should be instructed to follow up with their primary care provider (virtually as feasible) to monitor for symptom progression, and should return to the ED should they experience new/worsened systemic or respiratory symptoms.
4. In the absence of existing evidence, it is reasonable to consider a short period of observation prior to admission/discharge decision, for ED patients with suspected COVID disease whose clinical stability is uncertain. The benefit to reasonably rapid definitive disposition to home or a defined care setting however is acknowledged so this period should not be prolonged.

Summary of Evidence

Question 1

No literature directly addressed clinical features indicating safety for discharge. Instead, studies commonly described features associated with poor outcomes. Studies proposing outcomes prediction models were systematically reviewed by Wynants et al. (2020) and all found to be at high risk of bias. Wynants et al. note that much recently published COVID-19 characteristics and outcomes research is limited because controls are not similar to the general population, and studies commonly treat patients as if they will not progress to certain outcomes (e.g. ICU admission, death) when it is only fair to say that these patients do not have these outcomes during the study period.

Factors that published models use to predict hospital admission include “age, sex, previous hospital admissions, comorbidity data, and social determinants of health” (Wynants 2020). “Predictors included in more than one prognostic model were age (n=5), sex (n=2), features derived from CT scoring (n=5),

C reactive protein (n=3), lactic dehydrogenase (n=3), and lymphocyte count (n=2...)” (Wynants 2020). One study of mortality probability that took steps to test calibration and reported a c index was found by Wynants et al. to produce “probabilities of mortality that were too high for low risk patients and too low for high risk patients” when applied prospectively.

With the limitations of COVID-19 research in mind, comorbidities appear to be related to hospitalization and mortality. A large retrospective study of “1,590 laboratory-confirmed hospitalized patients [in] 575 hospitals” has found “COPD [hazards ratio (HR) 2.681, 95% confidence interval (95%CI) 1.424-5.048], diabetes (HR 1.59, 95%CI 1.03-2.45), hypertension (HR 1.58, 95%CI 1.07-2.32) and malignancy (HR 3.50, 95%CI 1.60-7.64)” to be associated with invasive ventilation, hospital admission and death. “The HR was 1.79 (95%CI 1.16-2.77) among patients with at least one comorbidity and 2.59 (95%CI 1.61-4.17) among patients with two or more comorbidities.” (Guan 2020). A meta-analysis of 46,248 Covid-19 patients has found that in “severe patients,” as categorized in included studies, “Compared with the Non-severe patient, the pooled odds ratio of hypertension, respiratory system disease, cardiovascular disease in severe patients were (OR 2.36, 95% CI: 1.46-3.83), (OR 2.46, 95% CI: 1.76-3.44) and (OR 3.42, 95% CI: 1.88-6.22) respectively” (Yang 2020).

A retrospective study comparing recovered hospitalized patients to those who died after hospitalization examined oxygen saturation and found “The blood oxygen saturation was significantly lower in the death group (85 [77, 91]% vs. 97 [95, 98]%, $Z=10.625$, $P<0.001$)” (Deng 2020).

One reviewer noted that studies of COVID-19 clinical characteristics often rely on univariate associations, which would be confounded by age. Another pointed out that if other jurisdictions have lower thresholds for admission, then the data on characteristics associated with admission will be of limited applicability to Alberta.

Question 1a

There are no risk stratification tools that have been empirically derived or validated to identify patients needing admission to hospital.

The Brescia Scale is being promoted through MDCalc (MDCalc 2020a). This scale was developed and used in Italy but has not been validated. An interview with the creator indicates that the treatment recommendations that accompany it are for use in an environment of inadequate health care resources, which is not currently the case in Alberta (MDCalc 2020b). MDCalc also promotes other tools for use with COVID-19 patients (MDCalc 2020a). Some are not validated or are for specific purposes, e.g. assessing pneumonia, hypoxia, etc.

The CURB-65 scale has been widely supported and is in clinical use in the Calgary Zone. One included retrospective study applied this scale to COVID-19 patients. “On admission, the median CURB-65 was 1.9 (SD: 1.1; range: 0-5). Eight (9.4%) patients had a CURB-65 score of 0, 27 (31.8%) patients had a score of 1 and 25 (29.4%) patients had a score of 2. These were classified as mild according to the CURB-65 guidelines. Only 25 patients were classified as severe on admission, of whom 20 (23.5%) patients had a score of 3, 3 (3.5%) had a score of 4, and 2 (2.4%) had a score of 5” (Du 2020). The CURB-65 scale may not be adequately sensitive for use in predicting mortality, or need for admission.

One included retrospective study examined the Sequential Organ Failure Assessment (SOFA) scale (Zhou 2020) and found “odds of in-hospital death associated with older age (odds ratio 1.10, 95% CI

1.03–1.17, per year increase; $p=0.0043$), higher Sequential Organ Failure Assessment (SOFA) score (5.65, 2.61–12.23; $p<0.0001$), and d-dimer greater than 1 $\mu\text{g/mL}$ (18.42, 2.64–128.55; $p=0.0033$) on admission.”

A number of prognostic tools were tested in a prospective study by Alberta Emergency Medical Services prior to the emergence of COVID-19, including NEWS2, and been found to predict hospital mortality well but to have only moderate discrimination for emergency department disposition (Lane 2020).

The three minute walk test has been studied in emergency departments for risk stratification for some conditions unrelated to COVID-19. For instance, applicability of the test to congestive heart failure and Chronic Obstructive Pulmonary Disorder were evaluated using a convenience sample of 40 patients (Pan 2009). A prospective sample of 114 patients examined the three minute walk test for dyspnea (Amin 2015). The walk test is also used in prospectively studied risk scoring systems for heart failure (Stiell 2013) and chronic obstructive pulmonary disorder (Stiell 2018). While the metric of the test, hypoxemia or tachycardia with ambulation, has good face validity and is associated with poor outcomes, it has not been validated in COVID-19 patients.

Question 1b

Results of imaging of COVID-19 patients are reported in two systematic reviews. A systematic review of imaging results by Cao found bilateral pneumonia (75.7%, 0.639-0.871), and ground glass opacification (69.9%, 0.602-0.796) among COVID-19 patients (Cao 2020). A systematic review by Saleh et al. notes “Known features of COVID-19 on initial CT include bilateral multilobar ground-glass opacification (GGO) with a peripheral or posterior distribution, mainly in the lower lobes and less frequently within the right middle lobe.” A scoping review and meta-analysis by Borges (2020) had similar findings, and points out that the majority of clinical symptoms and laboratory findings of COVID-19 are non-specific.

No single investigation, including CT scanning, has sufficient sensitivity or specificity to be used to identify patients requiring admission. CT scans should not be ordered routinely in patients evaluated in the ED nor or in patients admitted to hospital.

Question 1c

No academic literature on observation periods in emergency departments for COVID-19 was found.

Evidence from existing policies and guidelines

Question 1

United Kingdom National Institute for Health and Care Excellence (NICE) guidelines suggest clinicians should “Use the following symptoms and signs to help identify patients with more severe illness to help make decisions about hospital admission: severe shortness of breath at rest or difficulty breathing, coughing up blood, blue lips or face, feeling cold and clammy with pale or mottled skin, collapse or fainting (syncope), new confusion, becoming difficult to rouse, little or no urine output.”

Public Health Agency of Canada guidelines suggest that those with mild symptoms do not require hospitalization “unless there is concern about rapid deterioration or inability to return promptly to hospital” (PHAC 2020).

“Older patients and those with comorbidities (e.g. cardiovascular disease, diabetes mellitus, pre-existing lung conditions) have increased risk of severe disease and mortality. While they may present with mild disease, they have a higher risk of deterioration and should be monitored closely.” (PHAC 2020).

World Health Organization (WHO) (2020) guidelines are similar and cite Zhou 2020 above on the risk factors of COVID-19.

Both the PHAC and WHO documents also suggest for assessing sepsis, pneumonia and acute respiratory distress syndrome in patients evaluated for COVID-19 disease.

Canadian Association of Emergency Physicians (2020) guidelines note that particular care should be taken in discharging persons experiencing homelessness. They advise providers to:

“Contact the shelter to determine if there is the capability to provide isolation; Involve other providers early in the care process, where appropriate e.g., case worker, community outreach team, social worker, addictions services; Ensure that you have working contact information for the individual or service provider / delegate, as appropriate” and to avoid discharging without a transitional plan or after hours. It would seem reasonable to consider household crowding (for low income populations) and transportation limitations (e.g. for rural persons, and persons without private vehicles), for any discharge decision. Statistics Canada reports a crowding rate (more than one person per room, not counting hallways and bathrooms) of 2.14% in Alberta Households (2017). Indigenous households have higher household crowding (e.g. “35% of on-reserve and 8% of off-reserve First Nations people in Alberta lived in crowded homes” in 2011 (Statistics Canada 2016)).

Question 1a

United Kingdom guidelines recommend caution in using the CURB-65 scale as it requires assessing blood pressure and this is thought to increase cross contamination risk. The guidelines do state that the NEWS2 scale “for predicting the risk of clinical deterioration may be useful” in community (NICE 2020).

The United Kingdom guidelines recommend utilizing the Medical Research Council (MRC) Dyspnoea scale / MRC Breathlessness scale to assess dyspnea (NICE 2020), but the Medical Research Council advises that this scale is for epidemiologic study only and should not be used on an individual basis (Medical Research Council 2020).

Question 1b

Chest imaging can aid the diagnosis of acute respiratory distress syndrome, and identify complications and other etiologies of hypoxemia in patients with severe disease. (PHAC 2020). PHAC makes no recommendation for imaging in patients with mild disease.

The American College of Respiriology (2020) COVID-19 guidelines advise against chest CT for diagnosis of COVID-19. They state that, “A normal chest CT does not mean a person does not have COVID-19 infection - and an abnormal CT is not specific for COVID-19 diagnosis.”

The Canadian Association of Radiologists (CAR) and the Canadian Society on Thoracic Radiology (CSTR) Recommendations on COVID-19 Management repeat the above point and state that “Imaging

should only be conducted for those COVID-19 patients where imaging will impact management of the condition.”

The use of point of care ultrasound has been described, however similar significant overlap between the appearance of COVID-19 and other viral infections is noted and point of care ultrasound is not recommended for clinical decision making at this time (Peng 2020).

Question 1c

Canadian (PHAC 2020) and WHO (2020) guidelines suggest patients with mild symptoms can be discharged home to recover.

Italian National Institute for Infectious Diseases guidelines suggest ongoing clinical monitoring for even mild or asymptomatic cases, but offer no guidance on the duration, frequency or type of monitoring (Nicastri 2020).

An experience based Chinese handbook of COVID-19 care requires facility based isolation of all suspected and confirmed cases (separately), resulting in de facto observation of all cases (First Affiliated Hospital, Zhejiang School of Medicine (2020)).

Evolving Evidence (if applicable)

- New evidence will emerge on this topic.
- Rapid turnaround time afforded limited time to conduct a thorough search and review of the research and grey literature.
- Many relevant studies with small sample sizes could not be reviewed, assessed and compared in a timely manner.
- “Walk test” and related terms were not included in the librarian conducted search.

Date question received by advisory group: April 3, 2020

Date report submitted to committee: April 8, 2020

Date of first assessment: April 10, 2020

(If applicable) Date of re-assessment:

Authorship & Committee Members

This review was written by Patrick McLane and scientifically reviewed by Andrew McRae, Kerri Johansson (external reviewer), Evan Minty (external reviewer), Chris Fung (external reviewer), Finlay McAlister (external reviewer), and Dan Zuege (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, Andrew McRae, Jeremy Slobodan, James Talbot, Brandie Walker, and Nathan Zelyas.



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Appendix

List of Abbreviations

CAR - Canadian Association of Radiologists

CSTR - Canadian Society on Thoracic Radiology

CURB-65 – Confusion, Blood Urea, Respiratory Rate, Blood Pressure, Age 65 or older - Tool

LPM - Litres per minute

NEWS2 – National Early Warning Scale 2

National Institute for Health and Care Excellence (NICE)

PHAC – Public Health Agency of Canada

SOFA – Sequential Organ Failure Assessment Scale

WHO- World Health Organization

Literature Search Details

Databases and search engines: OVID MEDLINE, EMBASE, LitCovid, CINAHL, TRIP PRO, BMJ Best Practice, WHO Global research on coronavirus (database), Google and Google Scholar.

Search Strategy

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily 1946 to April 03, 2020 #

	Searches	Results
1	exp Coronavirus/ or exp Coronavirus Infections/ or coronaviru*.mp. or "coronavirus*".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-	21048

	Cov-19.mp. or SarsCov-19.mp. or SARSCOV2019.mp. or SarsCov-2019.mp. or SarsCov-2019.mp. or "severe acute respiratory syndrome cov 2".mp. or "2019 ncov".mp. or "2019ncov".mp.	
2	hospitalization/ or patient admission/ or patient readmission/ or triage/	150915
3	(hospitali* or admission* or admit* or readmit* or readmission* or triage*).mp.	645728
4	2 or 3	645728
5	1 and 4	1077
6	limit 5 to (english language and yr="2020 -Current")	190
7	exp clinical laboratory techniques/ or exp diagnostic imaging/	4882177
8	(lab or labs or laborator* or imag* or CT scan*).mp.	3004694
9	7 or 8	6001034
10	Emergency Treatment/ or Emergency Medicine/ or emergency medical services/ or emergency service, hospital/ or trauma centers/ or triage/ or exp Evidence-Based Emergency Medicine/ or exp Emergency Nursing/ or Emergencies/ or emergicent*.mp. or casualty department*.mp. or ((emergenc* or ED) adj1 (room* or accident or ward or wards or unit or units or department* or physician* or doctor* or nurs* or treatment*or visit*)).mp. or (triage or critical care or (trauma adj1 (cent* or care))).mp. [mp=title, abstract, original title, name of substance word, subject	317728

	heading word, floating sub- heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	
11	1 and 9 and 10	62
12	limit 11 to (english language and yr="2020 -Current")	10
13	Hypoxia/	63504
14	exp Oxygen/	181534
15	exp oxygen inhalation therapy/ or hyperbaric oxygenation/	25591
16	(hypoxia or hypoxemia or anoxemia or anoxia or oxygen deficienc* or oxygen*).mp.	822564
17	or/13-16	835282
18	1 and 17	291
19	limit 18 to (english language and yr="2020 -Current")	36
20	(CURB-65 or CURB criteria or NEWS2 or National Early Warning Score or (Brescia* adj7 (scale or algorithm))).mp.	709
21	1 and 20	5
22	exp risk assessment/ or risk factors/	997217
23	(risk adj3 (assess* or factor* or stratif* or tool*)).mp.	1361766
24	22 or 23	1364392
25	1 and 24	816
26	limit 25 to (english language and yr="2020 -Current")	101
27	Clinical Observation Units/	30
28	(clinical decision unit* or observation* unit* or observation* period* or observation* duration* or (clinical* adj3 observ*)).mp.	87162
29	27 or 28	87162
30	1 and 29	106
31	limit 30 to (english language and "humans only (removes records about animals)")	31

LitCovid

Search string 1: triage or admission or hospitali*

Search string 2: CURB-65 or "CURB criteria" or NEWS2 or "National Early Warning Score" or brescia

TRIP PRO / Google / Google Scholar

Search string 1: (hospitali* or admission* or admit* or readmit* or readmission* or triage*) 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

Search string 2: risk* AND (emergency department* or ED or emergency room* or emergency ward* or emergency unit* or hospital emergency service*) 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

Search string 3: (CURB-65 or "CURB criteria" or NEWS2 or "National Early Warning Score" or brescia) 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 string 1: ((hospitali* or admission* or admit* or readmit* or readmission* or triage*) AND (emergency department* or ED or emergency room* or emergency ward* or emergency unit* or hospital emergency service*)) 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]))

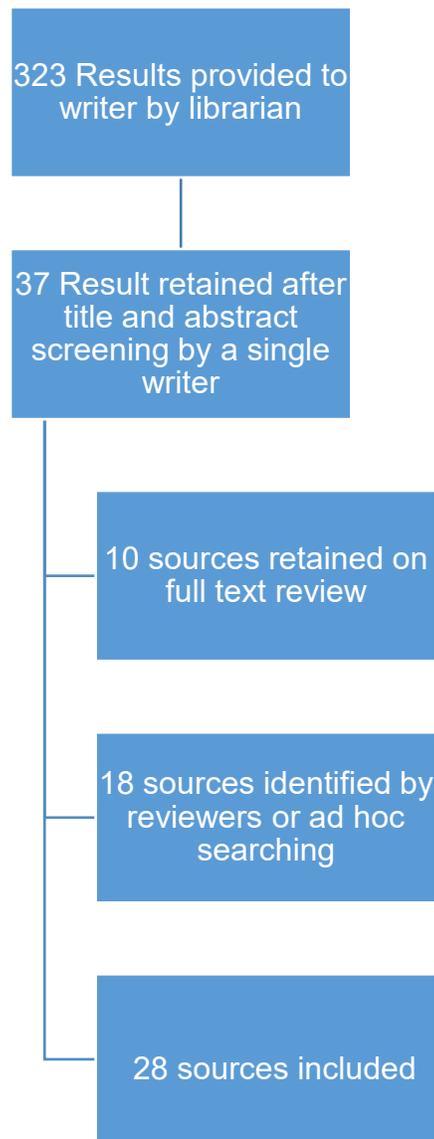
Search string 2: (((wuhan[tw] AND (coronavirus[tw] OR corona virus[tw])) OR coronavirus*[ti] OR COVID*[tw] OR nCov[tw] OR 2019 ncov[tw] OR novel coronavirus[tw] OR novel corona virus[tw] OR covid-19[tw] OR SARS-COV-2[tw] OR Severe Acute Respiratory Syndrome Coronavirus 2[tw] OR coronavirus disease 2019[tw] 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])) AND (CURB-65 or "CURB criteria" or NEWS2 or "National Early Warning Score" or Brescia)

Screening

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

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> - Guidelines and credible academic writing on emergency department management or hospital admission for COVID-19 patients. - Systematic reviews of Covid-19 clinical characteristics, imaging and outcomes. - Individual studies reporting on application of risk stratification tools to Covid-19 or similar patients. - Studies on “walk tests” in emergency departments. 	<ul style="list-style-type: none"> - News articles. - Opinion pieces. - Case studies or series. - Studies of unique populations (e.g. patients with cancer diagnoses, populations with high HIV rates, asymptomatic patients, seniors, children, pregnant persons). - Animal studies. - Studies proposing criteria for resource allocation when health a system is overwhelmed.

Figure 1: PRISMA Diagram



- PRISMA Citation:
Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement*. [PLoS Med 6\(7\): e1000097. doi:10.1371/journal.pmed1000097](https://doi.org/10.1371/journal.pmed1000097)

Reference List

American College of Respiriology. (2020). ACR Recommendations for the use of Chest Radiography and Computed Tomography (CT) for Suspected COVID-19 Infection. <https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Recommendations-for-Chest-Radiography-and-CT-for-Suspected-COVID19-Infection>

Amin, Q., Perry, J. J., Stiell, I. G., Mohapatra, S., Alsadoon, A., & Rodger, M. (2015). Ambulatory vital signs in the workup of pulmonary embolism using a standardized 3-minute walk test. *CJEM*, 17(3), 270–278. <http://doi.org/10.1017/cem.2014.45>

Borges do Nascimento IJ, Cacic N, Abdulazeem HM, et al. (2020). Novel Coronavirus Infection (COVID-19) in Humans: A Scoping Review and Meta-Analysis. *J Clin Med*. 9(4)

Canadian Association of Emergency Physicians. (2020). COVID-19 and Persons Experiencing Homelessness or Vulnerable Housing. <https://caep.ca/wp-content/uploads/2020/03/COVID-19-and-homelessness-CAEP-updated-0321-1.pdf>

Cao Y, Liu X, Xiong L, Cai K. (2020). Imaging and Clinical Features of Patients With 2019 Novel Coronavirus SARS-CoV-2: A systematic review and meta-analysis. *J Med Virol*.

CAR/CSTR (2020). The Canadian Association of Radiologists (CAR) and the Canadian Society on Thoracic Radiology (CSTR) Recommendations on COVID-19 Management in Imaging Departments. <https://car.ca/wp-content/uploads/2020/03/The-Canadian-Association-of-Radiologists-CAR-and-the-Canadian-Society-on-Thoracic-Radiology-CSTR-Recommendations-on-COVID19-Management-in-Imaging-Departments-1.pdf>

Deng Y, Liu W, Liu K, et al. (2020). Clinical characteristics of fatal and recovered cases of coronavirus disease 2019 (COVID-19) in Wuhan, China: a retrospective study. *Chin Med J (Engl)*.

Du Y, Tu L, Zhu P, et al. (2020). Clinical Features of 85 Fatal Cases of COVID-19 from Wuhan: A Retrospective Observational Study. *Am J Respir Crit Care Med*. doi:<https://dx.doi.org/10.1164/rccm.202003-0543OC>

First Affiliated Hospital, Zhejiang School of Medicine (2020). Handbook of COVID-19 Prevention and Treatment. <http://www.zju.edu.cn/english/2020/0323/c19573a1987520/page.htm>

Guan W-J, Liang W-H, Zhao Y, et al. (2020). Comorbidity and its impact on 1590 patients with Covid-19 in China: A Nationwide Analysis. *Eur Respir J*.

Lane DJ., Wunsch H, Saskin R, Cheskes S, Lin S, Morrison LJ. & Scales DC. (2020) Assessing Severity of Illness in Patients Transported to Hospital by Paramedics: External Validation of 3 Prognostic Scores, *Prehospital Emergency Care*, 24:2, 273-281, DOI: 10.1080/10903127.2019.1632998

National Institute for Clinical Excellence. (2020). COVID-19 rapid guideline: managing suspected or confirmed pneumonia in adults in the community. <https://www.nice.org.uk/guidance/ng165/chapter/3-Diagnosis-and-assessment>

Nicastri E, Petrosillo N, Bartoli TA, et al. (2020). National Institute for the Infectious Diseases “L. Spallanzani”, IRCCS. Recommendations for COVID-19 clinical management. *Infect Dis Rep*. 12(1):8543. doi:<https://dx.doi.org/10.4081/idr.2020.8543>

MDCalc. (2020a). COVID-19 Resource Center. <https://www.mdcalc.com/covid-19>

MDCalc (2020b). Interview with Italian Intensivist Dr. Simone Piva, Discussing the Brescia-COVID Respiratory Severity Score (BCRSS). <https://www.mdcalc.com/covid-19/brescia-covid-respiratory-severity-scale-bcrss-interview>

Medical Research Council (2020). MRC Dyspnoea scale / MRC Breathlessness scale. <https://mrc.ukri.org/research/facilities-and-resources-for-researchers/mrc-scales/mrc-dyspnoea-scale-mrc-breathlessness-scale/>

Pan AM, Stiell IG, Clement CM, et al Feasibility of a structured 3-minute walk test as a clinical decision tool for patients presenting to the emergency department with acute dyspnea. *Emergency Medicine Journal* 2009;26:278-282.

Peng QY et al. Chinese Critical Care Ultrasound Study Group (CCUSG). Findings of lung ultrasonography of novel corona virus pneumonia during the 2019-2020 epidemic. *Intensive Care Med* 2020. Mar 12. Doi: 10.1007/s00134-020-05996-6

Public Health Agency of Canada. (2020). Clinical Management of Patients with Moderate to Severe COVID-19 - Interim Guidance. <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/clinical-management-covid-19.html>

Salehi S, Abedi A, Balakrishnan S, Gholamrezanezhad A. (2020). Coronavirus Disease 2019 (COVID-19): A Systematic Review of Imaging Findings in 919 Patients. *Am J Roentgenol.* 1-7. doi:10.2214/AJR.20.23034 <https://doi.org/10.2214/AJR.20.23034> <https://doi.org/10.2214/AJR.20.23034>

Statistics Canada. 2016. Aboriginal Peoples: Fact Sheet for Alberta. <https://www150.statcan.gc.ca/n1/pub/89-656-x/89-656-x2016010-eng.htm>

Statistics Canada. 2017. *Alberta [Province] and Canada [Country] (table). Census Profile.* 2016 Census. Statistics Canada Catalogue no. 98-316-X2016001. Ottawa. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E> (accessed April 9, 2020).

Stiell, I.G., Clement, C.M., Brison, R.J., Rowe, B.H., Borgundvaag, B., Aaron, S.D., Lang, E., Calder, L.A., Perry, J.J., Forster, A.J. and Wells, G.A. (2013), A Risk Scoring System to Identify Emergency Department Patients With Heart Failure at High Risk for Serious Adverse Events. *Acad Emerg Med*, 20: 17-26. doi:[10.1111/acem.12056](https://doi.org/10.1111/acem.12056)

Ian G. Stiell, Jeffrey J. Perry, Catherine M. Clement, Robert J. Brison, Brian H. Rowe, Shawn D. Aaron, Andrew D. McRae, Bjug Borgundvaag, Lisa A. Calder, Alan J. Forster, Jennifer Brinkhurst, George A. Wells. (2018). Clinical validation of a risk scale for serious outcomes among patients with chronic obstructive pulmonary disease managed in the emergency department. *CMAJ.* 190 (48) E1406-E1413; DOI: 10.1503/cmaj.180232

World Health Organization (2020). Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected. Interim guidance. <https://www.who.int/publications->

[detail/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-\(ncov\)-infection-is-suspected](#)

Wynants Laure, Van Calster Ben, Bonten Marc M J, Collins Gary S, Debray Thomas P A, De Vos Maarten et al. (2020). Prediction models for diagnosis and prognosis of covid-19 infection: systematic review and critical appraisal *BMJ*; 369 :m1328

Yang J, Zheng Y, Gou X, et al. (2020). Prevalence of comorbidities in the novel Wuhan coronavirus (COVID-19) infection: a systematic review and meta-analysis. *Int J Infect Dis*.

Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet (London, England)*.