Patient Care Algorithms

for the Identification, Admission and Investigation of Pregnant Persons with Suspected or Confirmed SARS-CoV2 Infection

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Aims and objectives

- To become proficient at assessing, triaging and managing pregnant persons with suspected or confirmed SARS-CoV2 infection, based on standardized patient-care algorithms

- Disclaimer
  - These are ‘living documents’
  - Not meant to be prescriptive, and require the use of clinical judgement
  - Note ‘words of caution’ at the end of the presentation

Rationale

COVID-19 in pregnancy: early lessons

Noelle BRESLIN, M.D., Caitlin BAPTISTE, M.D., Russell MILLER, M.D., Karin FUCHS, M.D., Dena GOFFMAN, M.D., Cynthia GYAMFI-BANNERMAN, M.D, M.S.., Mary D'ALTON, M.D.

COVID in pregnancy
- 86%: mild
- 9.3%: severe
- 4.7%: critical

Breslin case series (43)

Can we identify the 14% that are likely to progress to severe/critical disease, and safely discharge the other 86%?

Case	Age	BMI	GA	PMH	Chief Complaint	Review of systems on admission								Temp	WBC	Platelets	Dispo
						Fever	Cough	Myalgias	Dyspnea	Chest pain	Headache	Diarrhea	Sick contacts				
1	38	38	37+0	T2DM	Labor induction	N	N	N	N	N	N	N	N	36.9 - 38.1 C	7.4	216	ICU
2	33	47	37+5	T2DM, cHTN	Labor induction	N	N	N	N	N	N	N	N	36.5- 38.8 C	7.3	276	ICU
3	30	30	35+5	None	Tachycardia (pulse 130 bpm)	N	N	N	N	Y	Y	N	Y	36.7 - 38.3 C	4.5	185	Admit^
4	32	29	32+5	None	Fever, myalgias, cough	Y	Y	Y	N	N	N	N	Y	36.6 - 37.6 C	6.5	180	Admit^
5	27	31	26+3	None	Chest pain	N	N	N	N	Y	N	N	N	36.7 - 37.1 C	6.8	129	Home
6	38	34	28+0	Asthma	Fever, myalgias, cough	Y	Y	Y	N	N	N	N	N	36.9 - 37.0 C	-	-	Home
7	39	23	34+6	None	Cough, HA, myalgias	N	Y	Y	N	N	Y	N	N	36.4 - 37.2 C	5.4	255	Home

*GA = gestational age (weeks + days); PMH = past medical history; T2DM = type two diabetes mellitus; cHTN = chronic hypertension; HA = headache; WBC = white blood cell count; Dispo = initial disposition; ICU = intensive care unit

^ Cases 3 and 4 were each admitted for supportive care, and each was discharged home on hospital day three

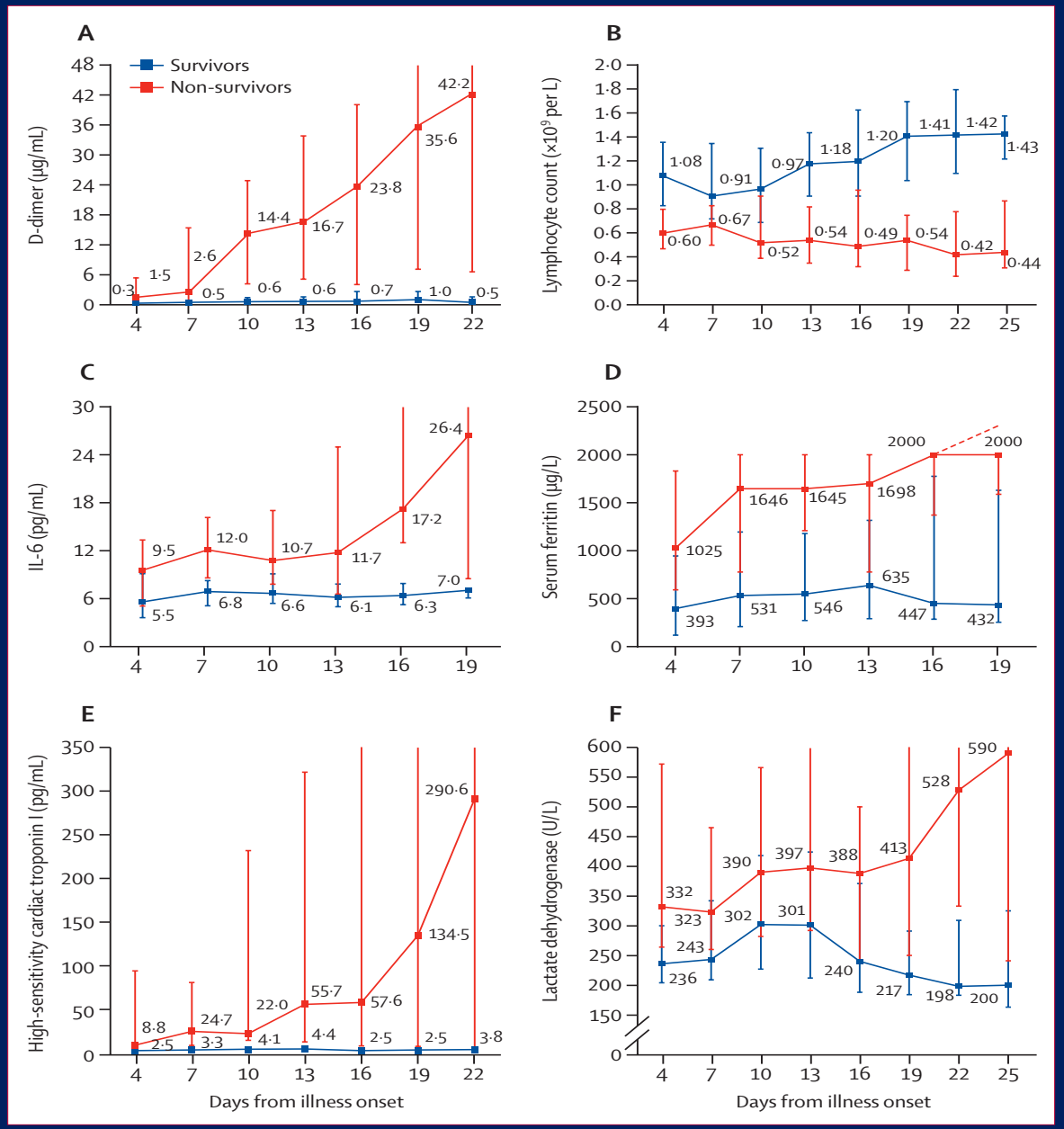
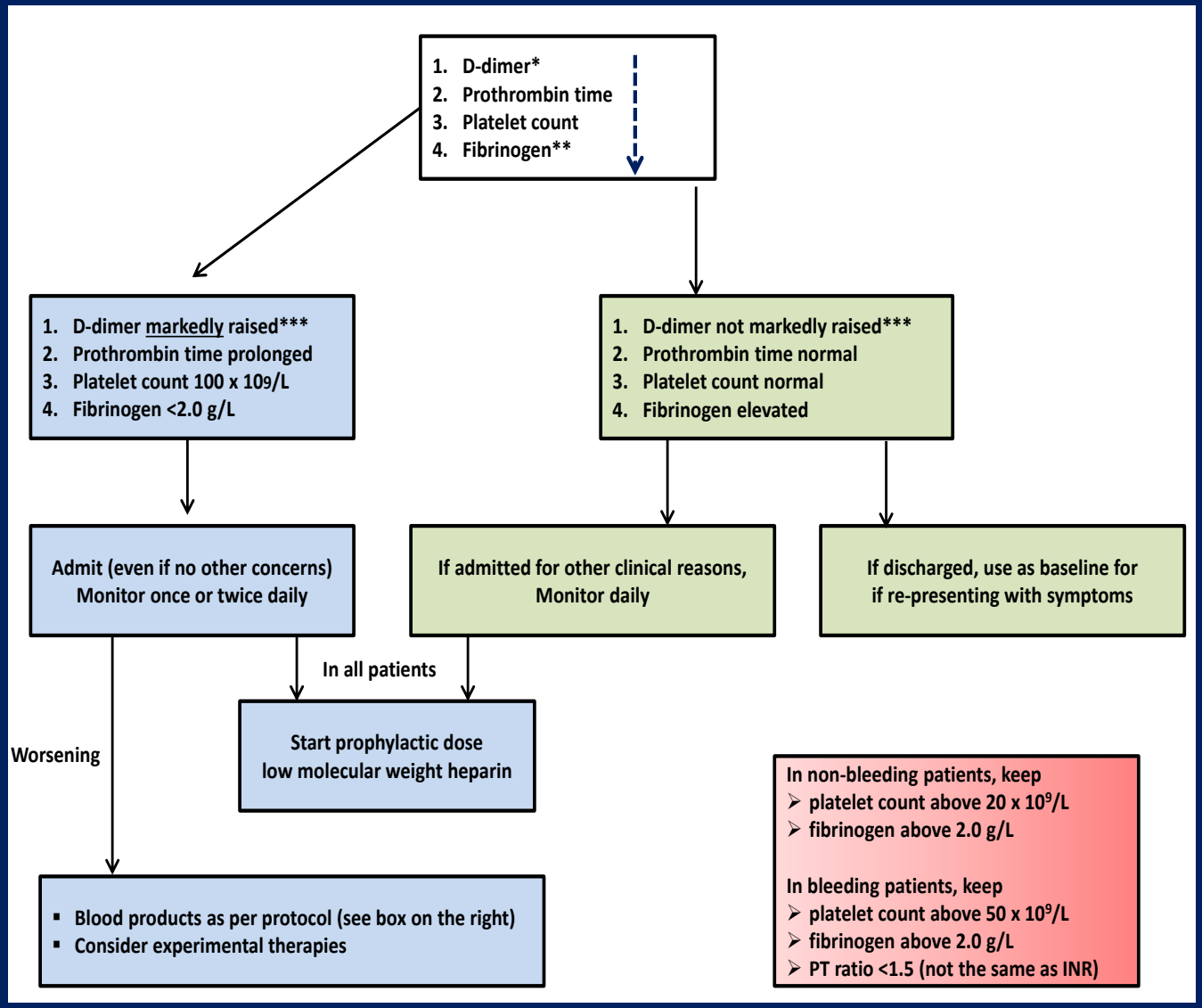


Figure 2: Temporal changes in laboratory markers from illness onset in patients hospitalised with COVID-19

Figure shows temporal changes in d-dimer (A), lymphocytes (B), IL-6 (C), serum ferritin (D), high-sensitivity cardiac troponin I (E), and lactate dehydrogenase (F). Differences between survivors and non-survivors were significant for all timepoints shown, except for day 4 after illness onset for d-dimer, IL-6, and high-sensitivity cardiac troponin I. For serum ferritin (D), the median values after day 16 exceeded the upper limit of detection, as indicated by the dashed line. COVID-19=coronavirus disease 2019. IL-6=interleukin-6.



ISTH interim guidance on recognition and management of coagulopathy in COVID-19

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Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study

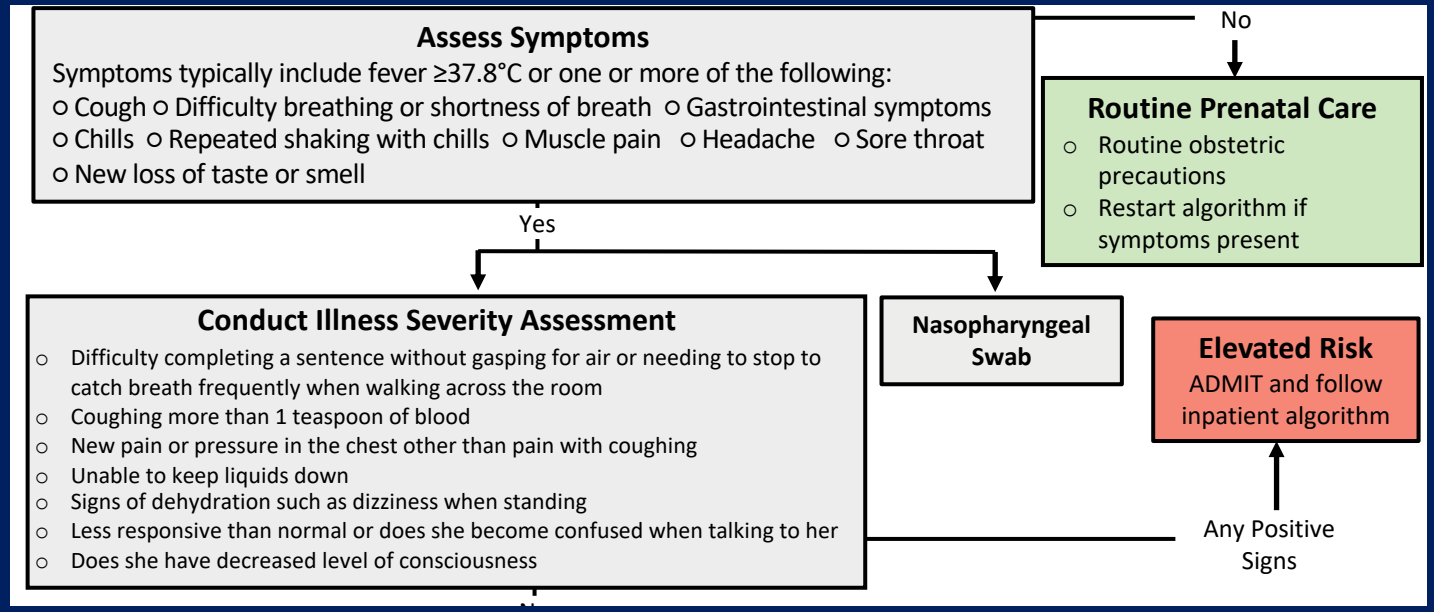
Fei Zhou*, Ting Yu*, Ronghui Du*, Guohui Fan*, Ying Liu*, Zhibo Liu*, Jie Xiang*, Yeming Wang, Bin Song, Xiaoying Gu, Lulu Guan, Yuan Wei, Hui Li, Xudong Wu, Jiuyang Xu, Shengjin Tu, Yi Zhang, Hua Chen, Bin Cao

Outpatient/ Ambulatory Settings

- Aim: To determine which pregnant persons with suspected or confirmed SARS-CoV2 infection require inpatient management
- Version:5
- Sources
  - ACOG/SMFM Algorithm (22 Apr 2020)
  - Mount Sinai slide-deck [Dr. Wendy Whittle]
  - Other published evidence
  - Comments of clinicians that reviewed versions 1-3

ACOG, American College of Obstetricians and Gynecologists
SMFM, Society of Maternal-Fetal Medicine

Outpatient Algorithm



1. Presence of symptoms warrants testing, not admission
2. Assessment of severity of symptoms is a crucial step
3. Note: Temperature ≥ 37.8 and not 38

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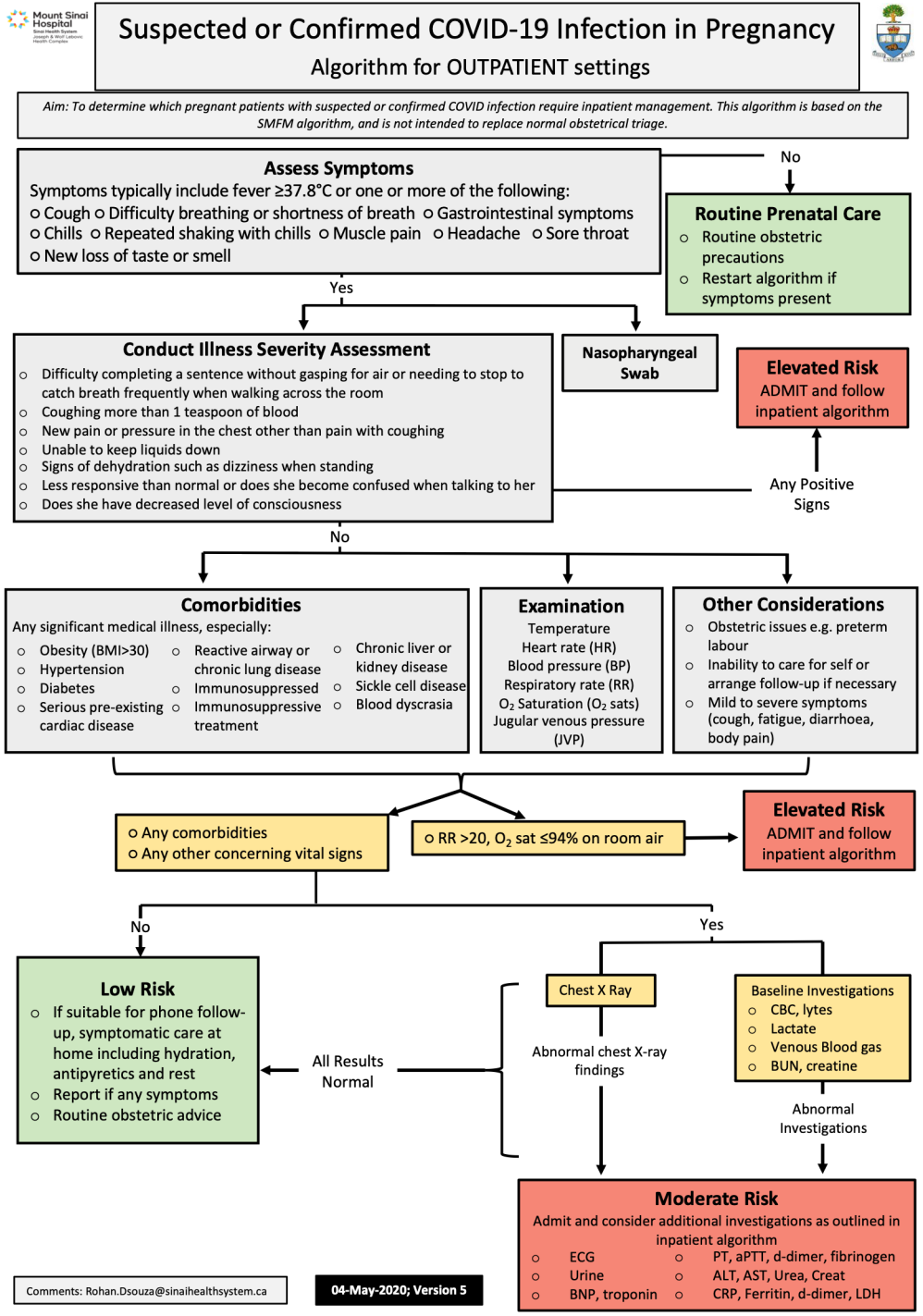

No

Comorbidities

Any significant medical illness, especially:

- Obesity (BMI>30)
- Hypertension
- Diabetes
- Serious pre-existing cardiac disease
- Reactive airway or chronic lung disease
- Immunosuppressed
- Immunosuppressive treatment
- Chronic liver or kidney disease
- Sickle cell disease
- Blood dyscrasia

Examination

Temperature
Heart rate (HR)
Blood pressure (BP)
Respiratory rate (RR)
O_2 Saturation (O_2 sats)
Jugular venous pressure (JVP)

Other Considerations

- Obstetric issues e.g. preterm labour
- Inability to care for self or arrange follow-up if necessary
- Mild to severe symptoms (cough, fatigue, diarrhoea, body pain)

1. List of comorbidities is not exhaustive – use clinical judgement
2. The examination must include RR and oxygen saturations on room air
3. JVP should be assessed to determine judicious fluid management
4. Do not forget about
   - The ability of the patient to care for self and arrange follow up
   - Routine obstetrics and non-obstetric/ non-COVID conditions

No

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- Obstetric issues e.g. preterm labour
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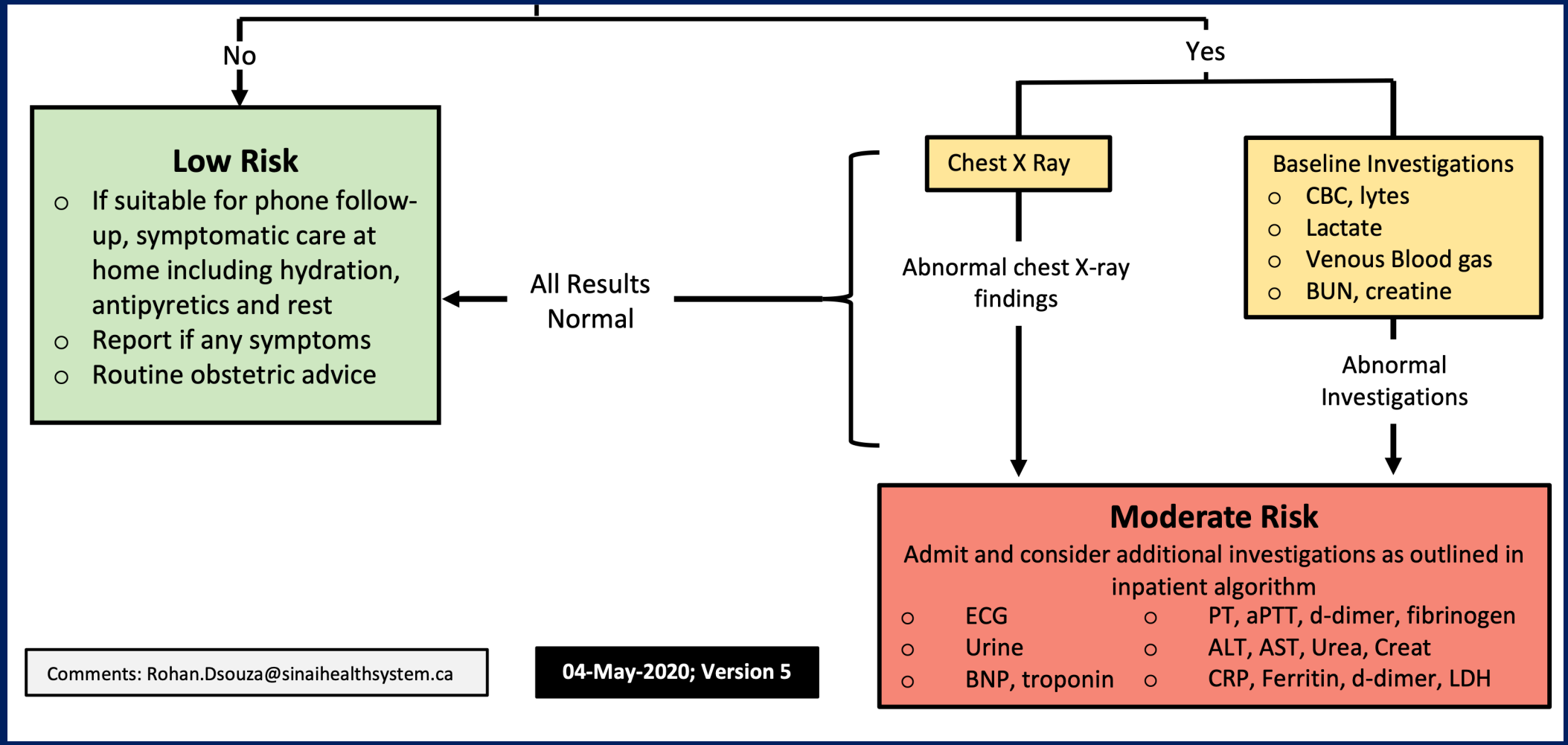
- Any comorbidities
- Any other concerning vital signs

- RR >20, O_2 sat ≤94% on room air

Elevated Risk

ADMIT and follow inpatient algorithm

1. Respiratory concerns to be taken seriously, even in the absence of comorbidities or normal other findings
2. Comorbidities in pregnancy to be taken seriously
3. “Other concerning vital signs” – deliberate attempt at not being prescriptive



1. Chest X-ray findings warrant special attention
2. 'Baseline' investigations deemed sufficient in the first instance

Inpatient Setting

- Aim: To determine which pregnant persons with suspected or confirmed SARS-CoV2 infection are likely to have severe or critical illness, and institute early supportive treatment
- Version:4
- Sources
  - Evidence from non-pregnant populations
  - Correspondence with colleagues around the world (Dr. Whittle)
  - Multidisciplinary team involvement at Mt. Sinai (MFM, obstetrics, obstetric medicine, haematology, cardiology, obstetric anaesthesia, respirology, ICU, family practice)
  - Comments of those that reviewed versions 1-3
- Disclaimer
  - SMFM ”Considerations” document (29/Apr) are currently being evaluated

Cardinal symptoms – assess daily				
Symptom	No (0)	Mild (1)	Moderate (2)	Severe (3)
Fever				
Cough				
Shortness of breath				
Fatigue				
Body pain				
Diarrhoea				

1. Must be assessed daily – good clinical practice
2. Worsening symptoms should trigger appropriate clinical response

General Management

Start empiric **thromboprophylaxis** (enoxaparin) for the entire duration of hospitalization
For anticipated preterm birth: administer **antenatal corticosteroids**
Judicious use of **intravenous fluids**, based on clinical presentation
Low-dose **aspirin** can be continued
Currently no restriction on **Indomethacin** for tocolysis & **NSAIDs** post-childbirth
Consider limiting **MagSulf** to a 4gm bolus over 1 hour in those with respiratory depression

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Mount Sinai Hospital
Sinai Health System
Joseph & Wolf Lebovic Health Complex

Suspected or Confirmed COVID-19 Infection in Pregnancy

Algorithm for INPATIENT management

This algorithm is intended for COVID-positive pregnant patients who are deemed unwell enough to require INPATIENT management. The aim is to use clinical signs, laboratory markers and radiologic findings to identify those at risk for serious maternal morbidity/ ICU admission. Please adapt to your center.

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Symptom	No (0)	Mild (1)	Moderate (2)	Severe (3)
Fever				
Cough				
Shortness of breath				
Fatigue				
Body pain				
Diarrhoea				

General Management
Start empiric **thromboprophylaxis** (enoxaparin) for the entire duration of hospitalization
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Examination

HR, BP, RR, O_2 sats
- Significant change or HR > 100, RR >20, Temp ≥ 37.8C, Hypo or Hypertension, O_2 sat ≤94% on room air → Repeat hourly → Consult Medicine/ID/ICU
- N → None/ constant → Repeat 4-hourly

Oxygen Requirements
- New use (if sats ≤94%, start O_2 to keep >94%)
- 50% increase in O_2 demands over 1-2 hours
- >4L O_2 by facemask
- RR increases despite normal O_2 sats
- Increased O_2 need to maintain sats >94%

→ Consult Medicine/ID/ICU

Laboratory

CBC, lytes
PT, aPTT, fibrinogen
- Delivery Anticipated During Visit → Fib <4 OR platelets <80 → Repeat Daily
- N → Repeat Day 4, 7 or if symptomatic
- Delivery NOT Anticipated During Visit → Platelets <50 or active bleeding

CRP, Ferritin, d-dimer, LDH → Prognostic marker for SMM - Repeat Day 4 & 7

Lactate, Venous Blood Gas
- abN → Arterial blood gas → Consult Medicine/ID/ICU
- N → Repeat as indicated

ALT, AST, Urea, Creat → abN → Consult Medicine/ID/ICU

Urine → Rule out UTI and preeclampsia

Radiology/ Other

BNP, troponin
- N → Repeat Day 7 or symptomatic
- abN → Cardiology for Echo

ECG
- N → Repeat if symptomatic
- abN → Cardiology for Echo

X-ray chest
- abN → Signs of superimposed bacterial infection – Start azithromycin + cephalosporin; Signs of COVID-infection – NO ANTIBIOTICS; Supportive care
- N → Repeat if symptomatic

POCUS (if available)
- abN or insufficient → CT scan; Echocardiogram

Table 1. ASE POCUS Protocol in Suspected or Confirmed COVID-19 Infection. A modified POCUS protocol to assist in the assessment of COVID-19 patients includes heart, chest and vessel views.

COVID19 POCUS Protocol	Structure Imaged	Assessment	Disease Associations
Cardiac	Left Ventricle	Size, Global and Regional Function	Myocarditis ACS Cardiomyopathy Shock
	Right Ventricle	Size and Function; TR for PASP if available	PE Cardiomyopathy
	Pericardium	Effusion	Tamponade
	Valves	Gross Regurgitation or stenosis	Pre-existing CV disease
Lung	8 or 12 point exam	B Lines (A lines, pleural sliding are normal)	Edema or Pneumonia
		Sub-pleural Consolidation Thickened Pleura	Pneumonia ARDS
		Lobar consolidation with air Bronchograms	Pneumonia ARDS
		Effusion	CHF
Vascular	JVP or Subcostal IVC	Fluid Status	CHF, hypovolemia
	"+/- Leg Veins"	2 point compression*	DVT

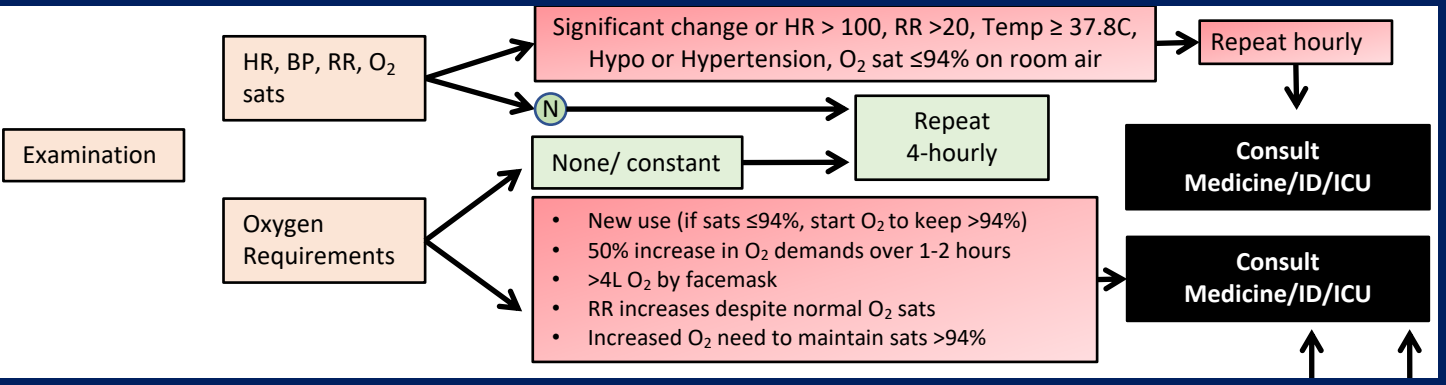
*Leg veins may be assessed if the operator has training in this technique, clinical suspicion exists, and the results will change management.
ACS, acute coronary syndrome; TR, tricuspid regurgitation; PASP, pulmonary artery systolic pressure; PE, pulmonary embolism; CV, cardiovascular; ARDS, acute respiratory distress syndrome; JVP, jugular venous pulsation; IVC, inferior vena cava; CHF, congestive heart failure; DVT, deep vein thrombosis.

Abbreviations
BNP: B-type natriuretic peptide
MRP: Most Responsible Physician
POCUS: Point of care ultrasound

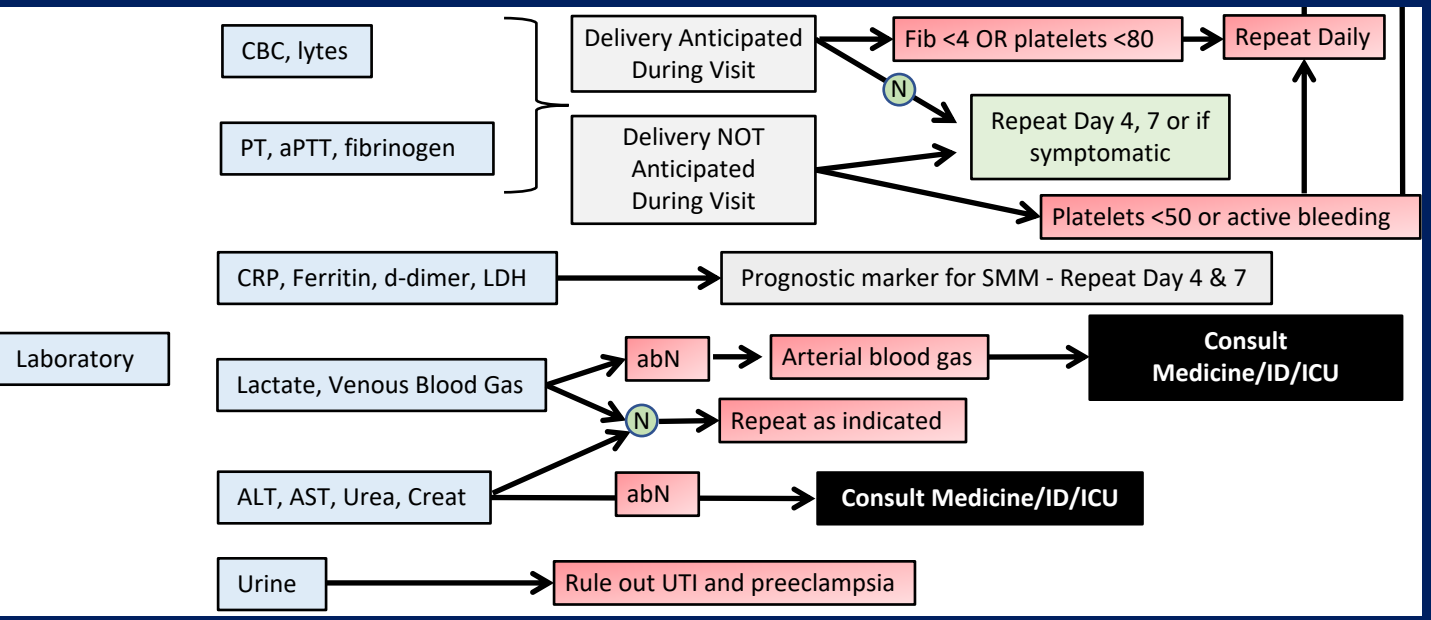
Comments: Rohan.Dsouza@sinaihealthsystem.ca

29-April-2020; Version 4

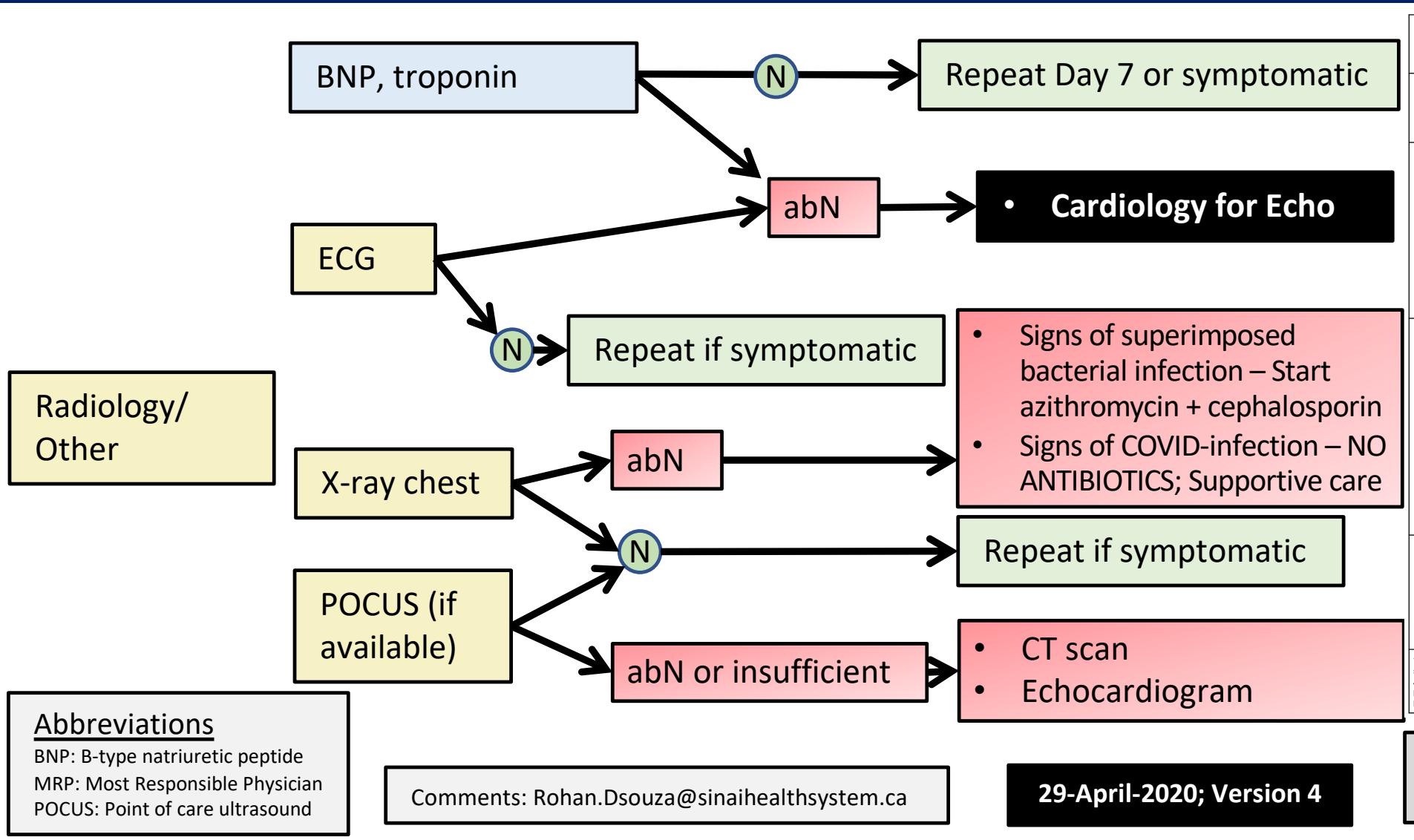
Johri et al 2020 Am Society of Echocardiography Statement on Point-of-Care ultrasound (POCUS) during the 2019 Novel Coronavirus Pandemic"



1. Temp ≥ 37.8 and O_2 sats ≤ 94% always concerning
2. Use clinical judgement and overall picture; not absolute values in determining "significant change"
3. Change in oxygen requirements must be taken seriously
4. Pathway (ICU vs ID vs Medicine) to be determined by individual sites



1. Haematologic changes could be profound, and are among the earliest prognostic markers of severe disease
2. CRP and d-dimers although not traditionally used in obstetrics, are among the most important early markers of disease severity
3. Interpretation of abnormal values should be done in conjunction with specialists, and may depend on whether birth is imminent or not
4. Abnormal blood gases, regardless of symptom severity, should prompt referral/escalation
5. Severe COVID can mimic other obstetric and medical emergencies



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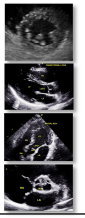
Cardiac 	Left Ventricle	Size, Global and Regional Function	Myocarditis ACS Cardiomyopathy Shock
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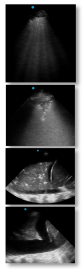
Lung 	8 or 12 point exam	B Lines (A lines, pleural sliding are normal)	Edema or Pneumonia
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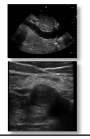
		Effusion	CHF
Vascular 	JVP or Subcostal IVC	Fluid Status	CHF, hypovolemia
	+/- Leg Veins*	2 point compression*	DVT

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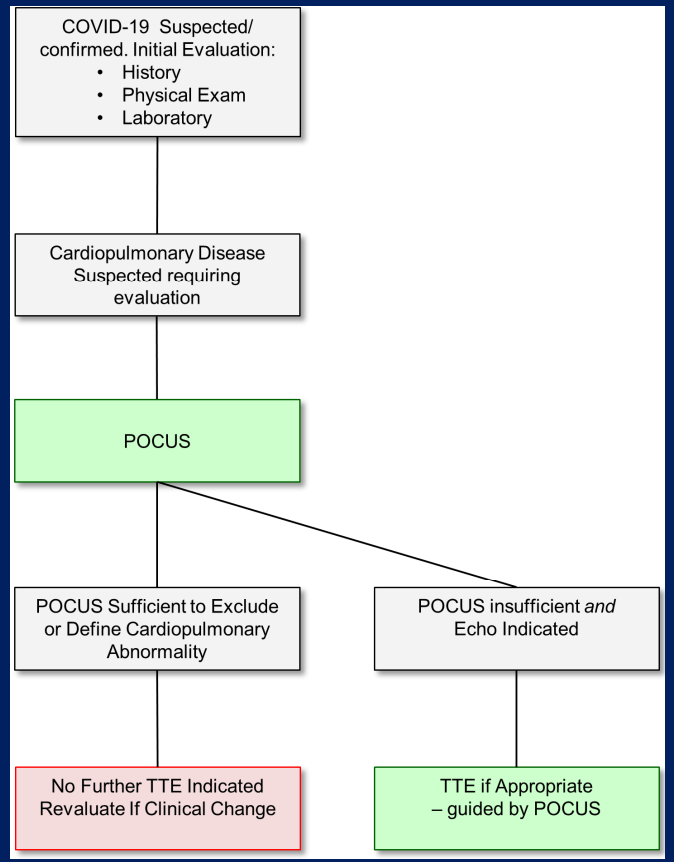
(Hocus) POCUS



ASE AMERICAN SOCIETY OF ECHOCARDIOGRAPHY
Sound Saves Lives

ASE Statement on Point-of-Care Ultrasound (POCUS) During the 2019 Novel Coronavirus Pandemic

1. Depends on training/ availability
2. Could potentially avoid unnecessary contact between infected person and care providers/ resource use
   - Echocardiography
   - Leg Dopplers
   - CT scans
3. If not possible, may need alternate investigative pathways

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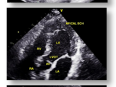	**Pericardium**	Effusion	Tamponade
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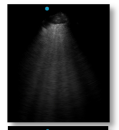
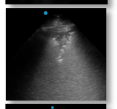
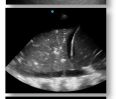
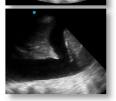
Lung 	**8 or 12 point exam**	B Lines (A lines, pleural sliding are normal)	Edema or Pneumonia
		Sub-pleural Consolidation Thickened Pleura	Pneumonia ARDS
		Lobar consolidation with air Bronchograms	Pneumonia ARDS
		Effusion	CHF
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Words of caution!

- Use the most up-to-date algorithm
  - Posted on the OBGYN UofT / SOON - COVID-resource page
  - SMFM recommendations on H-Score etc. (29 April) being considered by multi-disciplinary team
- Feedabck
- Careful about site-specific modifications
  - This is a novel disease and care pathways must reflect that

OK

1. Consider alternate referral pathways
2. Modify investigative pathways in consultation with a local multidisciplinary team
3. Consult referral centres in case of any doubts/ questions

NOT OK

1. Changing thresholds
2. Setting absolute values
3. Ignoring a sudden change in symptoms
4. Replacing parts of the algorithm with prediction models not validated in pregnancy or for COVID

Anticipated benefits

- Standardized and safe approach towards
  - Identifying early, the 14% at increased risk for serious/critical disease
  - Reducing hospital admissions and the length of hospital stay
  - Reducing unnecessary investigations and resource utilization
- Protecting healthcare professionals and other patients
- Other benefits
  - Quality Improvement, Patient Safety
  - Research implications
  - Framework for regional/ provincial/ national collaboration

Acknowledgements

- Wendy Whittle
- Ann Kinga Malinowski
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- Cynthia Maxwell
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- Nadine Shehata (Haematology)
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