Review of Acute Care Rehabilitation Considerations for Pandemic Team-based Care

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Land Acknowledgement

McMaster University recognizes and acknowledges that it is located on the traditional territories of the Mississauga and Haudenosaunee nations, and within the lands protected by the "Dish with One Spoon" wampum agreement.

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Acknowledgements

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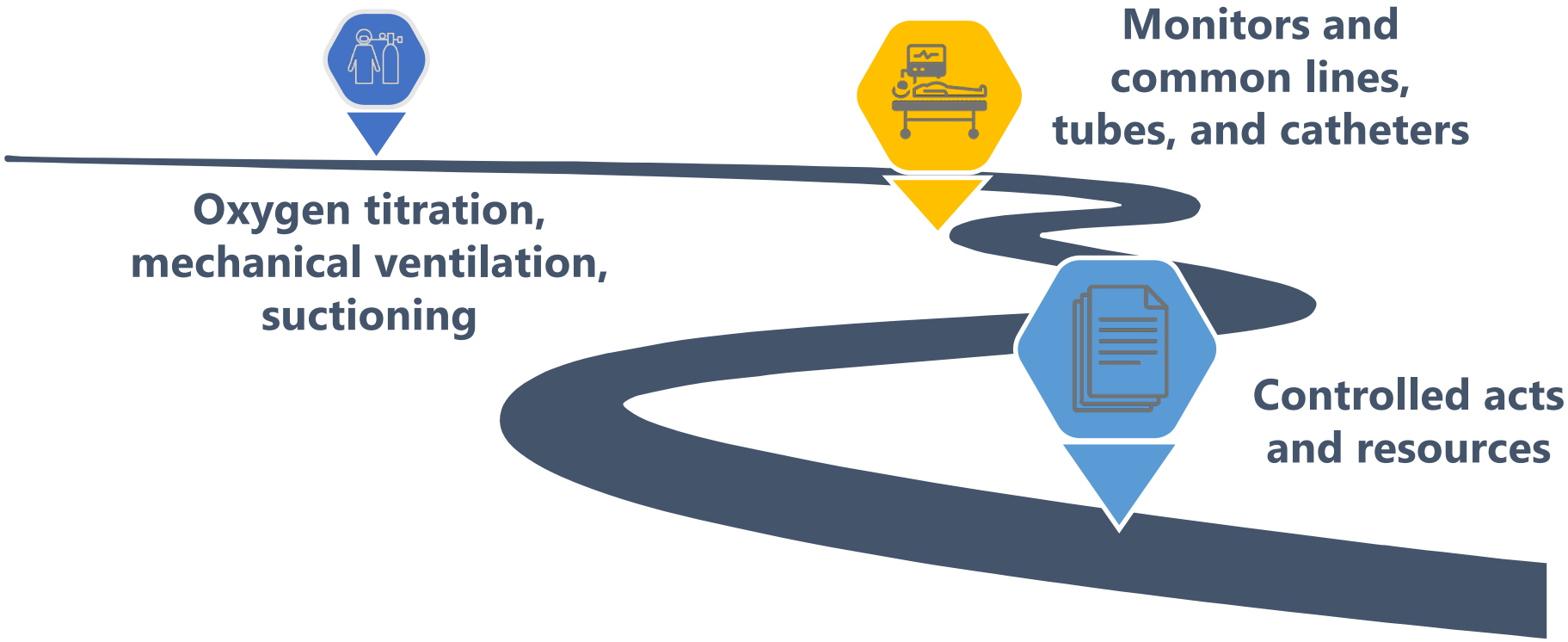
Organization of today's talk



Expanding Team Based Models Considerations		
Domain	**Summary**	**Tools and Resources Examples**
Patient Care Needs	Define patient needs that can be met by skills of alternate care providers Determine Staff Ratios (baseline number of Critical Care RN's, Patient to Nurse ratio, ratio of CCRN to non-CCRN, role of non nurse)	Critical Care Multi- Professional Role Matrix (Appendix E)
Role Clarity	Create defined roles with clear responsibilities and expectations, using Patient Skill Categories (Appendix D) where possible	Role Examples ○ Critical Care Nurse (Patient Skill Levels: A, B, C) ○ Alternate Care Provider, Safety Officer, Extern, Patient Helper (Patient Skill Levels C,D)
Professional Responsibility	Ensure redeployed health professionals have understanding of regulatory guidance for scope of practice and standards of care during COVID-19	e.g. CNO COVID-19 Practice Resources https://www.cno.org/en/trending-topics/covid-19-practice-resources/
Orientation/ Skill Development	Provide streamlined education ensuring integration of safety processes, including method for follow-up in new clinical context	COVID and Critical Care Learning, Simulation (Appendix E)
Working with Unregulated staff	Ensure clinical teams understand their responsibilities when working with unregulated care providers, including delegation	e.g. CNO Practice Guideline: Working with Unregulated Care Providers https://www.cno.org/globalassets/docs/prac/41014_workingucp.pdf
Team Based Processes	Provide local team training and standardized tools to support integration of new roles: communication strategies, safety processes and debriefing	e.g. SBAR, daily team huddles, intentional rounding, and safety checks
Leader Roles	Strategies to welcome and integrate new team members: identification of ongoing learning needs, gaps, safety concerns, team wellness	Team check-ins, leader rounding, communication strategy
Evaluation	Consistent evaluation of Pandemic Staffing Plan and Strategy with regular review of patient needs, team-based model processes	Monitor patient acuity, quality, safety, and workload

02/06/2021

Critical Care Services Ontario https://drive.google.com/drive/folders/1vN4d2f3suTc2pxa_qQ9DvvLfueZ2mR8Z

Oxygen titration, oxygen delivery devices, mechanical ventilation, and suctioning

Consequences of too little oxygen - hypoxia

Hypoxia		
	Effects	Risks
Respiratory system	- Increased ventilation - Pulmonary vasoconstriction	- Pulmonary hypertension
Cardiovascular system	- Coronary vasodilation - Decreased systemic vascular resistance (transient) - Increased cardiac output - Tachycardia	- Myocardial ischemia/infarction - Ischemia/infarction of other critically perfused organs - Hypotension - Arrhythmias
Metabolic system	- Increased 2,3-DPG - Increased CO_2 carriage (Haldane effect)	- Lactic acidosis
Neurological system	- Increased cerebral blood flow due to vasodilation	- Confusion - Delirium - Coma
Renal system	- Renin-angiotensin axis activation - Increased erythropoietin production	- Acute tubular necrosis

College of Respiratory Therapists of Ontario Oxygen Therapy Best Practice Guideline November 2013

Consequences of too much oxygen - hyperoxia

Hyperoxia		
	Effects	Risks
Respiratory system	- Decreased ventilation	- Worsened ventilation / perfusion matching - Absorption atelectasis
Cardiovascular system		- Myocardial ischemia (in context of decreased haematocrit) - Reduced cardiac output - Reduced coronary blood flow - Increased blood pressure - Increased reactive oxygen species
Metabolic system	- Decreased 2,3-DPG - Decreased CO_2 carriage (Haldane effect)	- Increased reactive oxygen species
Neurological system	- Decreased cerebral blood flow	
Renal system		- Reduced renal blood flow

College of Respiratory Therapists of Ontario Oxygen Therapy Best Practice Guideline November 2013

Oxygenation Classification

	PaO2	SpO2 %
Mild Hypoxemia	60-79 mm Hg	90-94%
Moderate Hypoxemia	40 – 59 mm Hg	75-89%
Severe Hypoxemia	< 40 mm Hg	< 75 %

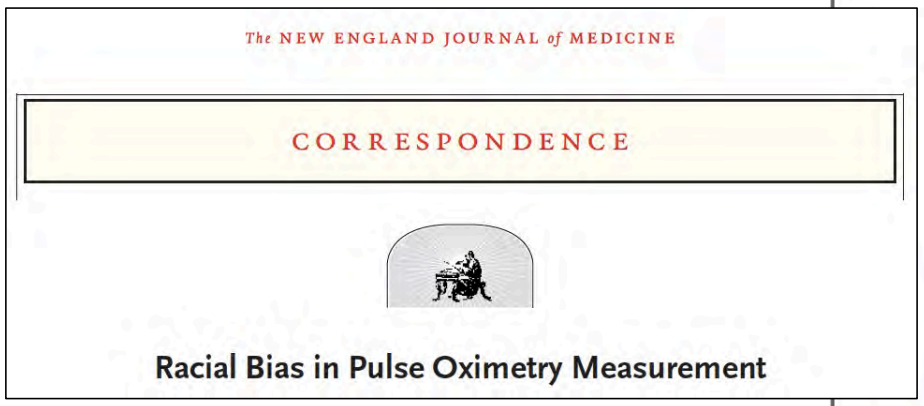
When is Oxygenation Concerning?

- FiO2 ≥ 0.6
- SpO2 ~ 90%

Slide Credit: Tom Piraino, RRT

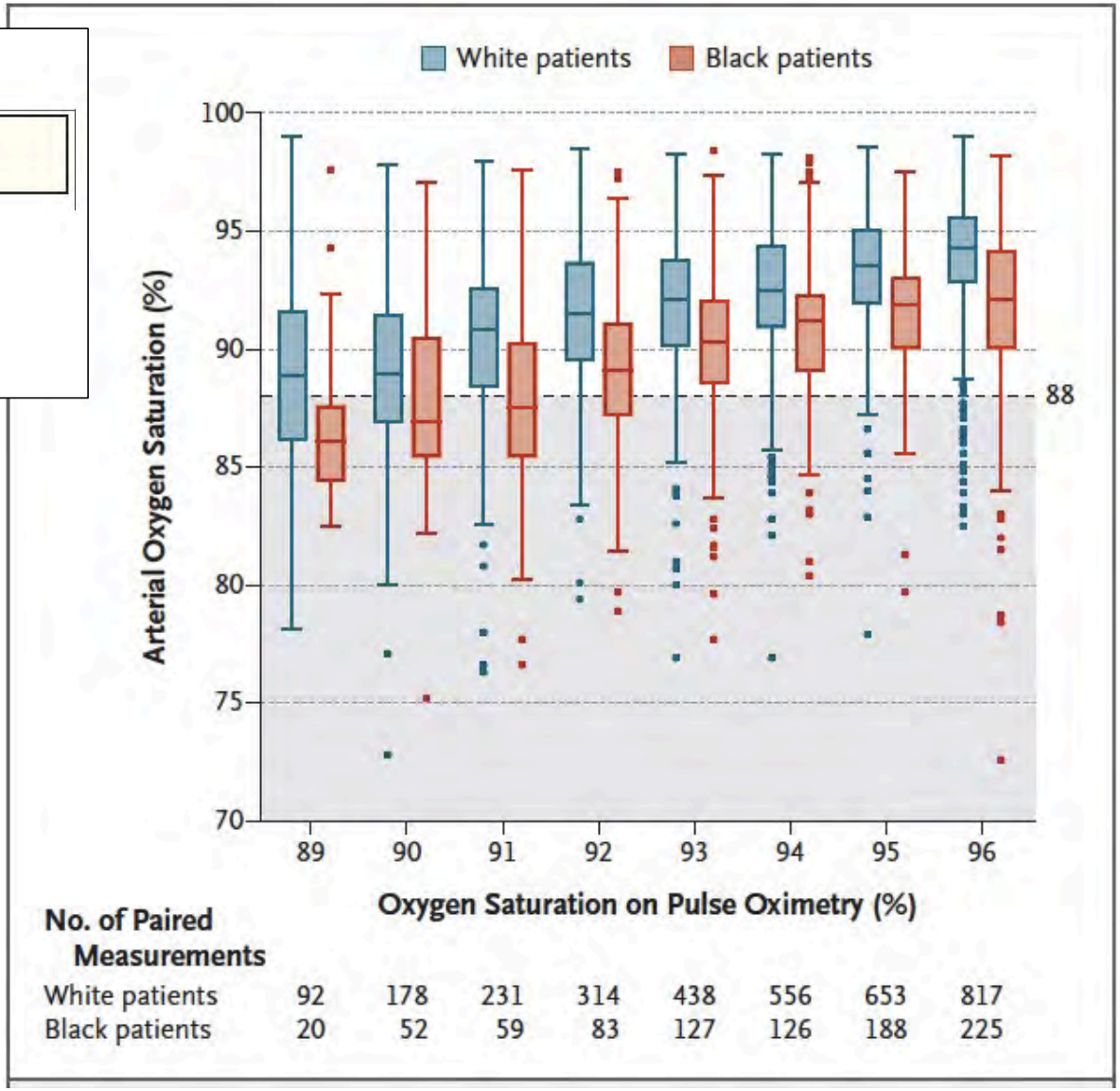
Estimating PaO2 with SpO2

SpO2 (%)	PaO2 (mmHg)
80	44
81	45
82	46
83	47
84	49
85	50
86	52
87	53
88	55
89	57
90	60
91	62
92	65
93	69
94	73
95	79
96	86
97	96
98	112
99	145



Sjoding et al., NEJM, 2020. 383;25

- Paired measures of SpO_2 and PaO_2 can be lower in black patients than in white patients
- SpO_2 may *over*estimate actual PaO_2 in black patients
- Consider your respiratory assessment and observation in black patients



Indications, contraindications, and adverse effects of supplemental oxygen administration

Indications

- **Documented hypoxemia** - decreased PaO2 in the blood below normal range
  - PaO_2 of < 60 torr or SaO_2 of < 90% in patients breathing room air, or with PaO_2 and/or SaO_2 below desirable range for specific clinical situation
- **Acute situation** w/ suspected hypoxemia
- Severe trauma
- Short-term therapy (e.g., carbon monoxide poisoning) or surgical intervention (e.g., post-anesthesia recovery).
- Pneumothorax absorption

Absolute Contraindications

- Patient/Client does not consent to receiving the oxygen
- Use of some O2 delivery devices
  - Nasal cannulas and nasopharyngeal catheters in neonates and pediatric patients that have nasal obstructions

Adverse Effects

- Oxygen toxicity
- Oxidative stress
- Depression of ventilation in a select population with chronic hypercarbia (e.g., COPD)

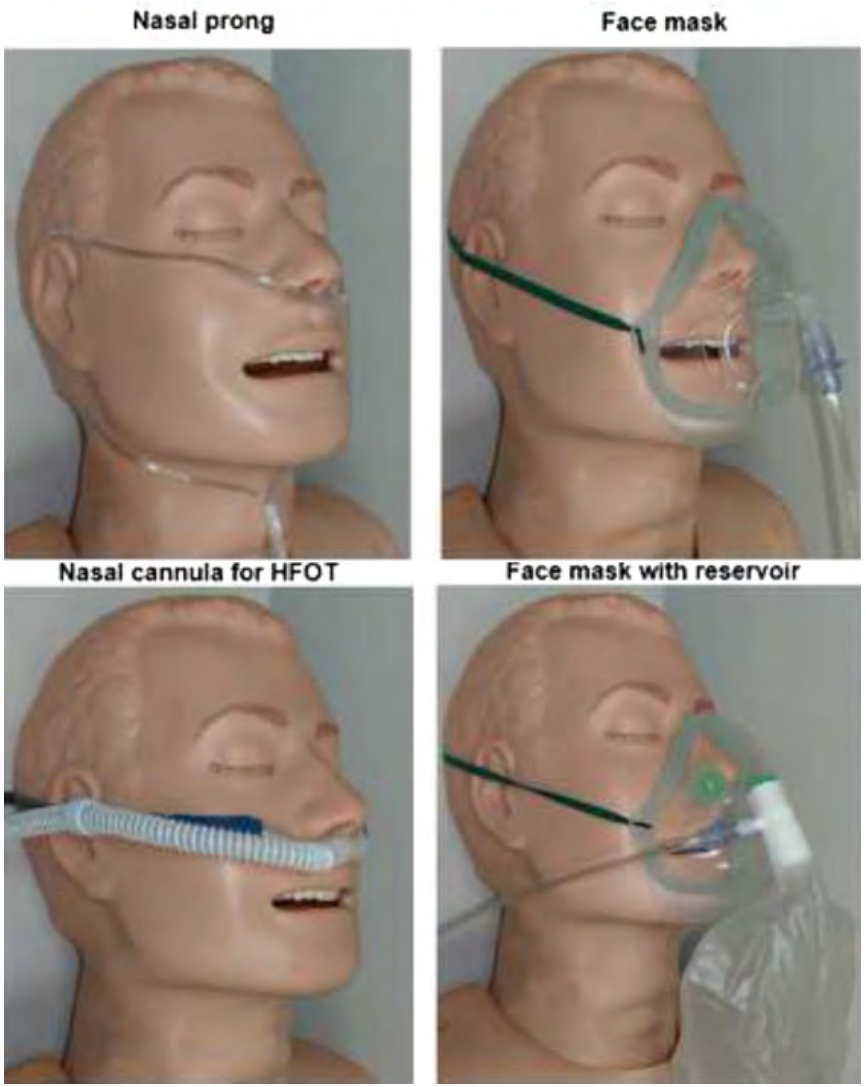
College of Respiratory Therapists of Ontario Oxygen Therapy Best Practice Guideline November 2013

Oxygen Delivery Systems

Least support

Most support

- Nasal prongs or cannula
- Face mask
- High flow nasal cannula
- Face mask with reservoir
- Mechanical ventilation
  - Non-invasive or invasive



Nasal cannula / prongs

Flow rate (L/min)	Estimated FiO_2
1	0.24
2	0.28
3	0.32
4	0.36
5	0.40
6	0.44

Oxygen Masks

Device	Simple	Venturi	Non-rebreather
O_2 Stability	Variable	Fixed	Variable
FiO_2	35% - 50%	24% - 50% or 60%	~100%
Flow Rate	6-10 L/min	3-15 L/min	8-15 L/ min

*To increase FiO2, identify the proper adapter *first*, then adjust flow rate

Mechanical Ventilation

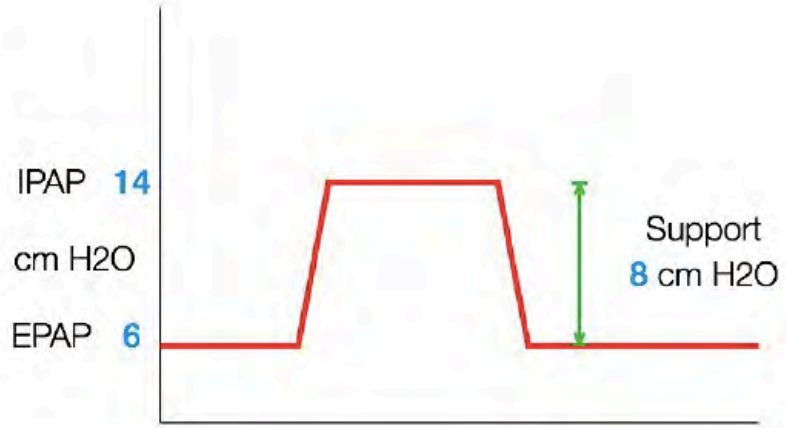
Non-invasive:

- Continuous Positive Airway Pressure (CPAP)
- Bilevel Positive Airway Pressure (BiPAP)
- CPAP and BiPAP both typically delivered by mask, and mode determined by ventilator settings

Invasive Mechanical ventilation

Non-Invasive Ventilation

- CPAP = continuous positive airway pressure
  - Can assist with maintaining airway opening
  - Minimize atelectasis
  - No support during inspiration
    - No augmentation of tidal volume
- BiPAP = Bivel positive airway pressure
  - All of the benefits of CPAP
  - Augment tidal volume
  - Provide inspiratory support



Slide Credit: Tom Piraino, RRT

NIV and physical therapy/ rehabilitation

- NIV is *not* a contraindication for physical therapy / rehabilitation activities
- Tolerance of NIV is heavily affected by the interface (mask) and this may create a challenge for the level of mobility

						
Patient Assessment	Unresponsive/ rousable but not following commands Or Sedated	Fluctuating LOC/ inconsistently following commands; Unable to lift arm/leg off bed	Opens eyes, follows simple commands; Moderate weakness in arm/leg, unable to sit up independently	Mild weakness in arm/leg, able to move against gravity, unable to stand independently	Able to stand and transfer to chair with assist	Minimal assist/ Independent with mobility
SAS Score	**1-2**	**3-5**	**3-5**	**4-5**	**4-5**	**4-5**
RASS Score	-3 to -1	-2 to -1	0	0	0	0

Slide Credit: Tom Piraino, RRT

Mechanical ventilation terminology

FiO_2	Fraction of inspired oxygen
PEEP (cm H_2O)	Positive end-expiratory pressure
Trigger Sensitivity	The criteria used by the ventilator to determine patient effort

Slide Credit: Tom Piraino, RRT

Common Modes of Ventilation Inspiratory Support

	Volume	Flow	Pressure	Cycle	Frequency
Volume Assist Control	**Controlled**	Controlled	Determined by respiratory system	Volume or Time	Minimum rate is set, patient can breath above
Pressure Assist Control	Determined by respiratory system	Variable	**Controlled**	Time	Minimum rate is set, patient can breath above
CPAP with Pressure Support	Determined by respiratory system and patient demand	Variable	**Controlled**	% of peak flow	No set rate, patient controls the rate

Slide Credit: Tom Piraino, RRT

Invasive ventilation and physical therapy/ rehabilitation

- Invasive mechanical ventilation is *not* a contraindication for physical therapy / rehabilitation activities
- If a patient is on an “Assist-Control mode”, activities that increase respiratory rate may lead to air-trapping and patient discomfort

						
Patient Assessment	Unresponsive/ rousable but not following commands Or Sedated	Fluctuating LOC/ inconsistently following commands; Unable to lift arm/leg off bed	Opens eyes, follows simple commands; Moderate weakness in arm/leg, unable to sit up independently	Mild weakness in arm/leg, able to move against gravity, unable to stand independently	Able to stand and transfer to chair with assist	Minimal assist/ Independent with mobility
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RASS Score	-3 to -1	-2 to -1	0	0	0	0

Slide Credit: Tom Piraino, RRT

Mechanical ventilation, sedation, and rehabilitation

- Considerations related to mechanical ventilation normally co-exist with the level of critical illness and likely correlate with level of sedation
- These considerations should not prevent mobility/activity, but may limit the maximum level that can be achieved

						
Patient Assessment	Unresponsive/ rousable but not following commands Or Sedated	Fluctuating LOC/ inconsistently following commands; Unable to lift arm/leg off bed	Opens eyes, follows simple commands; Moderate weakness in arm/leg, unable to sit up independently	Mild weakness in arm/leg, able to move against gravity, unable to stand independently	Able to stand and transfer to chair with assist	Minimal assist/ Independent with mobility
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RASS Score	-3 to -1	-2 to -1	0	0	0	0

Slide Credit: Tom Piraino, RRT

- If a patient can get bathed, they can get PT! / rehabilitation
- Patients with low SpO2 will likely have low SaO2
- A patient with low hemoglobin is a disadvantage for tissue oxygenation particularly when SaO2 or cardiac output is low
  - Consider the hemoglobin
  - Consider the hemodynamic status of the patient
  - Consider less 'Active' forms of mobility until these issues are corrected

						
Patient Assessment	Unresponsive/ rousable but not following commands Or Sedated	Fluctuating LOC/ inconsistently following commands; Unable to lift arm/leg off bed	Opens eyes, follows simple commands; Moderate weakness in arm/leg, unable to sit up independently	Mild weakness in arm/leg, able to move against gravity, unable to stand independently	Able to stand and transfer to chair with assist	Minimal assist/ Independent with mobility
SAS Score	**1-2**	**3-5**	**3-5**	**4-5**	**4-5**	**4-5**

Slide Credit: Tom Piraino, RRT

Types of physical therapy / rehabilitation treatments & effects on oxygenation

	Positioning and airway clearance (chest physiotherapy)	Mobilization / Physical activity
Cardiopulmonary	↑ lung volumes ↑ lung capacities ↓ work of breathing ↑ mobilization of secretions	↑ tidal volume ↑ respiratory rate ↑ mobilization of secretions
Cardiovascular	↓ work of the heart	↑ cardiac output ↑ stroke volume and heart rate ↑ oxygen dissociation and extraction at tissue

Adapted from Main and Denehy, 2016 p. 321

Suctioning

Click here to access suctioning video

Teaching Video: https://www.youtube.com/watch?v=blSMSuWEiPA

Indications

- Remove pulmonary secretions
- Inability to clear secretions when audible/ visible evidence persistent in large airways despite patient's best cough effort
  - Visible secretions in airway, Increased tactile fremitus
- Auscultation of coarse, gurgling breath sounds, or diminished breath sounds
- Suspected aspiration
- Clinically apparent increased work of breathing
- Deterioration in arterial blood gases – hypoxemia/ hypercarbia
- Stimulate cough
- Maintain patency of artificial airway
- Obtain sputum sample

No absolute contraindications

- Relative to risk
- Failing to suction may be lethal

Respir Care 2010;55(6):758 –764

Monitors and common lines, tubes, and catheters

Reading the bedside monitor

Heart rate (green)

Arterial blood pressure (red)

Central venous pressure (orange)

Oxygen saturation (SpO2, blue)

Respiratory rate (white)

Interpreting Vital Signs

Parameters Indicating a Lack of Readiness for Physical Therapy Interventions

Pulmonary Measures[30,40–45]

- SaO_2: <88% or patient experiences a 10% oxygen desaturation below resting SaO_2
- Respiratory rate: >35 breaths/min
- PEEP: >10 cm H_2O
- FIO_2: ≥0.6

Cardiovascular Measures[30,40–45]

- Mean arterial pressure: <65 or >120 mm Hg or ≥10 mm Hg lower than normal systolic or diastolic blood pressure for patients receiving renal dialysis
- Resting heart rate: <50 or >140 bpm
- Systolic blood pressure: <90 or >200 mm Hg
- New arrhythmia developed (including frequent ventricular ectopic beats or new onset atrial fibrillation)
- New onset angina-type chest pain

Normal Vital Signs:
SpO2: 95-100%
Respiratory Rate: 12-20 bpm
HR: 80-100 bpm
BP: 120/80 mm Hg

Nordon-Craft et al., Phys Ther. 2012;92:1494–1506.

Systematic assessment of a patient in the ICU

Mechanical ventilator

Arms Note: Don't take a manual blood pressure on the same side as a PICC line or a dialysis fistula

Nose, mouth, neck

(e.g., NG tube, endotracheal tube, tracheostomy, central venous catheter)

Thorax

(e.g., central venous catheter (subclavian), chest tube, Jackson-Pratt (JP) drain, abdominal VAC dressing (abdominal binder?))

Arms

(e.g., IVs, PICC (peripherally-inserted central catheter), arterial line, SpO_2)

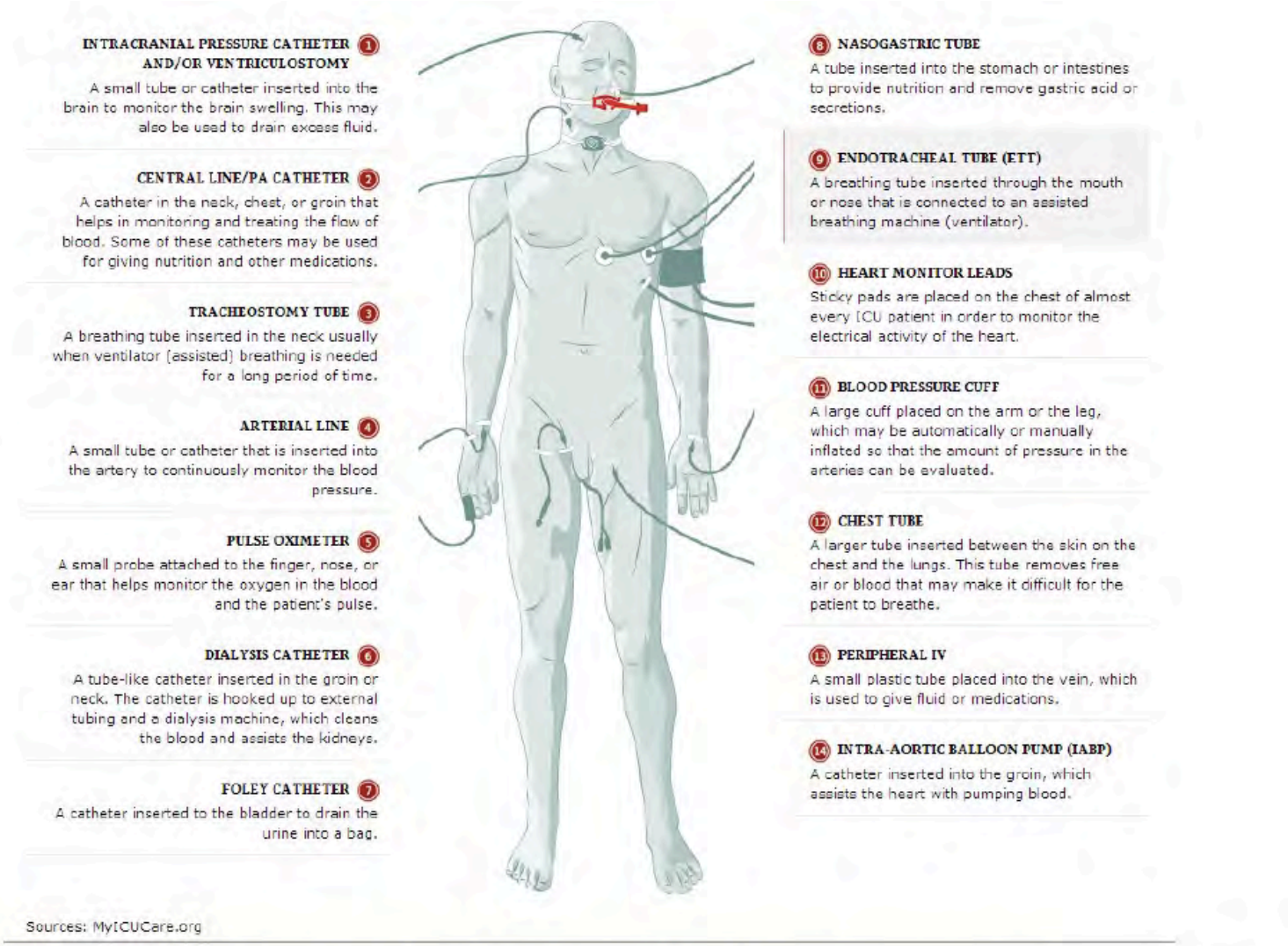
Groin

(e.g., Foley catheter, rectal tube)

Legs

(e.g., Femoral catheter (venous or arterial), pedal IV, sequential compression devices (moon boots))

Additional information available in online resources



http://www.theglobeandmail.com/life/health/end-of-life/the-links-to-life-for-a-patient-in-critical-care/article2246280/#

Typical devices/ containers below the bed

Sequential compression (moonboots) device controller

Chest tube drainage system (right)
Urine collection bag (left)

Urine collection bag (left)
Forced air (e.g. Bair hugger) airflow warming/ cooling unit (right)

Typical devices above and beside the bed

IV pumps, feeding pump (not shown)

Mechanical ventilator

Pressure bag – likely arterial line or central venous pressure

Typical lines, catheters, and tubes

Intravenous (IV) catheter in hand vein

Pulse Oximetry (SpO_2)

Central venous catheter (internal jugular vein in picture)
Also can be placed in other veins: subclavian, femoral

Radial arterial line (Blood pressure)

Nasogastric tube
Also can be placed in mouth (orogastric tube)

Arterial line: http://img.medscape.com/pi/features/slideshow-slide/radial-artery/fig17.jpg
Central Line: http://www.allegromedical.com/wound-care-c541/tegaderm-w-brdr-4-x-4-3-4-p549331.html
IV, SpO2, NG tube: Nursing Times 21.08.12 / Vol 108 No 34/35
http://dalemed.com/portals/0/images/product-pgs/Naso-prod-img.jpg

Pulling it all together

Pressure bag

Radial Arterial Catheter

Under the bed: Urine collection bag/ chest tube drainage system

ECG wires

Arterial blood pressure

Monitor

Endotracheal tube

Mechanical ventilator

Nasogastric tube

Central venous catheter (internal jugular)

SpO2

Peripheral IV

Feeding pump (*not shown*)

IV pump

Controlled acts and resources

***This portion of the presentation is for information purposes only. This information pertains to the Standards of the College of Physiotherapists of Ontario (CPO). Please note that this information may not be applicable to all jurisdictions. All Regulated Health Professionals looking for direction should connect with their Provincial Regulators to ensure any and all requirements are being met.**

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Controlled Act-CPO

Physiotherapists who perform controlled acts under their own authority must roster for each of these activities with the College. These include:

- tracheal suctioning
- spinal manipulation
- acupuncture (including dry needling)
- treating a wound below the dermis
- pelvic internal exams (this includes putting an instrument, hand or finger, beyond the labia majora, or beyond the anal verge)
- administering a substance by inhalation
    - https://www.collegept.org/rules-and-resources/controlled-acts-and-restricted-activities

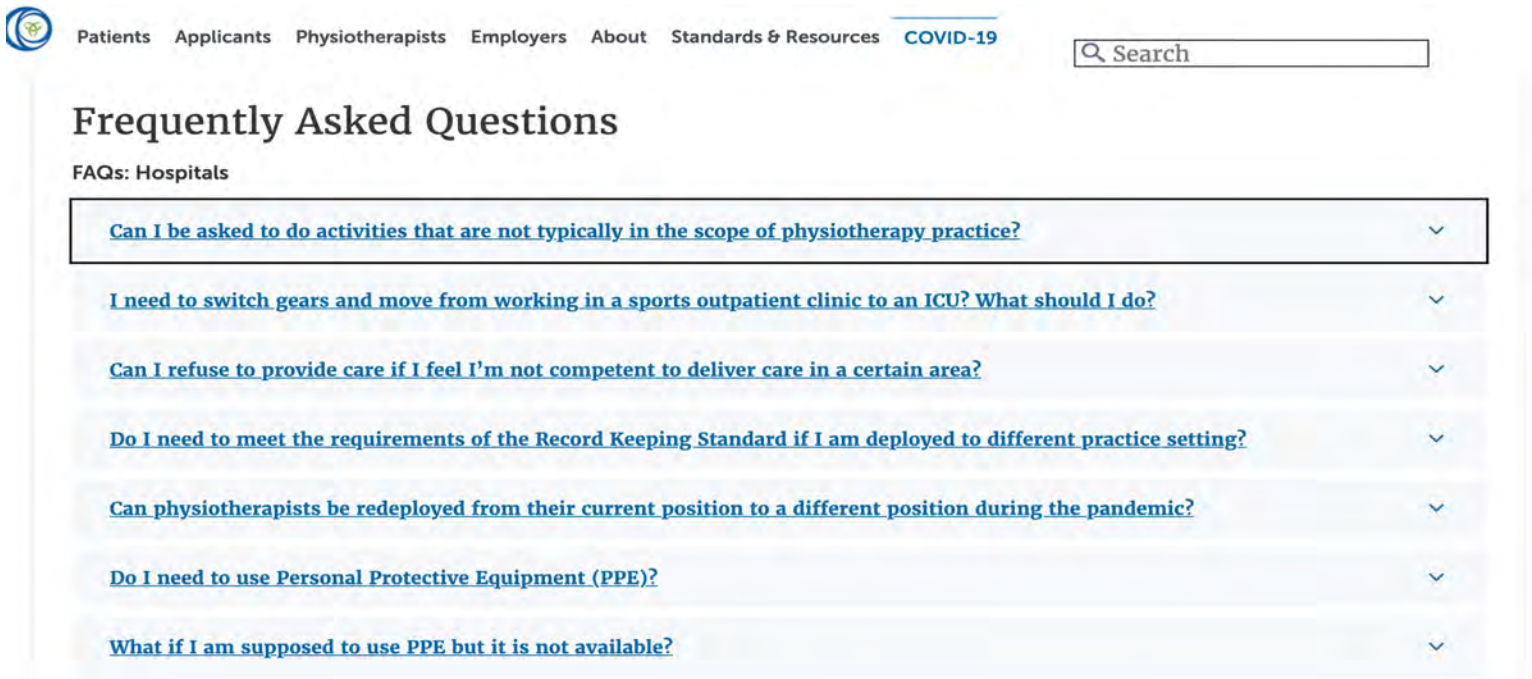
Authority and Responsibility

- Physiotherapists must have the authority to perform a controlled or legally restricted act. They get this authority from legislation, delegation, or a transfer of authority.
- Every ***controlled act*** performed by a physiotherapist must be within the scope of practice of physiotherapy.
- Physiotherapists are responsible both for deciding to offer a controlled act and for performing it.
- Physiotherapists who are asked by the College must be able to show that they meet the requirements in this standard.
    - https://www.collegept.org/rules-and-resources/controlled-acts-and-restricted-activities

Education and Training

- Physiotherapists must be able to prove that they have successfully completed training for the controlled acts they perform. This can be formal education or training delivered on the job. During the training, the physiotherapist must:
- Learn the indications, contraindications, adverse outcomes, and risks associated with performing the controlled act.
- Practise the controlled act under the supervision of a person who is authorized to perform it.
- Be evaluated on the knowledge, judgement, and practical skills needed to perform the controlled act.
- Show that they are able to safely and competently perform the controlled act.
    - https://www.collegept.org/rules-and-resources/controlled-acts-and-restricted-activities

Frequently Asked Questions (CPO-COVID-19/Hospitals)



https://www.collegept.org/coronavirus/hospitals

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Rehabilitation for Patients with COVID-19
Guidance for Occupational Therapists, Physical Therapists, Speech-Language Pathologists, and Assistants

Réadaptation pour les patients atteints de la COVID-19
Conseils pour les ergothérapeutes, physiothérapeutes, orthophonistes et assistant de réadaptation

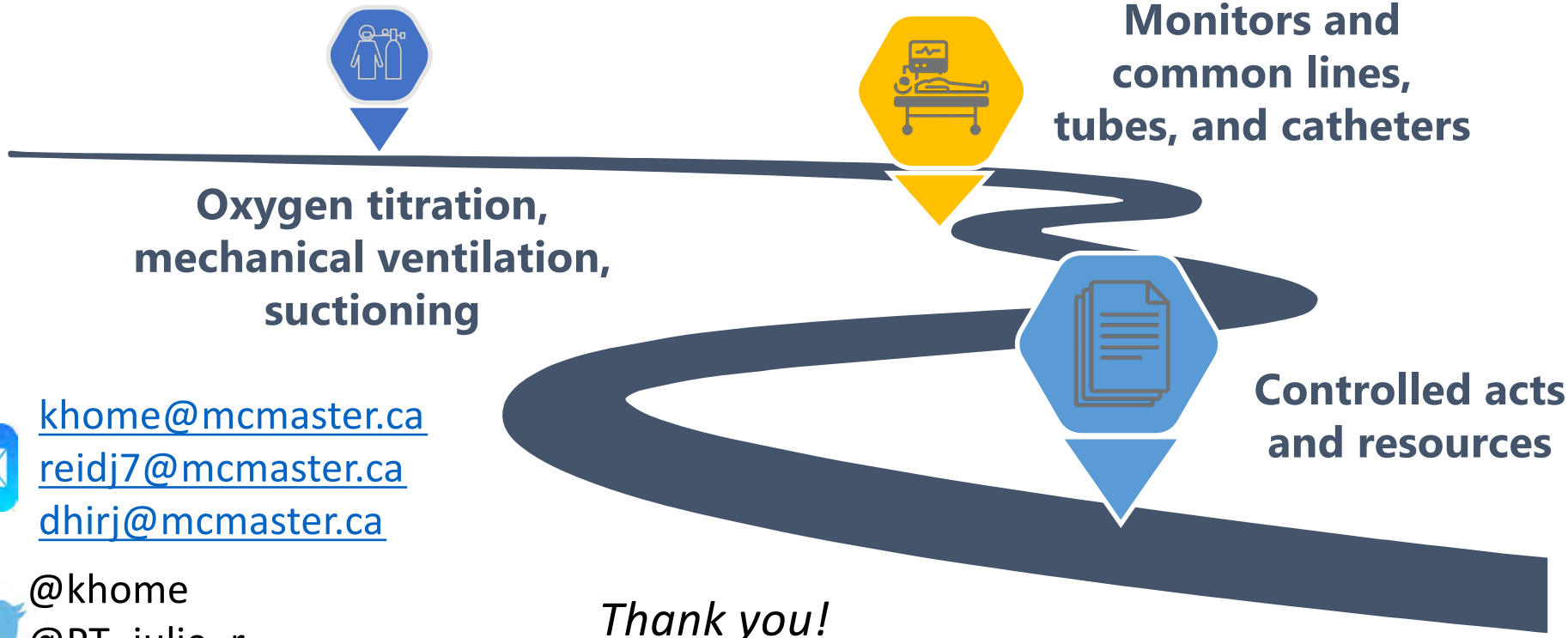
1. Complete point of care risk assessment before each patient interaction

2. Do as much as possible without patient contact
   - Limit therapist exposure to virus
   - Preserve personal protective equipment (PPE)

3. If direct patient contact required, determine type of PPE needed
   - Emphasis on *aerosol generating procedures* for airborne precautions
   - Access to N95 masks

Additional information available in online resources

Summary of today's talk



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Thank you!
We are so grateful for your help

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