Ontario Critical Care Clinical Practice Rounds (OC3PR): COVID-19

October 20 2022

Prolonged Ventilation Weaning in ICU

Chaired by Dr. Dave Neilipovitz

Presented by Dr. Ian Fraser

Meeting Etiquette

- Attendees can submit questions to Q&A in the Zoom chat.
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Prolonged-ventilation Weaning in the ICU

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Learning Objectives

Define

Acute, prolonged and long-term ventilation

Identify

Process barriers to prolonged ventilation weaning

Common reversible factors to prolonged ventilation weaning

Understand

Quality standards for care (*Action 11 framework*)

Options for management including

Referral to pilot long-stay ICU units,

Long-term ventilation strategy including Prolonged-ventilation Weaning Centre (PWC)

Virtual consultation.

Starting Point: *Expertise in acute ICU ventilation weaning & ICU liberation (ABCDEF) protocols*

1. Marra A, Ely EW, Pandharipande PP, Patel MB. The ABCDEF Bundle in Critical Care. Crit Care Clin. 2017 Apr;33(2):225–43. 2. Devlin JW, Skrobik Y, Gélinas C, Needham DM, Slooter AJC, Pandharipande PP, et al. Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU. Crit Care Med. 2018 Sep;46(9):e825–73.

What is prolonged-ventilation in the ICU?

1. Physiologically stable patient
2. Repeatedly unsuccessful weaning attempts
3. Consideration of the patient's wishes

Other Considerations

- Patient characteristics (underlying disease, presence of comorbidity and cognitive status)
- Diagnosis & prognosis
- Anticipated quality of life
- Consideration of patient & family motivation
- Establishment of a ventilator weaning plan

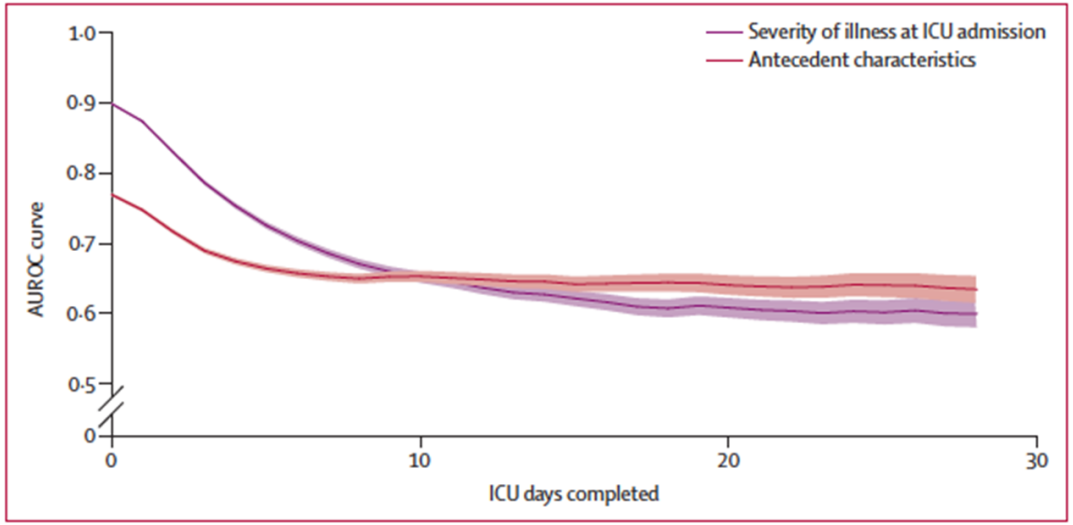

Figure 3: **Predictiveness of severity of illness at ICU admission and antecedent characteristics for hospital mortality in the validation cohort**
Shaded areas are 95% CIs. The appendix contains all characteristics and regression weights (β coefficients from derivation sample). AUROC=area under the receiver operating characteristics. ICU=intensive care unit.

Rose L, Fowler RA, Goldstein R, Katz S, Leasa D, Pedersen C, et al. Patient transitions relevant to individuals requiring ongoing ventilatory assistance: A Delphi study. Can Respir J. 2014;21(5):287–92
Iwashyna TJ, Hodgson CL, Pilcher D, Bailey M, Lint A van, Chavan S, et al. Timing of onset and burden of persistent critical illness in Australia and New Zealand: a retrospective, population-based, observational study. The Lancet Respiratory Medicine. 2016 Jul 1;4(7):566–73.

What is prolonged-ventilation in the ICU?

- 1 in 10 Vented ICU beds (11%)
- 50% one-year mortality
- 50% readmission rate within 1 year
- 90% diversion rate from invasive long-term ventilation
- CCSO stats (May 31, 2022)
  - 258 Long Stay patients
  - Median = 41.0, IQR (24.0-79.0) Range (11-618) Vented days

- Multiple transitions of care post acute care discharge
- Significant risk of caregiver anxiety & depression after acute care discharge
- Low probability of return to independent living in the community
- Estimated up to 30% ICU costs

Rose L, Fowler RA, Fan E, Fraser I, Leasa D, Mawdsley C, et al. Prolonged mechanical ventilation in Canadian intensive care units: A national survey. Journal of Critical Care. 2015 Feb 1;30(1):25–31.
Rose L, Fraser IM. Patient characteristics and outcomes of a provincial prolonged-ventilation weaning centre: a retrospective cohort study. Can Respir J. 2012 Jun;19(3):216–20.1.
Parotto M, Herridge MS. Recovery after prolonged treatment in the intensive care unit. CMAJ. 2020 Nov 30;192(48):E1637..

Ventilator-dependence Model

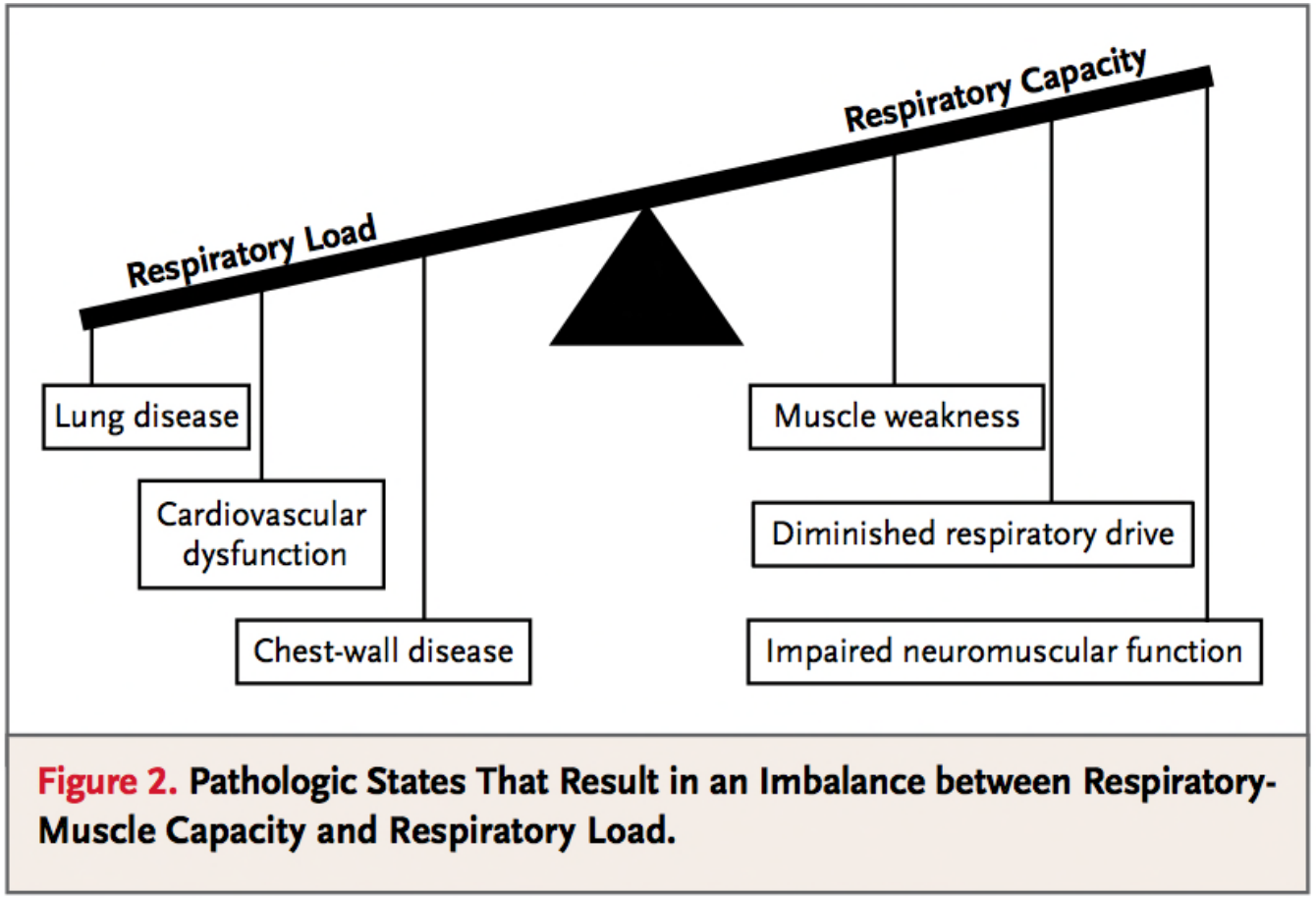

Figure 2. Pathologic States That Result in an Imbalance between Respiratory-Muscle Capacity and Respiratory Load.

John F. McConville, John P. Kress, Weaning Patients from the Ventilator N Engl J Med 2012;367:2233-2239

Common Unrecognized Individual Factors

Untreated hypothyroidism
Upper airway obstruction
Under-treated airway disease
Obesity-hypoventilation
Excess sedation
Unrecognized neuromuscular disease
Cardiac impairment
Sepsis (lines, catheters)
Pleural effusions/Fluid overload
Absence of shared understanding of natural history of disease with family

QI Audit (n=100) – Prolonged-ventilation Weaning Centre (PWC), MGH/TEHN

Barriers to Prolonged-ventilation Weaning

- Competing priorities of acute ICU
- Staffing Shortages
- Developing & Implementing Individualized Care Plan
  - Weaning, Communication with patient, Mobilization, Nutrition, Minimal Sedation, Psychological Management (Anxiety, Delirium, Depression, Sleep)
- Ensuring continuity of weaning care plan
  - day to day, weekday to weekend & week to week
- Patient/Family/ICU Team Discordance
- Intrinsic prolonged recovery from critical illness

Organizational and Team-Level Determinants of Effective Care for Prolonged ventilation

- Leadership
- Physician staffing
- Nursing staffing
- Protocols & pathways
- RRT, PT and OT staffing
- Ancillary staffing
- Team meetings
- Physical Plant

Rak KJ, Ashcraft LE, Kuza CC, Fleck JC, DePaoli LC, Angus DC, et al. Effective Care Practices in Patients Receiving Prolonged Mechanical Ventilation. An Ethnographic Study. Am J Respir Crit Care Med. 2020 Feb 5;201(7):823–31.

Organizational and Team-Level Determinants of Effective Care for Prolonged ventilation

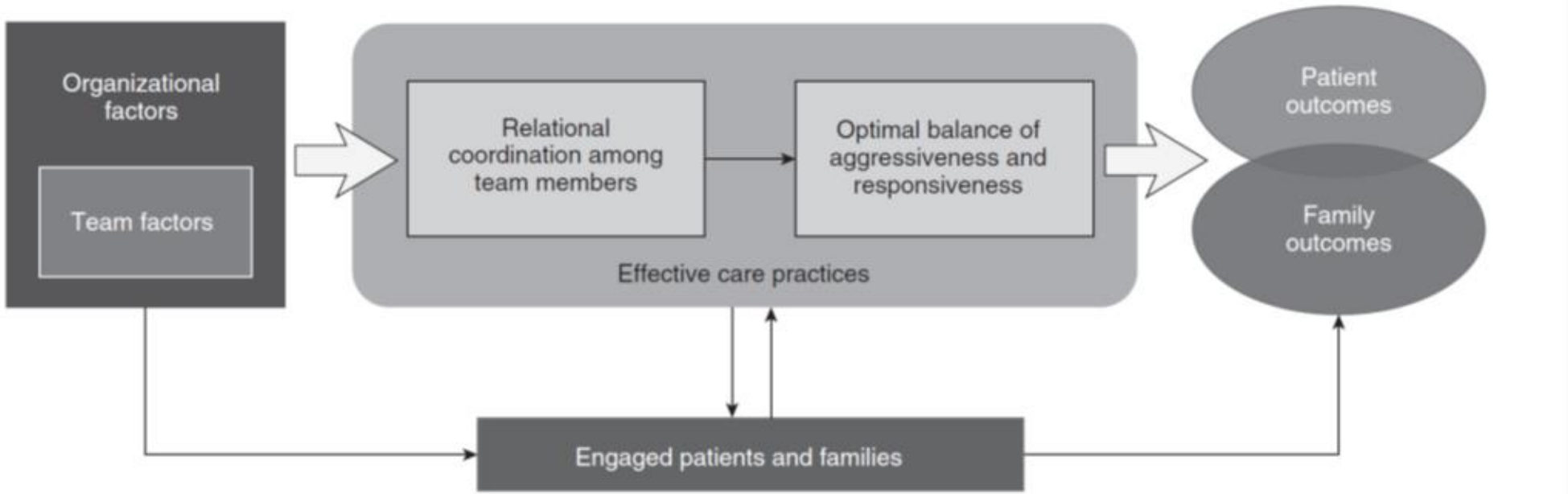

Figure 1. Conceptual framework for the care of patients receiving prolonged mechanical ventilation. This framework, derived from an ethnographic evaluation at eight long-term acute care hospitals, holds that patient and family outcomes are optimized when care achieves a balance of aggressiveness and responsiveness. Although typically this balance requires a trade-off between aggressiveness and responsiveness, care can be made both more aggressive and more responsive through relational coordination (i.e., task-oriented collaboration between care providers). Patient and family factors can influence, and be influenced by, these relationships. Relational coordination is also influenced by discrete organizational and team-level factors that are common at high-performing hospitals.

Rak KJ, Ashcraft LE, Kuza CC, Fleck JC, DePaoli LC, Angus DC, et al. Effective Care Practices in Patients Receiving Prolonged Mechanical Ventilation. An Ethnographic Study. Am J Respir Crit Care Med. 2020 Feb 5;201(7):823–31.

Action 11 Checklist

Patients, Families and Providers Improving Quality Together	
1	Involve patient and family in goal setting and decision making
2	Provide aids to help patients communicate (including method to access help)
3	Promote physical comfort and minimize complications
4	Promote self-care and restore normalcy
5	Optimize ventilator weaning
6	Optimize physical therapy
7	Assess swallowing function and establish safe return to normal drinking and eating
8	De-escalate/optimize pharmacotherapy including past medications for existing comorbidities
9	Assess and treat psychological issues
10	Minimize delirium risk
11	Appropriate referrals are made

Co-designed/consensus-based patient and family-centered actionable quality processes

Rose L, Istanboulian L, Amaral ACKB, Burry L, Cox CE, Cuthbertson BH, et al. Co-designed and consensus based development of a quality improvement checklist of patient and family-centered actionable processes of care for adults with persistent critical illness. Journal of Critical Care. 2022 Dec 1;72:154153.

5. Optimize ventilator weaning

- ❑ Assess and track ventilator weaning progress
- ❑ Use a structured tool (protocol or individualized weaning plan) to plan and guide weaning
- ❑ Include the patient (when able) and family in the development of the weaning plan
- ❑ Assess readiness to deflate the tracheostomy cuff, downsize or decannulate the tracheostomy as part of the weaning process
- ❑ Use strategies to manage excess secretions or inability to cough up secretions
- ❑ Assess endocrine function and treat in relation to weaning failure

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How can you improve the process of care?

Step	Prolonged ventilation weaning in ICU	Interventions
Plan	*Set Daily Goals*	Therapist-driven weaning protocols Measure Delirium (e.g. CAM-ICU) Measure Mobility (CCSO Early Mobility Toolkit) Communication Strategy (verbal & non-verbal) Action 11 Priorities
Do	*Ensure Continuity*	Continuity Intensivist model Nurse-specialist, NP or RRT coordinator Align interprofessional team Dedicated interprofessional weekly rounds Proactively scheduled regular patient/family meetings Order sets (Rehab, Nutrition, Sedation)
Study	*Trend Progress*	Graph Weaning Progress Dedicated health record notes/standard format Assign clear role accountability Weekly Interprofessional meetings
Act	*Individualize Care*	Involve patient & family in decision-making Consult experts (e.g. PWC Virtual consult) Non-Acute ICU environment (Specialized Unit Transfer)

Sampling of Provincial Resources for Prolonged & Long-term Ventilation

Medical Instability

Unit	System failure	Care setting & tracheostomy	London HSC	Mackenzie	Michael Garron (TEHN)	Toronto Grace	WestPark HC	Ottawa
Acute ICU	Single or Multisystem	Acute (+/- Trach)						
Non-acute ICU	Single or Multisystem	Acute (trach+ prolonged-ventilation	CIRP **	LSICU **	LSICU **			
Non-ICU Weaning Centre	Single Respiratory	Acute (trach + inhouse access to ICU)			PWC + Virtual consultation,			
Rehabilitation centre (+/- tracheostomy	Single Respiratory	Transition to home ventilation ICU Recovery				Weaning		Weaning
LTV beds	Single Respiratory	Long-term Care (Trach)						
Community	Single respiratory	OPD						

Provincial Long-term Ventilation Strategy

Renal replacement capacity , CIRP = Critical Illness Recovery Program (CIRP) , ** low dose IV vasopressors provided if necessary

Case Study (ICU day 3)

- 65 y.o. former 30 pack-year smoking obese (BMI 34) treated hypothyroid diabetic hypertensive widowed (lives alone) mother of 4 depression, atrial fibrillation, COPD (MRC =4), mild CKD (Cr 140) and past bowel resection for benign bowel obstruction (2018)
- Preadmit frailty score = 6
- Non-anglophone or -francophone as first language
- Acute hypercarbic COPDE secondary to diffuse CAP (COVID-19 PCR negative, influenza A +ve) requiring 24 hours of NIV in ICU
- Discharged to ward in the evening on weekend.

Case Study (ICU day 3)

- Readmitted to ICU within 24 hours after massive aspiration on ward
- “difficult” intubation
- resuscitated with invasive ventilation, IV fluid resuscitation, vasopressors, muscle paralysis, IV sedation and IV antibiotics.
- Labs: ABG 7.28 55 62 FIO2 0.5 PC 30/10 Vt 300 RR 20 Hb 90 Platelets 45 Cr 300 (ACEI stopped) Normal range Na, K, Ca, Mg, P

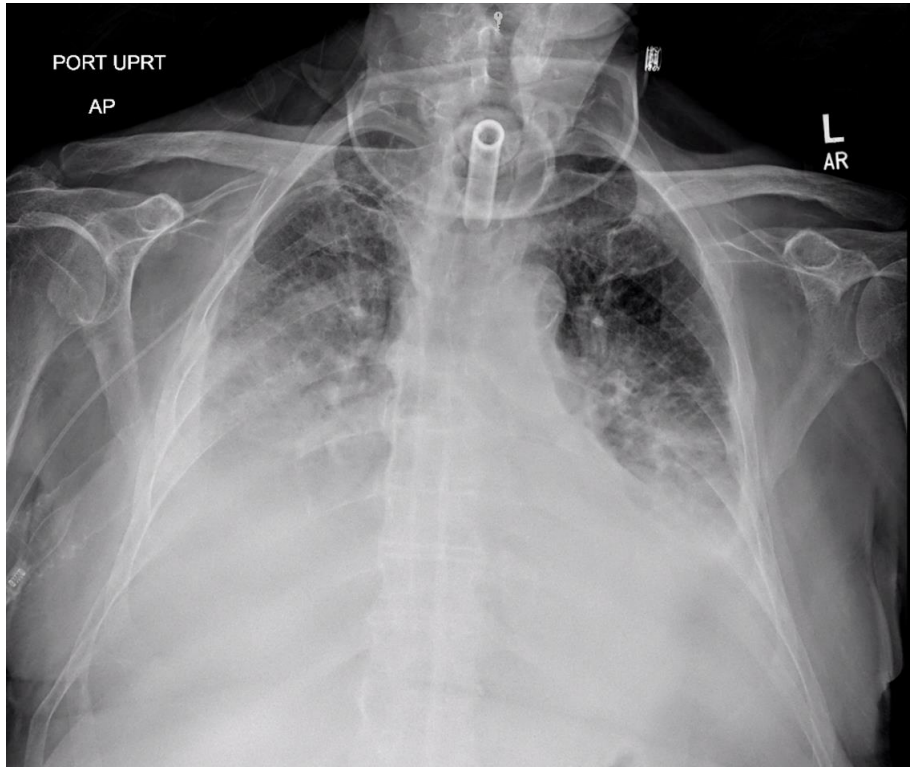
ICU day 14

Prolonged-ventilation?

- Tracheostomy & PEG tube inserted
- Failed weaning attempts (longest trach trial 15 minutes)
- Treated for VAP on day 10 (intermittent need for IV vasopressors)
- One family meeting (no identified single family contact)
- Worsening AKI – ? Need for renal replacement
- Conservatively treated GI bleed (Apixaban stopped)
- Ongoing delirium (small non-dominant embolic CVA on CT head)
- Lift to chair

ICU day 21

Prolonged-ventilation Weaning Centre Consult?
Other options?



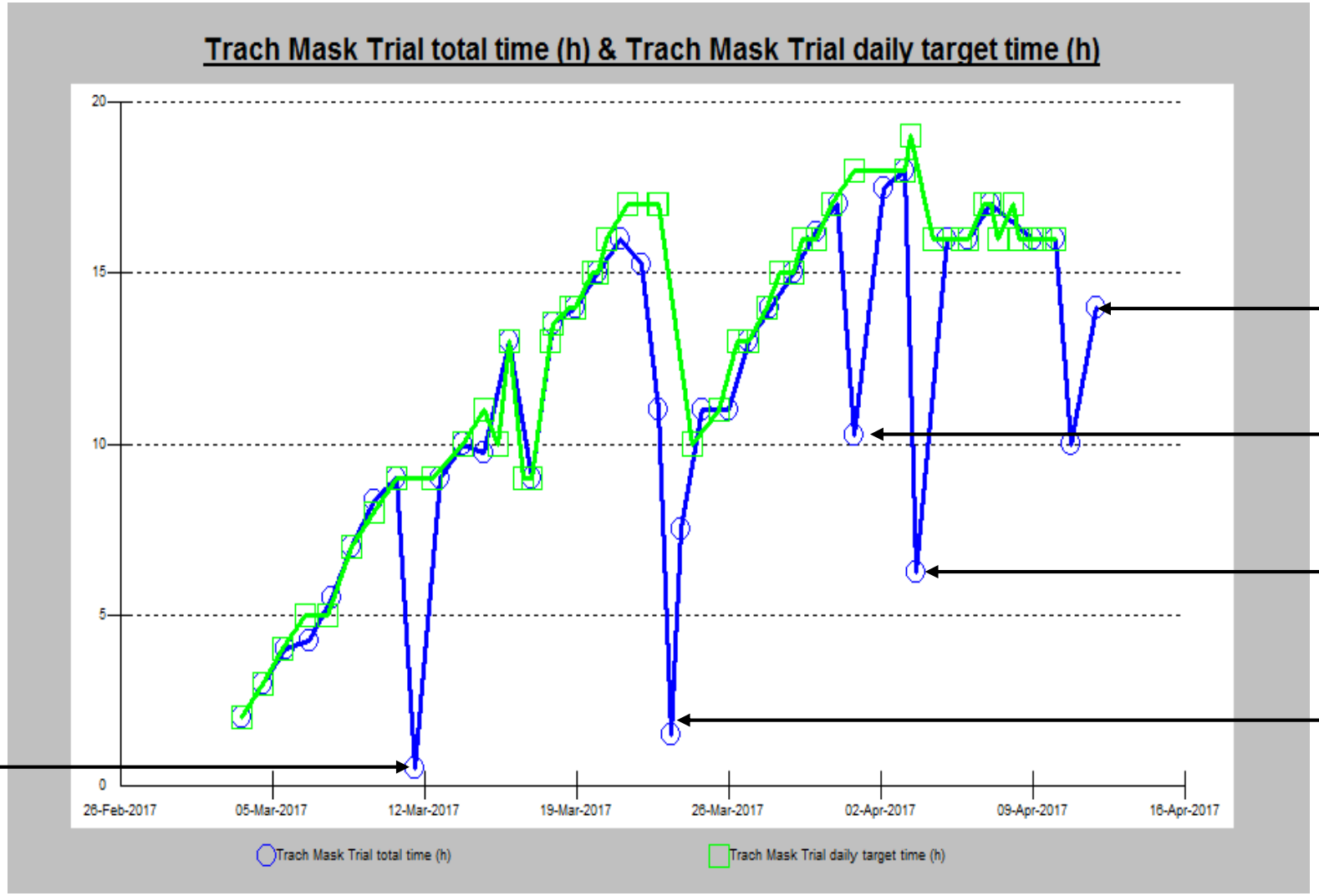
- Weaning progress (max = 1 hour trach mask BID)
  - Thick white secretions with plugs
  - FIO2 0.45 SpO2 90%
- Process check in
  - No documented weaning plan (varies week to week)
  - Family meeting being scheduled
  - Communication = lip reading by family & gestures
  - Continuous PEG tube feeds tolerated
  - Reducing sedation
- Intermittent IV low dose norepinephrine for BP
- Anasarca, Cr 500
- 2-person assist to sit up in bed
- Hyperactive delirium in evenings with night/day sleep reversal

ICU day 28

Prolonged-ventilation Weaning Centre Consult?
Other options?

- Weaning Progress (best result = 4 hours)
  - PAV, HFNO (Airvo), Trach mask trials
  - Cough-Assist BID added
- Line sepsis – PICC line removed
- Family meeting
  - Goals of care = to return home (other preferences not identified)
  - Fall while attempting to ambulate
  - Multiple family concerns raised with hospital patient representative
- Delirium management plan in place

Daily Weaning Progress with Goal Setting (target vs. actual trach mask hours)



Charting Error

Fatigue PvCO2 100

Mucous Plug

Fatigue PvCO2 65

Treated sepsis

ICU day 42

Prolonged-ventilation Weaning Centre Consult?
Long-term Ventilation Strategy Referral?
Other options?

- Weaning = trach mask weaning (max 16 hours daily)
- SLP consulted (swallowing & communication)
  - RRT collaboration for speaking valve trial
  - Refocus on simple non-verbal communication aids
- Foley removed
- 2-person assist to walk 3 m
- Nocturnal NIV (daytime practice sessions)

Early Mobility in Critical Care: A Toolkit for Adult Care Providers https://criticalcareontario.ca/wp-content/uploads/2022/05/CCSO_Early-Mobility-in-Critical-Care-Toolkit_20220505.pdf

Summary

Define Prolonged ventilation
Identify
- Common process barriers
- Individual reversible factors

Understand
- Consensus co-designed QI actions (*Action 11*)
- Options for management include
  - PDSA (goals, continuity, trend, individualize) process improvement
  - PWC virtual consultation prolongedventilation@tehn.ca
  - Pilot long-stay ICU units
  - Long-Term Ventilation Strategy including Prolonged-ventilation Weaning Centre (PWC)

Learn more about the LTVS (CCSO Webinar on October 27th)

Acknowledgements

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- Dr. Bernard Lawless (CCSO)
- Staff, Patients, & Families of the Long-term Ventilation Strategy

Addenda – Program Admission Criteria

- Long Stay ICU Pilot Program Admission Criteria
  LongStayICU@MackenzieHealth.ca & LongStayICU@tehn.ca
- Prolonged-ventilation Weaning Centre Admission Criteria (MGH/TEHN) prolongedventilation@tehn.ca **or via RMR**
- Critical Illness Recovery Program (LHSC) cathymawdsley@lhsc.on.ca
- Toronto Grace RECOVER Program for Chronic Critical Illness **via RMR**
- Long-term Ventilation Strategy (LTVS) (Western, Central & Eastern hubs) **via RMR**

Long Stay ICU pilot Admission Criteria

LongStayICU@MackenzieHealth.ca & LongStayICU@tehn.ca

Inclusion Criteria

Adult patient ≥ 18 years of age currently admitted to a Level 3 ICU within the catchment area.

ICU length of stay ≥ 10 days with reasonable evidence based on clinical diagnosis of a much longer need for critical care at the time of application.

Requiring invasive or non-invasive ventilation.

Not able to tolerate trials of weaning from invasive mechanical ventilation (or weaning from daytime non-invasive ventilation if not invasively ventilated).

Hemodynamically stable, with stable or decreasing vasopressor requirements.

Does not have a condition that precludes the potential for participation in rehabilitation and liberation from mechanical ventilation.

Clearly established and documented appropriate goals of care that are consistent with transfer to the Long Stay Unit for rehabilitation and weaning.

Exclusion Criteria

Patient is dependent on long-term (home) invasive ventilation prior to current admission.

Patient has a known terminal illness (e.g., end-stage cancer, dementia, etc.).

Patient's pre-admission Clinical Frailty Score = 8.

Patient is on peritoneal dialysis.

Patients has advanced chronic kidney disease (CKD) or is approaching the need for long-term dialysis and is known to a CKD program other than Mackenzie Health.

Patient is requiring a cardiac mechanical device (e.g., LVAD).

Patient requires ongoing care by that surgical service at the referring hospital.

Prolonged-ventilation Weaning Centre Admission Criteria (MGH/TEHN)

prolongedventilation@tehn.ca or via RMR

- Adult ICU patients who remain on a mechanical ventilator for more than 14 days and have a tracheostomy in place
- Patients who can participate in and direct their own care.
- Patients who are in stable condition, apart from mechanical ventilation
- Advanced care plan and/or goals of care discussions documented
- Patients who have a feeding support in place
- Patients who do not require kidney replacement treatment (in 2023, renal replacement will be available)
- Patients who do not have a clearly irreversible disease such as such as metastatic cancer or advanced dementia

Critical Illness Recovery Program (LHSC)

cathymawdsley@lhsc.on.ca

Admission Criteria

- Invasively ventilated over 14 days with tracheostomy
- Stable renal placement therapy (IHD, not PRIMSA/CRRT)
- Stable trajectory of vasopressors (e.g., weaning, maintenance to support IHD, etc)
- Neurologically able to participate in care plan, or reasonable expectation neurological recovery to the point of participation is expected
- Patients on chronic technology (e.g., NIV, LTV) as a baseline, known to our Home Respiratory and Ventilatory Care team), with goal of return to community
    - e.g., invasive ventilation with plan to extubate to NIV, and return to baseline settings and attempt to avoid tracheostomy
- Goals of care/patient values align with model of care of CIRP

Exclusion Criteria

- Unable to participate/meaningful engage in rehabilitation and recovery (devastating neurological injury, etc)
- CRRT or cardiac devices (e.g., LVAD, etc)
- Hemodynamic instability e.g., escalating pressors, etc
- Active acute and/or surgical issues

Toronto Grace RECOVER Program for Chronic Critical Illness via RMR

Patients requiring mechanical ventilation for >14 days, and medically stable for 7 days prior to transfer who have weaning and rehab potential/candidacy for vent to home/vent to palliation in the opinion of the referring critical care physician.

1. **Documented Advance Care Plan/Goals of Care discussion within 48h of transfer.**
2. **Stable ventilator settings for 7 days prior to transfer/Fi-02 < 0.5 on/off the ventilator.**
3. **Tracheal Suctioning frequency not to exceed q2-3 hours.**
4. **Tracheostomy in situ/PICC in situ.**
5. **G/J/PEG tube in situ.**
6. **No pressor/inotrope use 7 days prior to transfer.**
7. **No significant medication changes 7 days prior to transfer.**
8. **No major cardiac or respiratory events 7 days prior to transfer.**
9. **Hemodialysis is possible – Patient must be pre-scheduled at referring site prior to transfer.**
10. **If prior COVID infection, documented COVID negative in past 7 days. Repeat COVID testing will be required 72h prior to transfer.**
11. **All IPAC practices documented.**

Long-Term Ventilation Strategy (LTVS)

via RMR - contact Sally.McMackin@westpark.org

- Patient medically stable for past 30 days
- No constant monitoring requirements
- No inotropes in the past 30 days
- No significant medication changes in the past 30 days
- No major cardiac or respiratory events in the past 30 days
- Supplemental oxygen less than 40% on or off the ventilator
- No hemodialysis unless patient is able to attend outpatient clinic on their own
- No NG tube (patient either takes food orally or switched to G/J/PEG tube)
- Appropriate ventilator settings
- All patients should be fully ventilated at night utilizing set respiratory rate rather than pressure support
- Suctioning cannot be more frequent than every 2-3 hours
- Suggest lung hygiene routine (i.e. cough assist, breath staking) for patients on trach mask for patients who have an ineffective/weak cough

Coming Soon! LTVS Portal Website - Hub LTV Services and Referral Information

Thank you for joining us today

Feedback?
Suggestions for
the next topic?

Submit ideas in our evaluation survey (Link in chat)

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December

Early Warning Systems

Questions? **info@ccso.ca**

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