

Impact of the Long-term Ventilator Patient (Chronically Critically Ill)

Shannon S. Carson, MD
Associate Professor
Pulmonary and Critical Care Medicine
University of North Carolina

Outline

- Terminology
- Epidemiology
 - Incidence and growth
 - Outcomes
- Impact on the patient
- Impact on healthcare system
- Future approaches

Terminology

The diagram consists of three overlapping circles. The largest circle on the left is labeled 'Chronic Critical Illness' in red. The middle circle is labeled 'Prolonged Mechanical Ventilation >80,000 / year' in green. The smallest circle on the right is labeled 'Long-term (Home) Ventilation >3100 patients' in blue. The intersection of all three circles is shaded with a blue stippled pattern.

Long-term (Home) Ventilation

- Invasive Mechanical Ventilation
 - Appropriate for a limited number of conditions in adults
 - Underutilized
 - Underfunded
 - Almost entirely dependent on Respiratory Therapists
- Noninvasive Mechanical Ventilation
 - Easier
 - Better utilized
 - Underfunded

The Syndrome of Chronic Critical Illness

The diagram shows three concentric ovals. The innermost oval is yellow and labeled 'Chronic Critical Illness', containing: Ventilator Dependence, Brain Dysfunction, Neuromuscular Weakness, Endocrinopathy, Malnutrition, Anasarca, Skin Breakdown, and Symptom Distress. The middle oval is light green and labeled 'Acute Critical Illness', containing: Medical, Surgical, and Sepsis/Acute Co-Morbidities. The outermost oval is white and labeled 'Chronic Co-Morbidities', containing: Neurologic and Cardiac. At the bottom, the text 'Older Age' is written. The source 'AJRCCM 2010' is noted in the bottom left corner.

Criteria Defining "Chronically Critically Ill" Cohorts

1. Prolonged Mechanical Ventilation

A horizontal timeline labeled 'Ventilator Days' with markers at 0, 2, 4, 7, 14, 21, and 28. 'PAMV' is indicated between 2 and 7 days. 'Consensus' is indicated at 21 days.

2. Tracheostomy

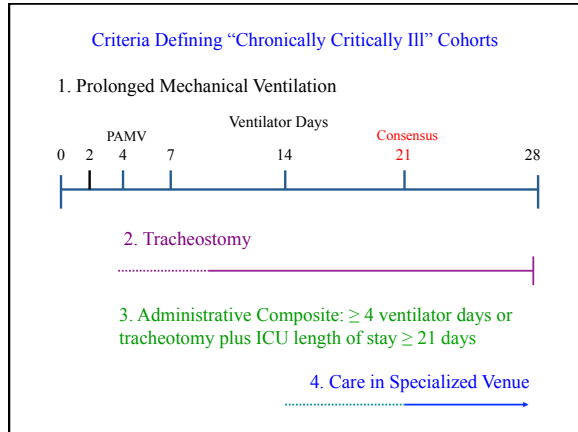
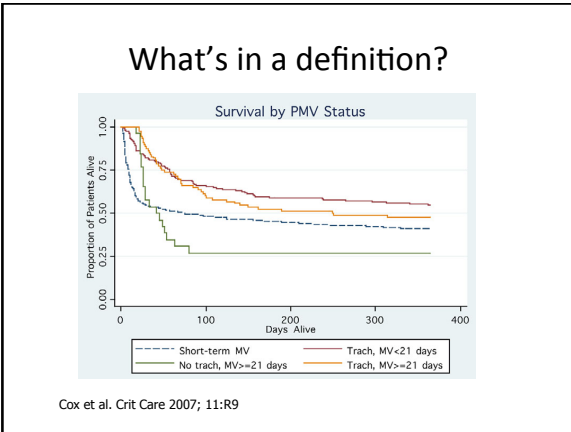
A horizontal timeline from 0 to 28 days with a purple bar representing tracheostomy starting at day 4 and ending at day 28.

3. Administrative Composite: ≥ 4 ventilator days or tracheotomy plus ICU length of stay ≥ 21 days

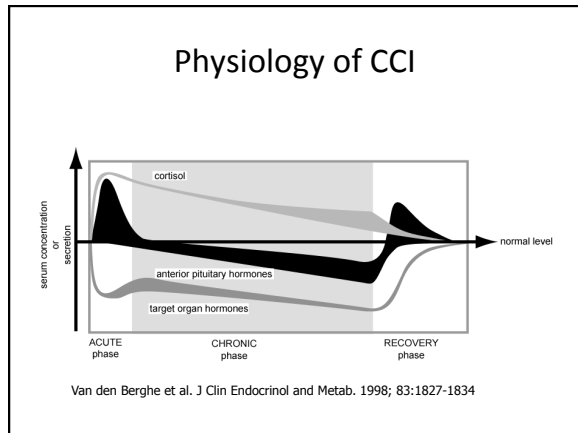
A horizontal timeline from 0 to 28 days with a green bar representing the administrative composite starting at day 4 and ending at day 28.

4. Care in Specialized Venue

A horizontal timeline from 0 to 28 days with a blue bar representing care in a specialized venue starting at day 4 and ending at day 28.



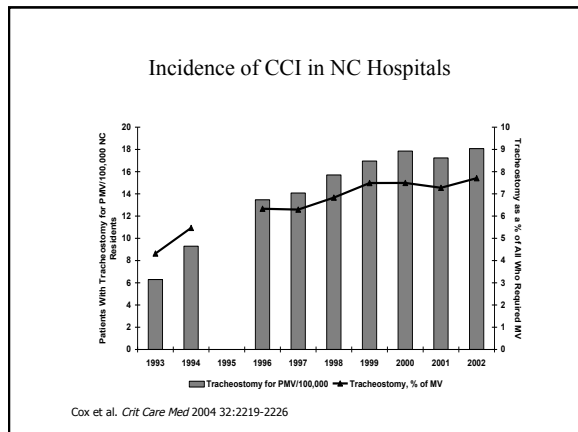
- ### At risk for CCI...
- At least 10 days of mechanical ventilation and:
 - Not expected to be extubated within 72 hours
 - Not expected to die within 72 hours
 - 204 patients on vent 10 days
 - 21 expected extubations
 - 17 expected deaths
 - 166 (81%) CCI patients



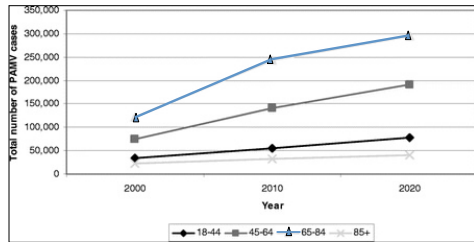
Short-term vs Prolonged MV

	MV <21 days n=524	MV ≥21 days n=114
In-hospital	43%	31%
6 months	55%	54%
12 months	59%	58%
Costs/ 1-year survivor	\$165,075	\$423,595

Cox et al. Crit Care 2007; 11:R9



Projected Growth of Prolonged Acute MV



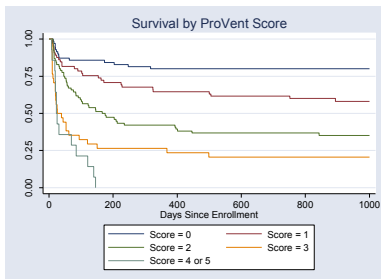
Zilberberg et al. Crit Care Med 2008;36:1451

Outcomes of CCI

Cohort Definition	Ventilation for ≥14 days	Ventilation for ≥21 days	Tracheostomy for Prolonged Mechanical Ventilation	LTAC Admission
Study	Combes	Carson	Cox	Engoren Kahn
N	347	200	114	267 347
Age, median (IQR) or mean ± SD	63-67 ^a	58 (42-69)	66 (47-74)	66 (45-75) 64-71
Hospital Length of Stay, median (IQR)	--	51 (36-72)	39 (30-52)	29 (22-38) 28-37
Died in Hospital	43%	41%	31%	20% 22%
Discharged Home	--	11%	4%	7% --
Alive at 12 months	32%	48%	42%	52% 50%
				31%

Day 21 of MV

- Age >65 - 2 points
- Age 50-65 - 1 point
- Platelets <150 - 1 point
- Vasopressors - 1 point
- Dialysis - 1 point

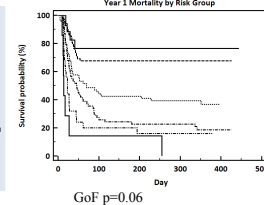
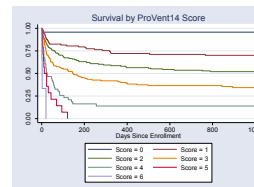


Area under ROC 0.79 (95% CI, 0.75, 0.81)
Hosmer Lemeshow GoF p=0.89

ProVent -14 Score – FACTT Cohort

ProVent Cohort
AUC = 0.80

FACTT Cohort
AUC = 0.78



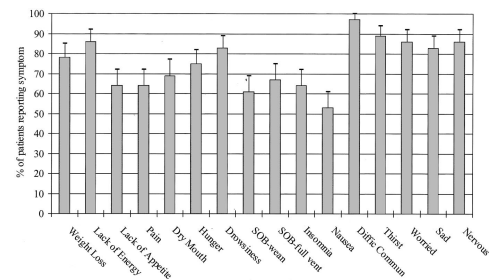
GoF p=0.06

Calibration – 14 Day Model

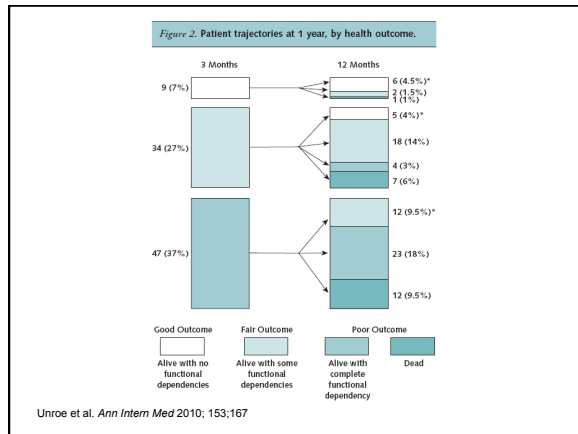
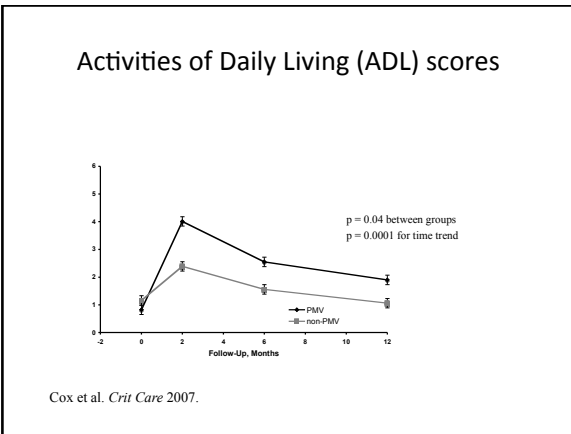
Group	Total	Partition for the Hosmer and Lemeshow Test			
		Dead 1 yr		Alive 1 yr	
		Observed	Expected	Observed	Expected
1	49	2	2.2	47	46.8
2	49	6	6.3	43	42.7
3	49	14	11.6	35	37.4
4	49	13	16.5	36	32.5
5	49	23	20.2	26	28.8
6	49	26	23.9	23	25.1
7	49	26	27.7	23	21.3
8	49	32	32.0	17	17.0
9	49	34	36.3	15	12.7
10	50	45	44.2	5	5.8

p=0.89

Symptom Burden

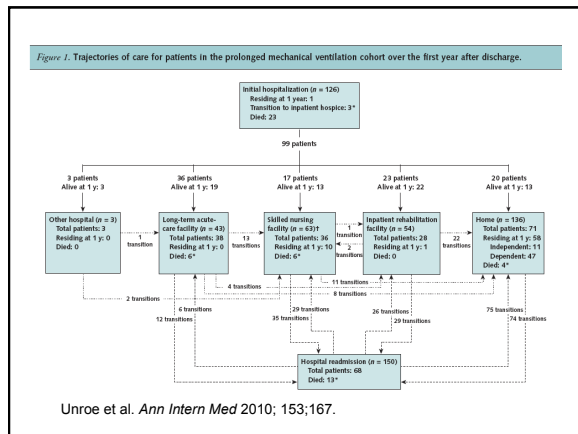
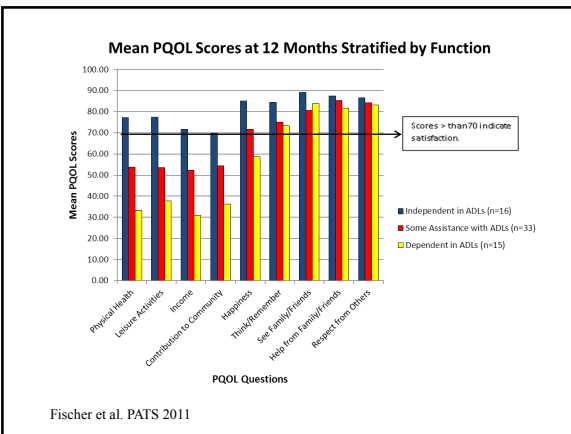
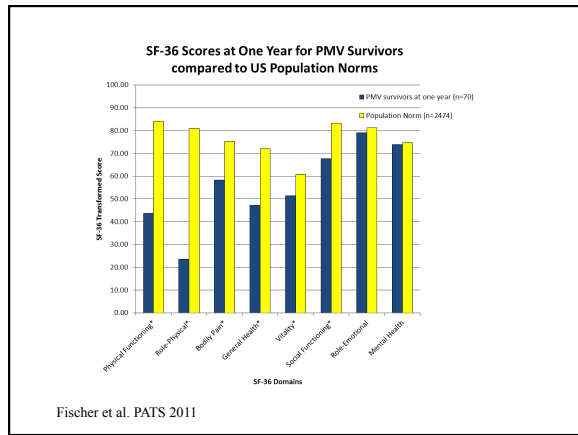


Nelson et al. Crit Care Med 2004; 32:1527



Brain Dysfunction in PMV

- Prospective cohort 203 patients from Respiratory Care Unit
 - Nelson et al. *Arch Intern Med* 2006;166:1993
 - 82% cognitively intact at baseline
 - 30% comatose throughout RCU stay
 - 50% non-coma patients delirious
- 6 month follow-up
 - 71% of survivors too cognitively impaired for tel. testing
 - Remaining 25% cognitively intact (30 patients)



Duke Cohort Outcomes

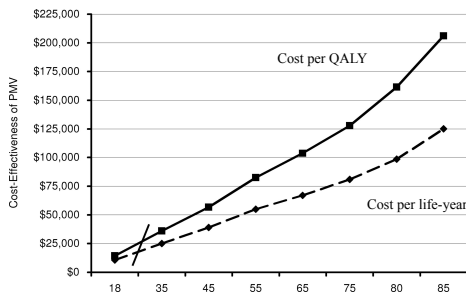
- 126 patients, 103 survivors
- 457 transitions, median 4 (3-5) per patient
- 74% of all days alive spent in hospital or postacute care facility
- 11 patients (9%) alive and fully functional at 1 year

Unroe et al. *Ann Intern Med* 2010; 153:167.

Cost-effectiveness Model

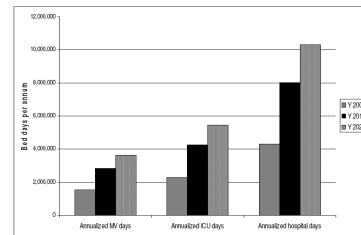
	Costs	Cost/Life Year	Cost/QALY
PMV Base Case	\$196,077	\$55,460	\$82,411
>50% predicted survival	\$221,233	\$41,065	\$60,967
<50% predicted survival	\$191,817	\$72,163	\$101,787
Withdraw by day 21	\$52,269		

Cost-effectiveness by Age



Cox et al. *Crit Care Med* 2007

Projected bed days for PAMV

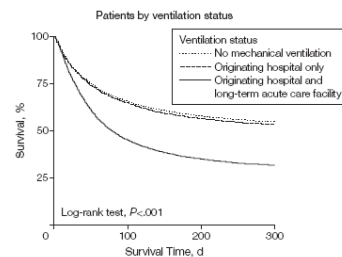


Zilberberg et al. *BMC Health Serv Res.* 2008;8:242

Dedicated Units for CCI Patients

- Multidisciplinary Rehabilitation Approach
- Specialization within disciplines
 - RT, Nutrition, PT
- Protocolized care
- Lower nursing intensity; less monitoring
 - Lower costs??
- Short-term acute care hospital models
- Long-term care hospital (LTCH) models

Survival of LTCH CCI Patients



LTCH Outcomes --NALTH Study

- Consecutive admissions for PMV to 23 Long-term Care Hospitals (LTCHs)
- Age 71.8 (18-97.7)
- Pre-morbid dx: 2.6 per patient
- 61% medical diagnoses
- MV duration before transfer: 25 (0-1154)
- 41.6% Pressure ulceration
- Hemodialysis: 6%

Scheinhorn et al. Chest 2007

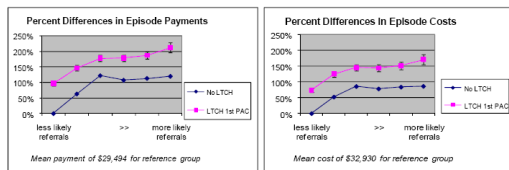
NALTH Study--Outcomes

- Died in LTCH - 25% (0-46%)
- Weaned - 54% (41-83%)
 - Ventilator Dependent - 21% (0-39%)
- Discharged Home - 29%
- Discharged to acute hospital - 20%
- One-year mortality - 63%
 - 48% died in LTCH
 - 52% died post-discharge

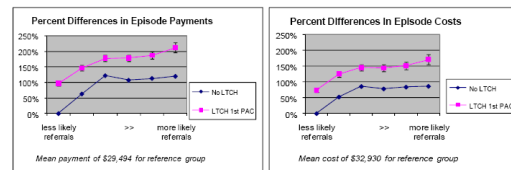
Scheinhorn et al. Chest 2007

LTAC vs Acute Costs for CCI

- LTCH patients and non-LTCH patients matched based upon propensity for LTCH referral
- 68 days in episode with LTCH care vs 45.8 days without LTCH care
- www.rti.org/reports/cms
- Differences in episode payments and costs relative to non-LTCH patient with low likelihood of LTCH referral (lower left point on graphs)



LTAC vs Acute Costs for CCI



- Differences in episode payments and costs relative to non-LTCH patient with low likelihood of LTCH referral (lower left point on graphs)
- LTCH patients and non-LTCH patients matched based upon propensity for LTCH referral
- 68 days in episode with LTCH care vs 45.8 days without LTCH care
- www.rti.org/reports/cms

Informational Needs in CCI

Information Topic	Important (%)	Received Information (%)
Risk of Hospital Death	89	64
Risk of Death by One Year	77	7
Expected Functional Status	99	20
Alternatives to Life Support	98	17

Nelson et al. J Crit Care. 2005;20:79

Discordance

	Surrogates (%)	Physicians (%)
High Expectations For:		
One-year Survival	93	43
Accurate	63	72
Functional Status	71	6
Quality of Life	83	4
Concordance: $\kappa = 0.08$		

Cox Crit Care Med 2009;37:2891

Improving Communication of Prognosis

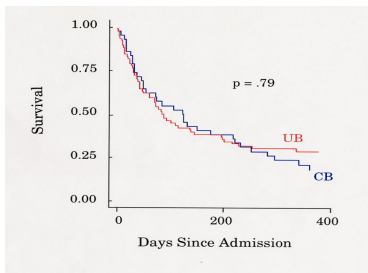
- RO1-AG 033718: Informing Decisions in Chronic Critical Illness: An RCT
 - Support and Information Team (SIT) Meetings vs Usual Care
 - SCCM Information Brochure
 - Family-centered outcomes
 - Goals of Care
 - Resource utilization
- Other Communication Strategies
 - Decision Aid

Impact of Physician Practice

	Univ-based n=76	Comm-based n=42	P value
Weaned, %	46%	30%	0.14
Time to wean, median days	33	45	0.02
Time to trach collar trial, days	9	18	0.05
LOS, days	64	94	0.08

Bach et al. AJRCCM 158:1410, 1998

Long-term Survival of LTAC patients



Bach et al. AJRCCM 158:1410, 1998

Summary

- Long-term home ventilation is underfunded and therefore underutilized
- The incidence of CCI has been increasing and will likely increase further over the next decade
- Long-term survival of CCI patients has not improved significantly but can be predicted with clinical prediction rules
- Functional outcomes and quality of life in CCI survivors should be a focus of future research
- Physical and cognitive limitations of hospital survivors demand a high proportion of healthcare resources now and in the future