

Outcomes in Chronic Critical Illness: Continuous Improvement at a Regional Weaning Center

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RATIONALE

Barlow Respiratory Hospital (BRH) is a 105-bed long-term care hospital (LTCH) that serves as a regional weaning center, accepting chronically critically ill (CCI) patients transferred from the ICUs of hospitals in southern California. For over four decades, BRH has focused on weaning ventilator-dependent patients from prolonged mechanical ventilation, with over 7,000 patients discharged from our Ventilator Weaning Program. Herein we report updates to patient characteristics, weaning outcomes, and discharge disposition from our Ventilation Outcomes Database (VOD), a performance improvement database. We also compare selected outcomes over an eight-year time period to demonstrate results and sustainability of performance improvement initiatives, specifically implementation of revisions to the Therapist-Implemented Patient-Specific (TIPS©) weaning protocol in 2014 and 2017.

METHODS

Descriptive report of patients admitted to the Ventilator Weaning Program. The VOD was queried for selected patient admission characteristics and outcomes. Outcomes (weaned, ventilator-dependent, died) were scored at BRH discharge; weaned was defined as patient being free of invasive mechanical ventilation for at least one full calendar day prior to day of discharge. Time to wean (days) was tallied from day of admission through last day of ventilator support prior to discharge. Weaning outcomes are presented in aggregate as well as divided by time period to show the impact of continuous improvement efforts.

RESULTS

From 1/1/2017 to 12/31/2021, 1,382 patients admitted for weaning were discharged from BRH. Discharge disposition by weaning outcome is presented for 1,255 live discharges. Selected admission characteristics and outcomes over time employ data of 2,004 patients discharged from 1/1/2015 to 12/31/2021.

REFERENCES

- Carson SS. Research needs and strategies to establish best practices and cost-effective models for chronic critical illness. *Resp Care*. 2012; 57(6):1014-1018.
- Nelson JE, Cox CE, Hope AA, et al. Chronic critical illness. *Am J Respir Crit Care Med*. 2010; 182:446-54.
- Scheinhorn DJ, Chao DC, Stearn-Hassenpflug M, et al. Outcomes in post-ICU mechanical ventilation: a therapist-implemented weaning protocol. *Chest* 2001; 119:236-242

Variable	2017-2021 (n=1,382)
Age, years Median [range]	69 [18 - 104]
Gender, male n (%)	762 (55%)
Medicare	872 (63%)
Race	
African American	87 (6%)
Asian/Pacific Islander	127 (9%)
Caucasian	1,012 (73%)
Hispanic	85 (6%)
Other/Unknown	71 (5%)
Ethnicity, Hispanic	351 (25%)
Pre-morbid location, home	75%
Pre-morbid mobility, independent	66%
LOS transfer facility, days	21 [1 - 371]
Pressure injuries ≥ stage 2	925 (67%)
Multiple pressure injuries	529 (38%)
Hemodialysis	272 (19.7%)
APACHE® III APS	43 [13 - 102]
Lab values: Mean (SD)	
Serum albumin (g/dl)	2.4 (0.59)
Hematocrit (%)	27.8 (4.3)
BUN (mg/dl)	37.7 (25.7)
Creatinine (mg/dl)	1.3 (1.4)
Serum glucose (mg/dl)	143.7 (49.9)
Glasgow Coma Score	13 [3 - 15]

Figure 1
Therapist-Implemented Patient-Specific (TIPS©) Protocol 2.0

At Barlow Respiratory Hospital, we provide the highest quality respiratory care. Our expert team of Barlow Physicians, Nurses and Therapists draw upon more than a century of respiratory health expertise. We are considered a leader in ventilator weaning, and specialist in serving patients with chronic critical illness and complex respiratory conditions who are dependent on a ventilator to take their next breath.

THERAPIST-IMPLEMENTED PATIENT-SPECIFIC (TIPS©) PROTOCOL 2.0
*Physician order for TIPS© Protocol triggers Speech Therapist evaluation for Passy-Muir Speaking Valve

DAILY WEANING EVALUATION (DWE)

Do NOT proceed to weaning trials if any of the following are present:

- Hemodynamic instability
- Vasopressor infusion used to stabilize blood pressure
- Systolic blood pressure < 90 mmHg
- Pulse < 50 or > 130
- BPM or increase from baseline > 20
- Respiratory rate > 35
- BPM
- O2 saturation < 90%
- Temp > 38.4
- FiO2 > 0.5 or PEEP > 8
- Prominent accessory muscle use
- Spontaneous tidal volume < 0.25 L

A: SBT TRIALS

1. SBT as tolerated return to original ventilator settings after 4-hour trial

2. SBT as tolerated up to 8 hours, then return to prior ventilator settings

3. SBT as tolerated up to 12 hours, then return to prior ventilator settings

4. SBT as tolerated up to 20 hours, then return to prior ventilator settings

5. SBT as tolerated up to 24 hours, then return to prior ventilator settings

6. SBT as tolerated up to 28 hours

B: CPAP/PS TRIALS

1. AC to CPAP w/ PEEP 5 not to exceed 10-12 hours

2. CPAP w/ PEEP 5/PS 10 not to exceed 10-12 hours

3. CPAP w/ PEEP 5/PS 10 not to exceed 10-12 hours

4. CPAP w/ PEEP 5/PS 10 not to exceed 10-12 hours

5. CPAP w/ PEEP 5/PS 10 not to exceed 10-12 hours

6. CPAP w/ PEEP 5/PS 10 not to exceed 10-12 hours

C: SIMV/PS TRIALS

Reduction of ventilator support up to 3 steps per day at Q2H intervals

1. AC to SIMV 10/PS 10

2. SIMV 8/PS 10

3. SIMV 6/PS 10

4. SIMV 4/PS 10

5. SIMV 2/PS 10

6. SIMV 1/PS 10

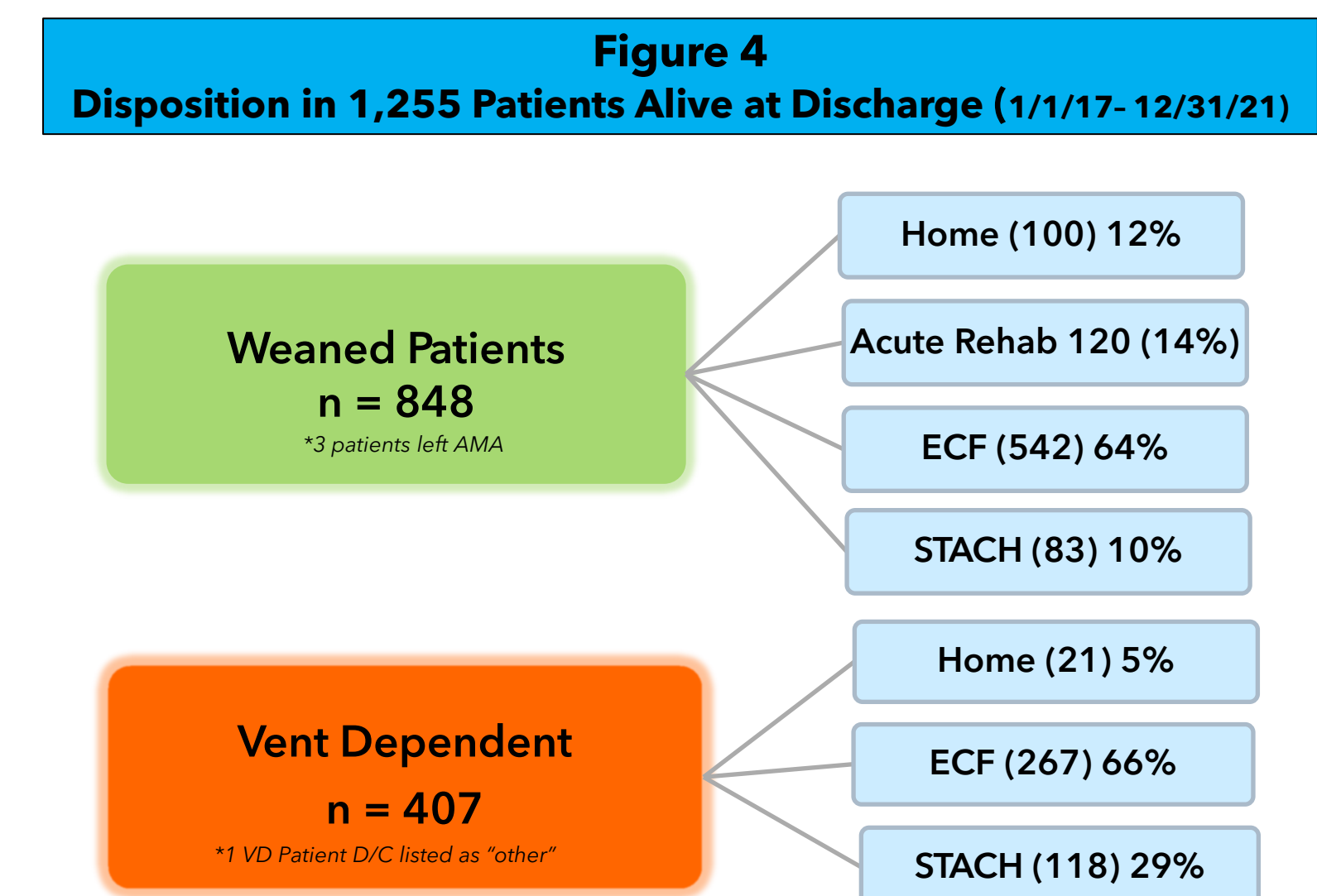
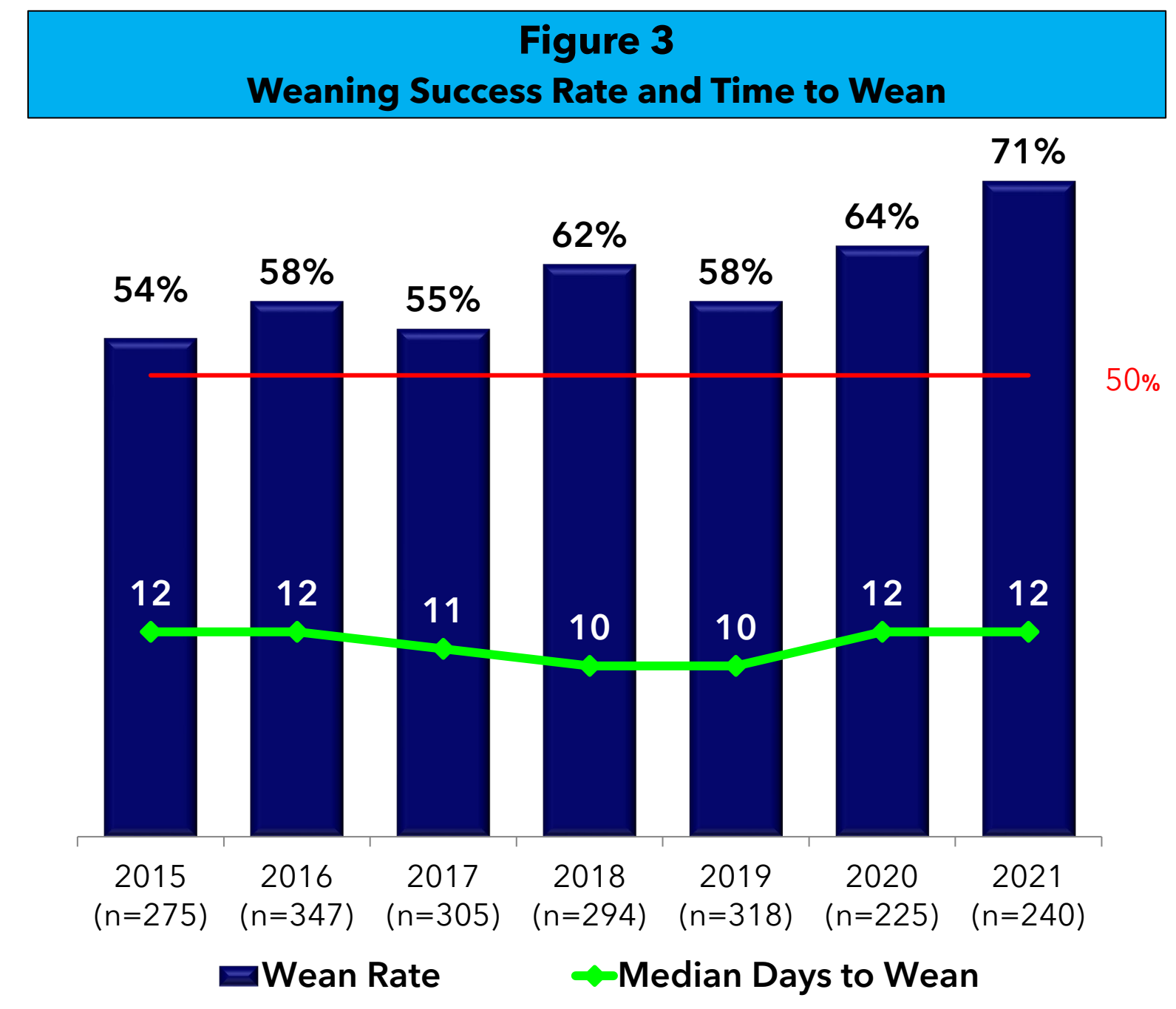
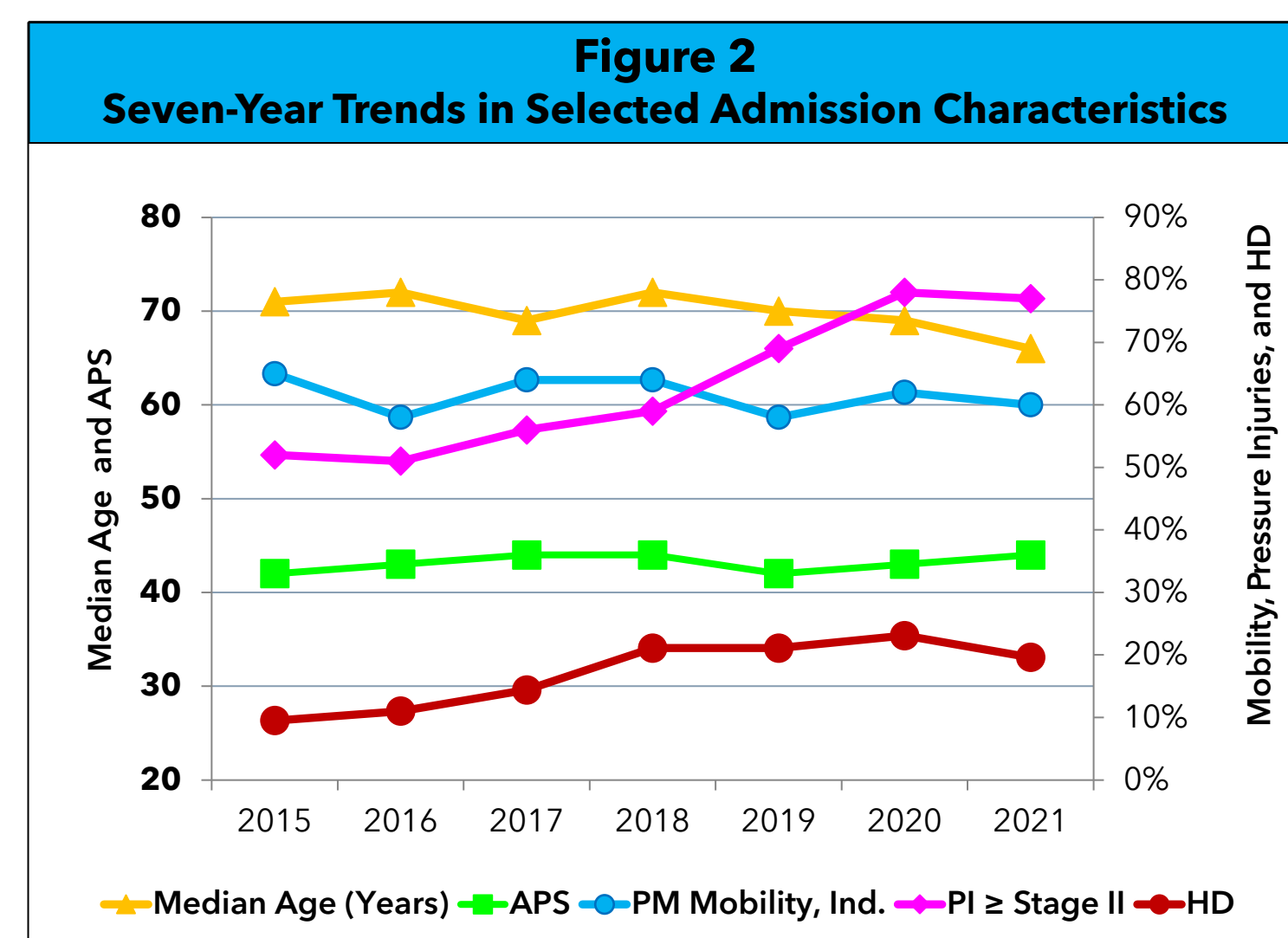
LEGEND / GLOSSARY

AC – Assist Control CPAP – Continuous Positive Airway Pressure PEEP – Positive End Expiratory Pressure PS – Pressure Support SBT – Self Breathing Trials SIMV – Synchronized Intermittent Mandatory Ventilation Passy-Muir Speaking Valve – commonly used to help patients speak more naturally, attaches to the inside opening of the tracheostomy tube Ventilator Weaning – gradual withdrawal of mechanical breathing support through utilization of a variety of weaning modes, periods of time, spontaneous ventilation, and appropriate rest periods

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The revised weaning protocol resulted in significant reduction in days to wean and LOS. Fewer days on mechanical ventilation may translate to less risk of ventilator-associated events, enhanced rehabilitation opportunities, and shorter LOS.

	2017-2021 (n=1,382)
Weaned	848 (61%)
Ventilator-dependent	407 (30%)
Died	127 (9%)
Time to wean, days	11 [1 - 261]
Length of stay, days	34 [2 - 320]
Discharge disposition: (1,255 live discharges)	
Home	121 (10%)
Subacute/SNF	783 (62%)
Acute Rehab	124 (10%)
Short-term acute	201 (16%)
Transfer Short-term (planned readmission)	16 (1%)
Transfer Intermediate Care Facility	5 (< 1%)
Hospice/AMA/Other	5 (< 1%)



COMMENTS AND CONCLUSIONS

Our high volume of patients treated, and culture of continuous improvement have helped us establish expertise in our approach to the CCI population. Implementation of revisions to the TIPS© weaning protocol resulted in a consistent weaning success rate of well over 50% with sustained median time to wean of less than two weeks. A cohort of 100 post-COVID 19 patients discharged 6/1/2020-12/31/2021 experienced a weaning success rate of 88%. Over 90% of all patients admitted for weaning were discharged alive. Of note are the percentages of patients dependent with indoor mobility (34%),

and discharge to ECF. As more patients survive the ICU experience to become chronically critically ill, and more survive to discharge from the LTCH hospital, determination of patient location, frequency of care transitions, ventilator status, quality of life, long-term survival and functional status become increasingly important considerations and challenges for all stakeholders. These data may provide opportunities to inform treatment decisions throughout the episode of critical illness.