

# Specifications

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## Descriptive Information

**De.1. Measure Type** *(Patient-reported outcomes include HRQoL/functional status, symptom/burden, experience with care, health-related behavior.)\**

### Outcome

## De.2. Measure Title\*

### Ventilator Weaning (Liberation) Rate

**De.3. Brief description of measure** *(including type of score, measure focus, target population, timeframe, e.g., Percentage of adult patients aged 18-75 years receiving one or more HbA1c tests per year)*

This measure reports facility-level Ventilator Weaning (Liberation) Rate for patients admitted to a Long Term Care Hospital (LTCH) requiring invasive mechanical ventilation support, *and* for whom weaning attempts were expected or anticipated as reported on the Admission Assessment. The Ventilator Weaning (Liberation) Rate will be reported for the following components separately:

- (1) Component 1: the percentage of patients who are fully weaned at discharge (alive),
- (2) Component 2: the percentage of patients who are not fully weaned at discharge (alive), and
- (3) Component 3: the percentage of patients who died.

Data will be collected using items to be added to the Long-Term Care Hospital Continuity Assessment Record and Evaluation Data Set (LTCH CARE Data Set) Admission, Planned Discharge, Unplanned Discharge, and Expired Assessments. A patient is considered fully weaned if he or she does not require any invasive mechanical ventilation support for at least 2 days prior to the date of discharge.

### Definitions:

- (a) For the purpose of this measure, invasive mechanical ventilation support is defined as the use of a device to assist or control pulmonary ventilation, inclusive of the weaning period, either intermittently or continuously through a tracheostomy or by endotracheal intubation.

Note: Lung expansion devices such as intermittent positive-pressure breathing (IPPB); nasal positive end-expiratory pressure (nasal PEEP); and continuous nasal positive airway pressure (CPAP, hypoCPAP) are not considered ventilators unless delivered via tracheostomy or endotracheal intubation (e.g., ET-CPAP).

- (b) For the purpose of this measure, Day 2 of LTCH stay is defined as the second day of the patient's LTCH stay, where Day 1 is the day of admission.
- (c) For the purpose of this measure, "weaning" patients are those patients admitted to the LTCH on invasive mechanical ventilation support for whom weaning attempts are expected or anticipated, at admission. Please refer to the definition of "weaning" in the LTCH Quality Reporting Program (QRP) Manual for additional information and examples. (<https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/LTCH-Quality-Reporting/LTCH-CARE-Data-Set-and-LTCH-QRP-Manual.html>)
- (d) For the purpose of this measure, "non-weaning" patients are those patients on invasive mechanical ventilation upon admission to the LTCH, for whom at the time of admission weaning attempts are NOT expected or anticipated (e.g., patients who are chronically ventilated in the community or a facility, or have progressive neuromuscular disease such as amyotrophic lateral sclerosis, or irreversible neurological injury or disease or dysfunction such as high (C2) spinal cord injury). Consideration of a patient as non-weaning *must* be based on documentation found in the patient's medical record at the time of admission. Please refer to the LTCH QRP Manual for additional information.

- (e) For the purpose of this measure, a patient is considered fully weaned if s/he does not require any invasive mechanical ventilation support for at least two (2) consecutive full calendar days immediately prior to the day of discharge (alive or dead) from the LTCH.
- (f) For the purpose of this measure, a patient is considered not fully weaned if s/he requires invasive mechanical ventilation support for any duration of time during the two (2) consecutive full calendar days immediately prior to the day of discharge (alive or dead) from the LTCH.

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## Measure Specifications

**S.1. Measure-specific Web Page** *(Provide a URL link to a web page specific for this measure that contains current detailed specifications including code lists, risk model details, and supplemental materials. Do not enter a URL linking to a home page or to general information.) \**

A draft version of the measure specifications, including item sets, will be posted at

<https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-instruments/MMS/CallforPublicComment.html> for solicitation of public comments.

**S.4. Numerator Statement** *(Brief, narrative description of the measure focus or what is being measured about the target population, i.e., cases from the target population with the target process, condition, event, or outcome)*  
*IF an OUTCOME MEASURE, state the outcome being measured. Calculation of the risk-adjusted outcome should be described in the calculation algorithm.*

The numerator represents the number of patients in the denominator sample who meet the following criteria at discharge:

- (1) Component 1: The numerator represents the percentage of patients who were fully weaned at discharge (alive):
  - a. The numerator of this component is the number of patients reported as fully weaned on Planned or Unplanned Discharge Assessment
- (2) Component 2: The numerator represents the percentage of patients who were not fully weaned at discharge (alive)
  - a. The numerator of this component is the number of patients reported as not fully weaned on Planned or Unplanned Discharge Assessment
- (3) Component 3: The numerator represents the percentage of patients who died
  - a. The numerator of this component equals the total number of patient who died (i.e., patients with an Expired assessment).

The ventilator weaning (liberation) rate (as a percentage) is calculated and reported for the three (3) components separately.

**S.5. Time Period for Data** *(What is the time period in which data will be aggregated for the measure, e.g., 12 mo, 3 years, look back to August for flu vaccination? Note if there are different time periods for the numerator and denominator.)*

This quality measure will be analyzed and reported for all patients discharged during the reporting period.

The time period for the numerator and denominator are identical. At this time, we anticipate the time period to be 12 months to allow an adequate sample size for the majority of LTCHs in the United States. However, please note that this will be informed by findings from (future) analyses of data collected and submitted by LTCHs using items to be added to the LTCH CARE Data Set.

**S.6. Numerator Details** *(All information required to identify and calculate the cases from the target population with the target process, condition, event, or outcome such as definitions, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b)*

*IF an OUTCOME MEASURE, describe how the observed outcome is identified/counted. Calculation of the risk-adjusted outcome should be described in the calculation algorithm.*

A patient is included in the numerator if the LTCH reports on the LTCH CARE Data Set Planned Discharge, Unplanned Discharge or Expired Assessments the following item responses, by numerator criterion:

- (1) Component 1: Number of patients who were fully weaned at discharge (alive): A patient is considered fully weaned at discharge if
  - a. **00350A** (Invasive Mechanical Ventilator: Weaning Status at Discharge) = 01 (Fully weaned)
- (2) Component 2: Number of patients who were not fully weaned at discharge (alive): a patient is considered not fully weaned if
  - a. **00350A** (Invasive Mechanical Ventilator: Weaning Status at Discharge) = 02 OR 03 (partially weaned) OR 04 (not weaned)
- (3) Component 3: Number of patients who died. A patient is included in the numerator of this component if
  - a. The patient has an Expired Assessment.

**S.7. Denominator Statement** *(Brief, narrative description of the target population being measured)*

*IF an OUTCOME MEASURE, state the target population for the outcome. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.18).*

The target population is the total number of patients discharged (alive or dead) from an LTCH during the reporting period AND who were on invasive mechanical ventilation support upon admission to the LTCH, for whom at admission weaning attempts were expected or anticipated.

**S.8. Target Population Category** *(Check all the populations for which the measure is specified and tested if any):*

- |   |  |
|---|--|
| <input type="checkbox"/> Children's Health                                    | <input checked="" type="checkbox"/> Populations at Risk : Individuals with multiple chronic conditions |
| <input type="checkbox"/> Maternal Health                                      | <input type="checkbox"/> Populations at Risk : Veterans  |
| <input checked="" type="checkbox"/> Populations at Risk : Populations at Risk | <input checked="" type="checkbox"/> Senior Care  |
| <input type="checkbox"/> Populations at Risk : Dual eligible beneficiaries    |  |

**S.9. Denominator Details** *(All information required to identify and calculate the target population/denominator such as definitions, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b)*

Patients discharged from an LTCH (i.e., patients with Planned or Unplanned Discharge Assessment or Expired Assessment (A0250 Reasons for Assessment = 10 (Planned Discharge) or 11 (Unplanned Discharge) or 12 (Expired)) during the reporting period AND for whom Admission Assessment item 00200A. Invasive Mechanical Ventilation Support upon Admission to the LTCH = 1 (Yes, Weaning) are included in the denominator.

For patients with more than one LTCH stay during the reporting period, each admission and discharge is included in the measure calculation and reporting. For example, if an LTCH patient is transferred to a short-stay acute care hospital for a procedure, surgery, or some other reason(s), returns to the LTCH within three (3) calendar days, and is subsequently discharged from the LTCH, this is considered one “patient stay.” However, if this patient’s “stay” at the short-stay acute care hospital exceeds three (3) calendar days, whereby day one begins on the day of transfer from the LTCH to the short-stay acute care hospital, regardless of the hour of transfer, then a new LTCH CARE Data Set Admission Assessment is conducted upon return of the patient to the LTCH, and a second LTCH CARE Data Set Discharge Assessment accompanies the second discharge. Admission and Discharge (Planned or Unplanned) Assessments are completed for this patient for the first stay, and Admission and Discharge (Planned, Unplanned, or Expired) Assessments are completed for the second stay. Both stays for this patient are included in the measure calculation and reporting.

All three measure components use the same denominator.

**S.10. Denominator Exclusions** *(Brief narrative description of exclusions from the target population)*

This measure excludes patients with missing data and invasively mechanically ventilated patients identified as non-weaning at the time of admission to an LTCH. Patients who may be considered non-weaning include patients who are considered chronically ventilated as defined by evidence-based guidelines for ventilator liberation (MacIntyre 2001) or patients with an acute or chronic medical conditions that negates at admission any expectation or anticipation of weaning attempts (e.g. progressive neuromuscular disease such as amyotrophic lateral sclerosis, or irreversible neurological injury or disease or dysfunction such as high (C2) spinal cord injury). Consideration of a patient as non-weaning must be based on documentation found in the patient’s medical record by Day 2 of LTCH stay.

After patient-level exclusions are applied, LTCHs with denominator counts of less than 20 patient stays during the reporting period will be excluded from public reporting, owing to a small sample size.

All three measure components use the same denominator exclusions.

**S.11. Denominator Exclusion Details** *(All information required to identify and calculate exclusions from the denominator such as definitions, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b)*

Patients are excluded from the target population (i.e., denominator) for all three measure components if they meet either of the following criteria:

- (a) Admission Assessment item **O0200A**. Invasive Mechanical Ventilator = 0, No (i.e., No Ventilation Support on Admission), OR
- (b) Admission Assessment item **O0200A**. Invasive Mechanical Ventilator = 2, Yes, Non-Weaning (i.e., No Weaning Attempts are Expected or Anticipated at Admission)

Additionally, patients with missing data will be excluded.

After patient-level exclusions are applied, LTCHs with a denominator count of less than 20 patient stays during the reporting period will be excluded from future public reporting owing to small sample size.

**S.12. Stratification Details/Variables** *(All information required to stratify the measure results including the stratification variables, definitions, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format with at S.2b)*

This measure is not stratified.

**S.13. Risk Adjustment Type** *(Select type. Provide specifications for risk stratification in S.12 and for statistical model in S.14-15)*

- ☐ No risk adjustment or risk stratification
- ☒ Statistical risk model
- ☐ Stratification by risk category/subgroup
- ☐ Other (specify)

**S.14. Identify the statistical risk model method and variables** *(Name the statistical method - e.g., logistic regression and list all the risk factor variables. Note - risk model development and testing should be addressed with measure testing under Scientific Acceptability)*

We anticipate developing, subsequent to measure testing, a statistical risk model based on logistical regression. The following variables will be used as risk adjustors for early testing efforts:

- (a) Age
- (b) Left ventricular assistive device
- (c) Metastatic cancer
- (d) Dialysis
- (e) Prior functional dependence
- (f) Vasoactive medication

**S.15. Detailed risk model specifications** *(must be in attached data dictionary/code list Excel or csv file. Also indicate if available at measure-specific URL identified in S.1.)*

*Note: Risk model details (including coefficients, equations, codes with descriptors, definitions), should be provided on a separate worksheet in the suggested format in the Excel or csv file with data dictionary/code lists at S.2b.*

- ☒ Available in attached Excel or csv file
- ☐ Provided in response box S.15a

**S.16. Type of score: (Please select one of the following options)**

- ☐ Count
- ☒ Rate/proportion
- ☐ Ratio
- ☐ Categorical, e.g., yes/no
- ☐ Continuous variable, e.g., average
- ☐ Other (specify):

**S.17. Interpretation of Score** *(Classifies interpretation of score according to whether better quality is associated with a higher score, a lower score, a score falling within a defined interval, or a passing score)*

- ☒ Better quality = higher score
- ☐ Better quality = lower score
- ☐ Better quality = score within a defined interval
- ☐ Passing score defines better quality

For patients admitted to an LTCH on invasive mechanical ventilation support, and for whom weaning attempts were expected or anticipated at admission, this measure calculates and reports the facility-level weaning rate, based on the following three (3) criteria:

- (1) Percentage of patients who were fully weaned at discharge (alive):
  - a. **Better Quality = Higher Score**
- (2) Percentage of patients who were not fully weaned at discharge (alive)
  - a. **Better Quality = Lower Score**
- (3) Percentage of patients who died
  - a. **Used in interpretation of Components 1 and 2.**

**S.18. Calculation Algorithm/Measure Logic** *(Describe the calculation of the measure score as an ordered sequence of steps including identifying the target population; exclusions; cases meeting the target process, condition, event, or outcome; aggregating data; risk adjustment; etc.)*

Measure Calculation Steps and Logic:

- (1) Identify all patients discharged (alive or dead) during the reporting period from an LTCH.
- (2) Of patients discharged from the LTCH during the reporting period, identify all patients who were admitted on invasive mechanical ventilation support upon admission to an LTCH. This is the target population.
- (3) Of patients identified in (2) above, identify the subset of patients for whom weaning attempts are not expected or anticipated at admission. These patients are excluded from the measure.
- (4) Of the patients identified in (2) above, identify the subset of patients for whom weaning attempts were expected or anticipated at admission. This is the denominator for all three measure components.
- (5) Of patients identified in (4) above, identify the subset of patients for the three (3) numerator components as follows:
  - (a) who are reported as fully weaned at discharge (alive),
  - (b) who are reported as not fully weaned at discharge (alive),
  - (c) who died (i.e., have an expired assessment).
- (6) Calculate the percentage of ventilator weaning (liberation) rate as follows:
  - (a) Patients who are fully weaned at discharge (alive) as a percentage of patients identified in (4) above.
  - (b) Patients who are not fully weaned at discharge (alive) as a percentage of patients identified in (4) above.
  - (c) Patients who died as a percentage of patients identified in (4) above.

Formulae:

- (1) **Percentage of weaning patients who are fully weaned at discharge (alive)** = [Number of patients who are fully weaned at discharge (alive)] \* 100 / [Total patients who were discharged (alive or dead) during reporting period AND who were on invasive mechanical ventilation support upon admission to the LTCH, for whom at admission weaning attempts were expected or anticipated.]
- (2) **Percentage of weaning patients who are not fully weaned at discharge (alive)** = [Number of patients who are not fully weaned at discharge (alive)] \* 100 / [Total patients who were discharged (alive or dead) during reporting period AND who were on invasive mechanical ventilation support upon admission to the LTCH, for whom at admission weaning attempts were expected or anticipated.]
- (3) **Percentage of weaning patients who died** = [Number of patients with an expired assessment] \* 100 / [Total patients who were discharged (alive or dead) during reporting period AND who were on invasive mechanical ventilation support upon admission to the LTCH, for whom at admission weaning attempts were expected or anticipated.]

**S.23. Data Source** (Check ONLY the sources for which the measure is SPECIFIED AND TESTED).

If other, please describe in 2a1.26.

- |   |   |
|---|---|
| <input type="checkbox"/> Administrative claims  | <input type="checkbox"/> Healthcare Provider Survey   |
| <input checked="" type="checkbox"/> Electronic Clinical Data : Electronic Clinical Data | <input type="checkbox"/> Management Data              |
| <input type="checkbox"/> Electronic Clinical Data : Electronic Health Record            | <input type="checkbox"/> Paper Medical Records        |
| <input type="checkbox"/> Electronic Clinical Data : Imaging/Diagnostic Study            | <input type="checkbox"/> Patient Reported Data/Survey |
| <input type="checkbox"/> Electronic Clinical Data : Laboratory                          | <input type="checkbox"/> Other                        |
| <input type="checkbox"/> Electronic Clinical Data : Pharmacy                            |   |
| <input type="checkbox"/> Electronic Clinical Data : Registry                            |   |

**S.26. Level of Analysis** (Check ONLY the levels of analysis for which the measure is SPECIFIED AND TESTED)

- |   |  |
|---|--|
| <input type="checkbox"/> Clinician : Individual     | <input type="checkbox"/> Population : Community      |
| <input type="checkbox"/> Clinician : Group/Practice | <input type="checkbox"/> Population : County or City |
| <input type="checkbox"/> Clinician : Team           | <input type="checkbox"/> Population : National       |
| <input checked="" type="checkbox"/> Facility        | <input type="checkbox"/> Population : Regional       |
| <input type="checkbox"/> Health Plan                | <input type="checkbox"/> Population : State          |
| <input type="checkbox"/> Integrated Delivery System |  |

**S.27. Care Setting** (Check ONLY the settings for which the measure is SPECIFIED AND TESTED)

- |   |  |
|---|--|
| <input type="checkbox"/> Ambulatory Care : Ambulatory Surgery Center (ASC)            | <input type="checkbox"/> Hospital/Acute Care Facility  |
| <input type="checkbox"/> Ambulatory Care : Clinician Office/Clinic                    | <input type="checkbox"/> Imaging Facility  |
| <input type="checkbox"/> Ambulatory Care : Outpatient Rehabilitation                  | <input type="checkbox"/> Laboratory  |
| <input type="checkbox"/> Ambulatory Care : Urgent Care                                | <input type="checkbox"/> Pharmacy  |
| <input type="checkbox"/> Behavioral Health/Psychiatric : Inpatient                    | <input type="checkbox"/> Post Acute/Long Term Care Facility : Nursing Home/Skilled Nursing Facility    |
| <input type="checkbox"/> Behavioral Health/Psychiatric : Outpatient Dialysis Facility | <input type="checkbox"/> Post Acute/Long Term Care Facility : Inpatient Rehabilitation Facility        |
| <input type="checkbox"/> Emergency Medical Services/Ambulance                         | <input checked="" type="checkbox"/> Post Acute/Long Term Care Facility : Long Term Acute Care Hospital |
| <input type="checkbox"/> Home Health  | <input type="checkbox"/> Other   |
| <input type="checkbox"/> Hospice  |  |

**S.28. COMPOSITE Performance Measure** - Additional Specifications (Use this section as needed for aggregation and weighting rules, or calculation of individual performance measures if not individually endorsed.)

This is not applicable.

## Importance

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Importance to Measure and Report is a threshold criterion that must be met in order to recommend a measure for endorsement. All three subcriteria must be met to pass this criterion. See guidance on evidence.

**Opportunity for Improvement (Measure evaluation criterion 1a)**

**1b.1. Briefly explain the rationale for this measure** (e.g., the benefits or improvements in quality envisioned by use of this measure)

IF a COMPOSITE (e.g. combination of component measure scores, all-or-none, any-or-none), SKIP this question and provide rationale for composite in question 1d.3 on the composite tab.

Patients on invasive mechanical ventilation support comprise a substantial proportion of long-term care hospital (LTCH) patient admissions, and thus present a critical focus for assessment of high quality care. Mechanically ventilated patients are increasingly common in both intensive care units (ICUs), where up to 40% of patients require some duration of mechanical ventilation (Dasta, McLaughlin, Mody, & Piech, 2005) and LTCHs, where patients are frequently transferred for weaning following treatment in ICUs (Dasta et al., 2005; Kahn, Benson, Appleby, Carson, & Iwashyna, 2010; MedPAC, 2015; Szubski et al., 2014). In Fiscal Year 2013, the LTCH MS-DRG for “Respiratory system diagnosis with ventilator support 96+ hours” (MS-DRG-LTCH 207) was the most frequently occurring diagnosis, accounting for over 11% (n=16,211) of total discharges. The LTCH MS-DRG for “Respiratory system diagnosis with ventilator support < 96 hours” (MS-DRG-LTCH 208) accounted for an additional 2.3% of discharges in FY 2013 (MedPAC, 2015).

Although often necessary for life support, invasive mechanical ventilation is not without risk of harm to patients, and these risks increase as duration of ventilation continues (Boles et al., 2007; Cox et al., 2007; Esteban et al., 2002; Penuelas et al., 2011). Studies show that prolonged mechanical ventilation (PMV, often defined as ventilation longer than 21 days) of critically ill patients is associated with adverse clinical outcomes, including higher rates of mortality (Cox & Carson, 2012; Dries, 1997; Kahn et al., 2010; Mancebo, 1996) and morbidity (e.g., ventilator-associated pneumonia [VAP] and nosocomial infection (Cook et al., 1998; Vincent et al., 1995), delirium (Ely et al., 1996), and ventilator associated lung injury (Meade & Cook, 1995; Meade, Cook, Kernerman, & Bernard, 1997; Slutsky & Tremblay, 1998). Other outcomes, occurring in both ICUs and LTCHs, include functional impairment, respiratory muscle weakness, upper airway pathology, myopathy, neuropathy, alterations in body composition, depression, anxiety, agitation, and chronic critical illness syndrome (Ambrosino & Gabbriellini, 2010; Barnato, Albert, Angus, Lave, & Degenholtz, 2011; Burns, Meade, Premji, & Adhikari, 2014; Cox & Carson, 2012; Cox et al., 2007; Jubran et al., 2010; Nelson, Cox, Hope, & Carson, 2010; O'Connor, Al-Qadheeb, White, Thaker, & Devlin, 2014).

In addition to increased morbidity and mortality, mechanical ventilation is also associated with higher costs. Studies in the ICU setting indicate that patients who require mechanical ventilation have 50% higher costs than patients who do not receive mechanical ventilation (Dasta, McLaughlin, Mody, & Piech, 2005). ICU patients who develop VAP incur at least \$40,000 more in hospital costs than ventilated patients without VAP (Kollef, Hamilton, & Ernst, 2012; Restrepo et al., 2010; Sedwick, Lance-Smith, Reeder, & Nardi, 2012).

Discontinuation of invasive mechanical ventilation, known as weaning or liberation, is feasible for many ventilated patients, and is associated with improved health outcomes. Although attempts to liberate patients from invasive mechanical ventilation in LTCHs have variable success, expectations of successful ventilator liberation are high for many LTCH patients (Hassenpflug et al., 2015; Hassenpflug, Steckart, & Nelson, 2011, 2014b; Rose & Fraser, 2012). A recent meta-analysis of weaning attempts in ICU patients with PMV found a pooled weaning rate in US LTCHs of 47% (95% CI 42-51). The analysis included nine studies (4,769 patients); weaning rates reported for included studies varied from 13% to 56% (Damuth, Mitchell, Bartock, Roberts, & Trzeciak, 2015). These findings have also been observed in LTCHs, where higher weaning rates have been associated with lower post-discharge mortality (Frengley, Sansone, Shakya, & Kaner, 2014; Hassenpflug, Steckart, & Nelson, 2014a; Hassenpflug et al., 2015; Hassenpflug et al., 2011, 2014b; Rose & Fraser, 2012; Scheinhorn et al., 2007; Stearn-Hassenpflug, Steckart, & Nelson, 2013). In LTCHs, fewer days of mechanical ventilation may lead to decreased risk of ventilator-associated complications/events, enhanced rehabilitation opportunities, and shorter LOS (Hassenpflug et al., 2015).

Unnecessarily prolonged mechanical ventilation increases the risk of negative patient outcomes and can be an indicator of poor quality care or of persistent illness (MacIntyre, 2013). Based on the evidence above, improving weaning processes and increasing weaning rates are expected to mitigate the risk of harm associated with invasive mechanical ventilation, thus contributing to more favorable clinical outcomes for patients (Blackwood, Burns, Cardwell, & O'Halloran, 2014; Jubran et



al., 2013) and decreased costs (Dasta et al., 2005). This quality measure, Ventilator Weaning (Liberation) Rate, will assess the proportion of patients discharged alive from an LTCH who are fully weaned, thereby promoting weaning efforts and encouraging quality management of LTCH patients on invasive mechanical ventilation.

#### Citations:

- Aboussouan, L. S., Lattin, C. D., & Kline, J. L. (2008). Determinants of long-term mortality after prolonged mechanical ventilation. *Lung*, 186(5), 299-306. doi:10.1007/s00408-008-9110-x
- Ambrosino, N., & Gabbriellini, L. (2010). The difficult-to-wean patient. *Expert Rev Respir Med*, 4(5), 685-692. doi:10.1586/ers.10.58
- Barnato, A. E., Albert, S. M., Angus, D. C., Lave, J. R., & Degenholtz, H. B. (2011). Disability among elderly survivors of mechanical ventilation. *Am J Respir Crit Care Med*, 183(8), 1037-1042. doi:10.1164/rccm.201002-0301OC
- Blackwood, B., Alderdice, F., Burns, K. E., Cardwell, C. R., Lavery, G., & O'Halloran, P. (2010). Protocolized versus non-protocolized weaning for reducing the duration of mechanical ventilation in critically ill adult patients. *Cochrane Database Syst Rev*(5), CD006904. doi:10.1002/14651858.CD006904.pub2
- Blackwood, B., Burns, K. E., Cardwell, C. R., & O'Halloran, P. (2014). Protocolized versus non-protocolized weaning for reducing the duration of mechanical ventilation in critically ill adult patients. *Cochrane Database Syst Rev*, 11, CD006904. doi:10.1002/14651858.CD006904.pub3
- Boles, J. M., Bion, J., Connors, A., Herridge, M., Marsh, B., Melot, C., . . . Welte, T. (2007). Weaning from mechanical ventilation. [Cited in Impact and Gap need to add to risk factors]. *Eur Respir J*, 29(5), 1033-1056. doi:10.1183/09031936.00010206
- Burns, K. E., Meade, M. O., Premji, A., & Adhikari, N. K. (2014). Noninvasive ventilation as a weaning strategy for mechanical ventilation in adults with respiratory failure: a Cochrane systematic review. *CMAJ*, 186(3), E112-122. doi:10.1503/cmaj.130974
- Cook, D. J., Walter, S. D., Cook, R. J., Griffith, L. E., Guyatt, G. H., Leasa, D., . . . Brun-Buisson, C. (1998). Incidence of and risk factors for ventilator-associated pneumonia in critically ill patients. *Ann Intern Med*, 129(6), 433-440. Retrieved from <http://annals.org/article.aspx?articleid=711674>
- Cox, C. E., & Carson, S. S. (2012). Medical and economic implications of prolonged mechanical ventilation and expedited post-acute care. *Semin Respir Crit Care Med*, 33(4), 357-361. doi:10.1055/s-0032-1321985
- Cox, C. E., Carson, S. S., Lindquist, J. H., Olsen, M. K., Govert, J. A., & Chelluri, L. (2007). Differences in one-year health outcomes and resource utilization by definition of prolonged mechanical ventilation: a prospective cohort study. *Crit Care*, 11(1), R9. doi:10.1186/cc5667
- Dalton, K., Kandilov, A., Kennell, D., & Wright, A. (2012). *Determining Medical Necessity and Appropriateness of Care for Medicare Long-Term Care Hospitals (LTCHs) Final Report*. Baltimore, MD Retrieved from <http://www.aha.org/advocacy-issues/postacute/ltach/resources.shtml>.
- Damuth, E., Mitchell, J. A., Bartock, J. L., Roberts, B. W., & Trzeciak, S. (2015). Long-term survival of critically ill patients treated with prolonged mechanical ventilation: a systematic review and meta-analysis. *Lancet Respir Med*. doi:10.1016/S2213-2600(15)00150-2
- Dasta, J. F., McLaughlin, T. P., Mody, S. H., & Piech, C. T. (2005). Daily cost of an intensive care unit day: the contribution of mechanical ventilation. *Crit Care Med*, 33(6), 1266-1271.
- Dries, D. J. (1997). Weaning from mechanical ventilation. *J Trauma*, 43(2), 372-384.
- Ely, E. W., Baker, A. M., Dunagan, D. P., Burke, H. L., Smith, A. C., Kelly, P. T., . . . Haponik, E. F. (1996). Effect on the duration of mechanical ventilation of identifying patients capable of breathing spontaneously. *N Engl J Med*, 335(25), 1864-1869. doi:10.1056/NEJM199612193352502
- Esteban, A., Anzueto, A., Frutos, F., Alia, I., Brochard, L., Stewart, T. E., . . . Mechanical Ventilation International Study, G. (2002). Characteristics and outcomes in adult patients receiving mechanical ventilation: a 28-day international study. *JAMA*, 287(3), 345-355. Retrieved from <http://jama.jamanetwork.com/data/Journals/JAMA/4816/JCE10020.pdf>
- Frengley, J. D., Sansone, G. R., Shakya, K., & Kaner, R. J. (2014). Prolonged mechanical ventilation in 540 seriously ill older adults: effects of increasing age on clinical outcomes and survival. *J Am Geriatr Soc*, 62(1), 1-9. doi:10.1111/jgs.12597
- Hassenpflug, M., Steckart, M. J., & Nelson, D. R. (2014a). Post-ICU Mechanical Ventilation: Weaning Outcomes And One Year Survival In The Very Elderly Chronically Critically Ill C45. *MECHANICAL VENTILATION* (pp. A4579-A4579): American Thoracic Society.
- Hassenpflug, M. S., Douglas, V., Rafael, S., David, R. N., Scott, A. S., & Steckart, M. J. (2015). Post-ICU Mechanical Ventilation: Outcomes of the Revised Therapist-Implemented Patient-Specific (TIPS?) Weaning Protocol B44. *Invasive And Non-Invasive Mechanical Ventilation* (pp. A3166-A3166): American Thoracic Society.
- Hassenpflug, M. S., Steckart, J., & Nelson, D. R. (2011). *Post-ICU Mechanical Ventilation: Extended Care Facility Residents Transferred From Intensive Care To Long-Term Acute Care*. Paper presented at the American Thoracic Society 2011

- International Conference, Denver, Colorado.
- Hassenpflug, M. S., Steckart, J., & Nelson, D. R. (2014b). *Post-ICU Mechanical Ventilation: Updates to Population Characteristics, Weaning Outcomes and Discharge Disposition*. Paper presented at the Society of Critical Care Medicine (SCCM) 2014 Critical Care Congress, San Francisco, CA.
- Jubran, A., Grant, B. J., Duffner, L. A., Collins, E. G., Lanuza, D. M., Hoffman, L. A., & Tobin, M. J. (2013). Effect of pressure support vs unassisted breathing through a tracheostomy collar on weaning duration in patients requiring prolonged mechanical ventilation: a randomized trial. *JAMA*, 309(7), 671-677. doi:10.1001/jama.2013.159
- Jubran, A., Lawm, G., Kelly, J., Duffner, L. A., Gungor, G., Collins, E. G., . . . Tobin, M. J. (2010). Depressive disorders during weaning from prolonged mechanical ventilation. *Intensive Care Med*, 36(5), 828-835. doi:10.1007/s00134-010-1842-4
- Kahn, J. M., Benson, N. M., Appleby, D., Carson, S. S., & Iwashyna, T. J. (2010). Long-term acute care hospital utilization after critical illness. *JAMA*, 303(22), 2253-2259. doi:10.1001/jama.2010.761
- Kollef, M. H., Hamilton, C. W., & Ernst, F. R. (2012). Economic impact of ventilator-associated pneumonia in a large matched cohort. *Infect Control Hosp Epidemiol*, 33(3), 250-256. doi:10.1086/664049
- MacIntyre, N. R. (2013). The ventilator discontinuation process: an expanding evidence base. *Respir Care*, 58(6), 1074-1086. doi:10.4187/respcare.02284
- Mancebo, J. (1996). Weaning from mechanical ventilation. *Eur Respir J*, 9(9), 1923-1931. Retrieved from <http://erj.ersjournals.com/content/9/9/1923.full.pdf>
- Meade, M. O., & Cook, D. J. (1995). The aetiology, consequences and prevention of barotrauma: a critical review of the literature. *Clin Intensive Care*, 6(4), 166-173.
- Meade, M. O., Cook, D. J., Kernerman, P., & Bernard, G. (1997). How to use articles about harm: the relationship between high tidal volumes, ventilating pressures, and ventilator-induced lung injury. *Crit Care Med*, 25(11), 1915-1922.
- MedPAC. (2015). *Chapter 11. Long-term Care Hospital Services*. In: *Report to the Congress: Medicare Payment Policy*. Retrieved from Washington, DC: <http://medpac.gov/documents/reports/chapter-11-long-term-care-hospital-services-%28march-2015-report%29.pdf?sfvrsn=0>
- Nelson, J. E., Cox, C. E., Hope, A. A., & Carson, S. S. (2010). Chronic critical illness. *Am J Respir Crit Care Med*, 182(4), 446-454. doi:10.1164/rccm.201002-0210CI
- O'Connor, H., Al-Qadheeb, N. S., White, A. C., Thaker, V., & Devlin, J. W. (2014). Agitation during prolonged mechanical ventilation at a long-term acute care hospital: risk factors, treatments, and outcomes. *J Intensive Care Med*, 29(4), 218-224. doi:10.1177/0885066613486738
- Penuelas, O., Frutos-Vivar, F., Fernandez, C., Anzueto, A., Epstein, S. K., Apezteguia, C., . . . Esteban, A. (2011). Characteristics and outcomes of ventilated patients according to time to liberation from mechanical ventilation. *Am J Respir Crit Care Med*, 184(4), 430-437. doi:10.1164/rccm.201011-1887OC
- Restrepo, M. I., Anzueto, A., Arroliga, A. C., Afessa, B., Atkinson, M. J., Ho, N. J., . . . Kollef, M. H. (2010). Economic burden of ventilator-associated pneumonia based on total resource utilization. *Infect Control Hosp Epidemiol*, 31(5), 509-515. doi:10.1086/651669
- Rose, L., & Fraser, I. M. (2012). Patient characteristics and outcomes of a provincial prolonged-ventilation weaning centre: a retrospective cohort study. *Can Respir J*, 19(3), 216-220. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3418097/pdf/crj19216.pdf>
- Scheinhorn, D. J., Hassenpflug, M. S., Votto, J. J., Chao, D. C., Epstein, S. K., Doig, G. S., . . . Petrak, R. A. (2007). Post-ICU mechanical ventilation at 23 long-term care hospitals: a multicenter outcomes study. *Chest*, 131(1), 85-93. doi:10.1378/chest.06-1081
- Sedwick, M. B., Lance-Smith, M., Reeder, S. J., & Nardi, J. (2012). Using evidence-based practice to prevent ventilator-associated pneumonia. *Crit Care Nurse*, 32(4), 41-51. doi:10.4037/ccn2012964
- Slutsky, A. S., & Tremblay, L. N. (1998). Multiple system organ failure. Is mechanical ventilation a contributing factor? *Am J Respir Crit Care Med*, 157(6 Pt 1), 1721-1725. doi:10.1164/ajrccm.157.6.9709092
- Stearn-Hassenpflug, M., Steckart, M., & Nelson, D. (2013). 678: Post-ICU Mechanical Ventilation: Trends in Mortality and 12-month Post-discharge Survival. *Critical Care Medicine*, 41(12), A166. doi:10.1097/01.ccm.0000439916.52441.12
- Szubski, C. R., Tellez, A., Klika, A. K., Xu, M., Kattan, M. W., Guzman, J. A., & Barsoum, W. K. (2014). Predicting discharge to a long-term acute care hospital after admission to an intensive care unit. *Am J Crit Care*, 23(4), e46-53. doi:10.4037/ajcc2014985
- Vincent, J. L., Bihari, D. J., Suter, P. M., Bruining, H. A., White, J., Nicolas-Chanoine, M. H., . . . Hemmer, M. (1995). The prevalence of nosocomial infection in intensive care units in Europe. Results of the European Prevalence of Infection in Intensive Care (EPIC) Study. EPIC International Advisory Committee. *JAMA*, 274(8), 639-644. Retrieved from <http://jama.jamanetwork.com/article.aspx?articleid=389495>

**1b.2. Provide performance scores on the measure as specified (current and over time)** at the specified level of analysis. (This is required for endorsement maintenance. Include mean, std dev, min, max, interquartile range, scores by decile.

Describe the data source including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities include). This information also will be used to address the subcriterion on improvement (4b.1) under Usability and Use.

This is not applicable.