Measure Abbreviation: PUL 02

Description: Percentage of cases with median tidal volumes less than or equal to 8 ml/kg.

NQS Domain: Patient Safety

Measure Type: Process

Scope: Calculated on a per case basis.

Measure Summary: PUL 02 measures performance in lung protective ventilation techniques. PUL 02 will measure the median tidal volume (in ml/kg ideal body weight) across a case.

Rationale: The use of lung protective ventilation techniques (low tidal volumes and positive end-expiratory pressure) should be part of standard anesthetic practice for most cases that require positive pressure ventilation. Several randomized controlled trials, as well as a meta-analysis in 2015 describe the benefit with low vs high tidal volume techniques.[1-6]

Inclusions:
Patients undergoing endotracheal intubation.

Exclusions:
- ASA 5 and 6 cases
- Patients < 12 years of age
- Patients <20kg.
- Patients ≥ 18 years old with a height <121.9cm (48 in) OR >213.4cm (84 in)
- Patients 12-17 years old with a height <91.4cm (36 in) or >213.4cm (84 in)
- Cases without a documented sex
- Cases without a documented height
- Cases in which patients are mechanically ventilated for less than 45 cumulative minutes.
- One lung ventilation procedures as indicated by intraoperative notes or note details mapped to one of the following MPOG concepts:
    - 50501: Thoracic: Single-lung ventilation
    - 50202: Thoracic: Single-lung ventilation, side detail

MPOG Concept IDs Required:

Endotracheal Tube MPOG Concept IDs		Ideal Body Weight MPOG Concept IDs		One-Lung Ventilation MPOG Concept IDs		Tidal Volume MPOG Concept IDs	
50121	Intubation Endotracheal Tube Stylet Used	**70257**	Physical Exam-Height (cm)	**50501**	Thoracic-Single lung ventilation	**3190**	Tidal Volume Actual
50122	Intubation Endotracheal Tube Size	**70258**	Physical Exam-Height (in)	**50202**	Thoracic-Single lung ventilation side detail	**3192**	Tidal Volume Set
50123	Intubation Endotracheal Tube Type						
50124	Intubation Endotracheal Tube Secured Mechanism						
50125	Intubation Endotracheal Tube Secured Distance						
50126	Intubation Endotracheal Tube Secured Reference Point						
50202	Emergence-Patient Extubated						
50205	Intubation Tube Note						
50671	Intubation-endotracheal tube in situ						

Data Diagnostics Affected:

- Percentage of Cases with Any Physiologic Observation
- Percentage of Physiologic Observations with a Meaningful Type Mapping
- Percentage of Cases with a Tidal Volume Observation
- Percentage of Cases with Patient Height
- Percentage of Cases with Patient Weight
- Percentage of Cases with an Intubation Note
- Percentage of Cases with a Meaningful Admission Type Mapping
- Percentage of Cases with Percentage of Cases with any Staff Tracking
- Percentage of Anesthesia Provider Sign-Ins that are Timed

Collations Used:

- AnesthesiaEnd
- AsaNotes
- Height
- MpogCaseId
- StaffRoles
- Asa5or6
- EndotrachealTube
- IdealBodyWeight
- PrimaryProvider
- TidalVolumeActualMedian
- TidalVolumeSetMedian

Other Measure Build Details:

- For a given case, this measure will exclude periods when patients are not under positive pressure ventilation (as defined by PIP - PEEP ≤ 6).
  - Peak Inspiratory Pressure determined by values mapped to MPOG Concept 3185. If no PIP documented, PIP is considered null and tidal volume is included.

  - PEEP will be determined using values associated with the following variables:

    1. Use Measured PEEP (MPOG Concept: 3210). If not documented,
    2. Use Set PEEP (MPOG Concept: 3212). If not documented,
    3. Assume PEEP = 0.

- For a case to be included for the PUL 02 measure, it must have at least 45 valid values of actual tidal volume or set tidal volume

- For patients ≥18 years old with height>121.9cm (48 in) but <213.4cm (84 in), the following equation is used to determine Ideal Body Weight. For patients less than 5 feet, 5 feet (152.4 cm) will be used for the IBW formula:
  Male patients: 50kg + 0.91kg * (height in cm - 152.4)
  Female patients: 45.5kg + 0.91kg * (height in cm - 152.4)

- For patients 12-17 years old and height >91.4cm (36 in) but <213.4cm (84 in), the McLaren Method is used to determine Ideal Body Weight. The McLaren Method is the most commonly used method to determine IBW in children and uses growth charts to determine IBW by identifying the 50th percentile height for age, then using that height to determine 50th percentile weight. This weight is the patient's Ideal Body Weight (IBW).[7]

- Algorithm for determining Case Duration:
  Case Start:
  1. Anesthesia Induction End. If not available, then
  2. Anesthesia Induction Begin. If not available, then
  3. Procedure Start. If not available, then
  4. Patient in Room. If not available, then
  5. Anesthesia Start

  Case End:
  1. Patient Extubated. If not available, then
  2. Procedure End. If not available, then
  3. Patient Out of Room. If not available, then
  4. Anesthesia End.

Success: Median tidal volume ≤ 8 ml/ kg ideal body weight

Threshold: 90%.

Responsible Provider: Provider signed in for largest portion of case. See 'Other Measure Build Details' section of this specification to view the algorithm used for determining case duration.

Method for determining Responsible Provider:
In the event that two or more providers in the same class are signed in for the same duration, all providers signed in for the longest duration will be attributed.

Risk Adjustment (for outcome measures):
Not applicable.

References:

1. Brower RG, Matthay MA, Morris A, Schoenfeld D, Thompson BT, Wheeler A. Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. *The New England journal of medicine.* 2000;342(18):1301-1308.
2. Fernandez-Perez ER, Keegan MT, Brown DR, Hubmayr RD, Gajic O. Intraoperative tidal volume as a risk factor for respiratory failure after pneumonectomy. *Anesthesiology.* 2006;105(1):14-18.
3. Futier E, Constantin JM, Paugam-Burtz C, et al. A trial of intraoperative low-tidal-volume ventilation in abdominal surgery. *The New England journal of medicine.* 2013;369(5):428-437.
4. Guldner A, Kiss T, Serpa Neto A, et al. Intraoperative protective mechanical ventilation for prevention of postoperative pulmonary complications: a comprehensive review of the role of tidal volume, positive end-expiratory pressure, and lung recruitment maneuvers. *Anesthesiology.* 2015;123(3):692-713.
5. Serpa Neto A, Hemmes SN, Barbas CS, et al. Protective versus Conventional Ventilation for Surgery: A Systematic Review and Individual Patient Data Meta-analysis. *Anesthesiology.* 2015;123(1):66-78.
6. Severgnini P, Selmo G, Lanza C, et al. Protective mechanical ventilation during general anesthesia for open abdominal surgery improves postoperative pulmonary function. *Anesthesiology.* 2013;118(6):1307-1321.

7. Phillips S, Edlbeck A, Kirby M, Goday P. Ideal body weight in children. *Nutrition in clinical practice : official publication of the American Society for Parenteral and Enteral Nutrition.* 2007;22(2):240-245.