Developing pediatric respiratory failure definitions

White Paper

FEATURES

Applying diagnostic criteria is a significant challenge in the pediatric population. The process is not "one size fits all," as consideration must be made for unique circumstances, including prematurity adjustment for age, congenital conditions, and developmental stage, all of which may impact the patient's presentation and the treatment plan. Due to these varying factors, both care providers and those reviewing for clinical validation require strong clinical judgment and critical thinking skills.

No organizations, such as the American Academy of Pediatrics, have put forth a universal consensus of diagnostic criteria to support the presence of acute respiratory failure in the pediatric population. This diagnosis relies on the patient's clinical presentation and the physician's judgment. If possible, we suggest developing organizational consensus definitions using agreed-upon diagnostic criteria with appropriate consideration for the patient population. The goal of clinical documentation integrity (CDI) is to create documentation that accurately reflects the physician's intent and the care provided to the individual patient.

This white paper, published jointly by the Association of Clinical Documentation Integrity Specialists (ACDIS) and the American College of Physician Advisors (ACPA), aims to provide direction and advice in the development of institutional definitions for common, critical pediatric conditions, or to assist organizations in validating and refining their existing institutional definitions.

Definitons

Respiratory failure is the inability of the respiratory system to meet the body's oxygenation, ventilation, and/or metabolic requirements. It is important to know the values and presentations that are considered to be within the defined limits of each patient population.

Any underlying condition, process, or trauma that interferes with oxygenation or ventilation can result in respiratory failure. Examples of such conditions within the pediatric population include, but are not limited to, the following:

- Cardiopulmonary diseases
  - Reactive airway diseases such as asthma or bronchiolitis, bronchopulmonary dysplasia (BPD), primary pulmonary hypertension, pulmonary edema, pulmonary embolus, congenital heart conditions, cystic fibrosis (CF)

- Infections
  - Pneumonia (e.g., aspiration, bacterial, viral), respiratory syncytial virus, croup, epiglottitis, sepsis, meningitis
- Neurologic disorders
  - Guillain-Barré syndrome, spinal muscular atrophy, conditions and/or poisoning contributing to respiratory neuromuscular weakness
- Traumas
  - Spinal cord injury, traumatic brain injury, drowning, traumatic pneumothorax, airway obstruction
- Complications secondary to medical interventions
  - Postprocedural pneumothorax, adverse reactions to medications and/or anesthesia

Respiratory failure may present with varying levels of acuity:

- **Acute** respiratory failure develops over minutes to hours and is life-threatening.
- **Chronic** respiratory failure can develop gradually over a period of weeks or months, or it may be the result of unrecoverable acute respiratory failure, requiring chronic oxygen, mechanical ventilation, and/or advanced airway such as tracheostomy. Metabolic (renal) compensation occurs, with a near-normal serum pH. Chronic respiratory failure is often the result of a chronic illness, such as BPD, CF, or persistent pulmonary hypertension.
- **Acute on chronic** respiratory failure is an acute condition with acute respiratory distress superimposed on underlying chronic respiratory failure.

Finally, there are three types of respiratory failure, and they can be found concomitantly:

- Hypoxic respiratory failure (Type 1)*
- Hypercapnic respiratory failure (Type 2)*
- Combined respiratory failure with hypoxia and hypercapnia

**Note that documentation of "Type 1" or "Type 2" respiratory failure does not support ICD-10-CM code assignment.*

Although the words "hypoxia" and "hypoxemia" are often used interchangeably, hypoxia describes low oxygen levels within the tissues at the cellular level, while hypoxemia describes low oxygen levels in the blood.

Clinical signs, symptoms, and diagnostics

To support clinical validation, the health record documentation must include clinical indicators of nontransient respiratory distress that evoke the diagnosis of acute respiratory failure. Documentation should include indicators such as:

> *Tachypnea, bradypnea, retractions (e.g., intercostal, subcostal, suprasternal), head bobbing, nasal flaring, grunting, cyanosis, diaphragmatic breathing, diaphoresis, lethargy, confusion, difficulty feeding, tripoding/posturing/ extended airway, wheezing, stridor, crackles (fine/coarse), diminished paradoxical movement, flail chest, tachycardia, bradycardia, hypoglycemia, acidosis (respiratory/metabolic).*

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Most patients, adult or pediatric, with acute or acute on chronic respiratory failure look acutely ill.

Capturing the level of activity at the time of the assessment is important to provide context for the abnormal presentation. For example, a child who is crying when their respiratory function and rate are assessed may have quite different results compared to a child who is calm and quiet.

The specificity of acute respiratory failure is based on identification of the presence of hypoxemia and/or hypercapnia:

- Acute hypoxic respiratory failure is defined as PaO_2 < 60 mmHg, SaO_2 < 88%–90% on room air, oxygen needs of 30% or greater to maintain SaO_2 > 90%, oxygen (oxygenation) index ≤ 25, or P/F ratio < 300 with normal Hb, acutely and in the appropriate clinical context
- Acute hypercapnic respiratory failure is defined as an acute increase of 10–15 mmHg from normal range of 35–45 with pH < 7.32, acutely and in the appropriate clinical context

Acute on chronic respiratory failure can be classified as hypoxic, hypercapnic, or both:

- Acute on chronic hypoxic respiratory failure is defined as a PO_2 decrease of 10 mmHg or more from baseline
- Acute on chronic hypercapnic respiratory failure is defined as a $PaCO_2$ increase of 10 mmHg or more from baseline and pH < 7.35

Pulse oximetry can be affected by pH and the presence of fetal hemoglobin, carboxyhemoglobin, and methemoglobin, so it should be interpreted with caution. Under typical circumstances, an SaO_2 of ≤ 90% on room air is considered hypoxemia (an SaO_2 of 90% correlates with a PO_2 of 60 mmHg).

Acute on chronic respiratory failure represents an acute decline in pulmonary function superimposed on chronic failure. The clinician should take care to identify the chronic condition as well as the overlying acute respiratory failure. The expectation of treatment is that the patient will hopefully return to baseline function.

Other clinical indicators include treatment with extracorporeal membrane oxygenation (ECMO), endotracheal intubation, noninvasive ventilation such as continuous positive airway pressure (CPAP)/bi-level positive airway pressure (BiPAP), and/or supplemental oxygen. Oxygen or high-flow nasal cannula value associated with acute respiratory failure will vary by age and weight, as well as institutional policy and guidelines.

ACDIS/ACPA Tip

ACDIS and ACPA suggest developing an interdisciplinary organizational guideline for the required level of respiratory support to indicate the diagnosis of acute respiratory failure.

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Best-practice documentation to support clinical validation and medical decision-making should include:

- Identification of the etiology, acuity, and type of the respiratory failure
- Supportive physical signs/symptoms of respiratory distress (listed earlier in this paper)
- Clinical data and management such as:
  - Laboratory studies/diagnostics such as:
    - Pulse oximetry (hypoxemia)
    - Arterial blood gas (hypoxemia, hypercapnia, respiratory acidosis/metabolic acidosis)
    - Complete blood count (polycythemia that may result from chronic hypoxemia or anemia)
    - Electrolyte derangement (e.g., hypokalemia, hypocalcemia, or hypophosphatemia may result in weakness)
    - Toxicology
    - Imaging (e.g., infiltrates, ground glass, atelectasis, hyper-/hypoinflation, cardiomegaly, pleural effusion [a clear chest X-ray could suggest congenital heart defects], pulmonary hypertension, pulmonary embolism)
  - Interventions and escalations such as:
    - Treatment of underlying etiology
    - Capnography/transcutaneous monitoring
    - Oxygen, high-flow nasal cannula, CPAP, BiPAP/nasal intermittent positive pressure ventilation, conventional ventilation (i.e., pressure or volume control), high-frequency oscillatory ventilation, high-frequency jet ventilation, ECMO

- Airway clearance (e.g., cough assist, positive expiratory pressure therapy, chest physiotherapy, repositioning, airway clearance suctioning)
- Incentive spirometry

– Medications (specify frequency and route) such as:

- Steroids
- Beta-agonists, such as albuterol (short-acting) or salmeterol (long-acting)
- Anticholinergic medications
- Racemic epinephrine
- Heliox
- Inhaled nitric oxide
- Hypertonic saline

– Patient's response to treatment and evolving plan of care

Each patient is unique in presentation and history, with age, size, and prematurity contributing to varied interpretations of diagnostic criteria.

Conclusion

The pediatric population presents many challenges in the process of clinical validation and best-practice documentation. Each patient is unique in presentation and history, with age, size, and prematurity contributing to varied interpretations of diagnostic criteria. Provider documentation must communicate both clinical support and the complexity of their medical decision-making. CDI professionals must apply critical thinking to the process of clinical validation.

This guidance document is intended to assist organizations in establishing or refining institutional consensus definitions related to respiratory failure in the pediatric population. Such guidelines can be used to direct best practice documentation strategies and assist in clinical validation efforts to ensure documentation integrity.

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Acknowledgments

ACDIS would like to thank the following members of ACDIS and ACPA for their contributions to writing and reviewing this white paper:

- Erica E. Remer, MD, CCDS, ACPA-C
- Laurie L. Prescott, RN, MSN, CCDS, CCDS-O, CRC, CDIP
- Amy Bush, BS, RN, MJ, CCDS, CCS
- Beatriz Ladd, MD, FAAP
- Kiran Kulkarni, MD, MS, FAAP
- Denise Goodman, MD, MS, FCCM
- Jeff Morris, RN, BSN, CCDA, CCS
- Laurie Stelmach, RN, MSN, CNL, CCDS
- Dana Howard, BS-RRT
- Alyss Riley, MD, Med, FAAP, ACPA-C, CHCQM-PHYADV

Second reviewers and editors include Linnea Archibald, Adam Carroll, and Rebecca Hendren.

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