Respiratory Insufficiency: Common Complications and Conditions

MCG Health
Inpatient & Surgical Care
30th Edition

CCC: CCC-045 (ISC)
Link to Codes

Prevention

- Prevention issues and possible preventive measures include(1):
  - Monitor pulmonary function in patient with neuromuscular disease (eg, Guillain-Barre syndrome or myasthenia gravis).[A](2)(3)(4)(5)
  - Screen patients preoperatively for sleep apnea.[B](6)(7)(8)(9)
  - Use CPAP or BPAP postoperatively in patient with obstructive sleep apnea.(9)
  - Use BPAP or noninvasive ventilation[C] for patients with known or suspected obesity hypoventilation syndrome.(10)
  - Preoperative anesthesiology evaluation for patient with history of prior difficult intubation, distorted airway anatomy, sleep apnea, or other finding suspicious for a difficult airway.[D](6)(11)
  - Use CPAP for patients with postoperative atelectasis.(12)
  - Consider BPAP or combined noninvasive ventilation[C] with high-flow nasal oxygen post extubation to prevent reintubation in patients at high risk of extubation failure (eg, age older than 65 years, underlying cardiac or respiratory disease, neuromuscular weakness).(4)(13)
  - Consider noninvasive ventilatory support (eg, high-flow nasal cannula (HFNC), CPAP, BPAP) to avoid intubation for patients in acute respiratory failure.(14)
  - Use lung-protective low tidal volume ventilation intraoperatively.[E](1)(12)(15)(16)
  - Identify adult at risk for postoperative respiratory complications, including(1)(17):
    - Current cigarette use
    - American Society of Anesthesiologists class II or greater American Society of Anesthesiologists (ASA) Physical Status Classification System (1)
    - Elevated pulmonary complication risk (eg, ARISCAT) score[F]
    - Functionally dependent
    - Serum albumin level less than 3.5 g/dL (35 g/L)(1)
    - Preoperative Hypoxemia
    - Obesity (BMI greater than 35)  BMI Calculator

- COPD
- Severe or poorly controlled asthma
- Chronic heart failure
- Pulmonary hypertension(18)
- Poorly controlled asthma
- Sleep apnea(6)(8)
- Obesity hypoventilation syndrome(9)
- Bronchiectasis
- Tracheomalacia
- Severe neuromuscular or neurologic disease (eg, impaired respiratory effort)(4)
- Thoracic, aortic, upper abdominal, or emergency surgery
- Prolonged surgery (eg, longer than 3 hours)
- Emergent surgery

− Identify child at risk for postoperative respiratory complications, including(5)(16):

- Elevated pulmonary complication risk (eg, SPORC-C) score[G](19)
- Age younger than 3 years
- Premature infant
- Lung disease (eg, asthma, cystic fibrosis)
- Congenital heart disease
- Neurologic disease
- Obstructive sleep apnea
- Tobacco inhalation (smoking, passive smoking, vaping)(1)
- Obesity (BMI greater than 35) BMI Calculator
- Preoperative anemia
- American Society of Anesthesiologists class III or greater American Society of Anesthesiologists (ASA) Physical Status Classification System
- Emergent or otolaryngology procedure

- Use postoperative lung expansion modalities (eg, deep breathing exercises, positive-pressure breathing) for patient identified as higher risk for surgical pulmonary complications.(1)(16)(20)(21)
- Use perioperative and postoperative bronchodilators for patients with a history of bronchospasm.(22)
- Use perioperative and postoperative pulmonary artery pressure monitoring and pulmonary arterial antihypertensive agents for patients with severe pulmonary arterial hypertension.(18)
- Use reminders to improve adherence to incentive spirometry when prescribed.[H](21)
- Provide preoperative education regarding patient incentive spirometry or deep breathing exercises and need for early ambulation postoperatively.(1)
- Provide preoperative smoking cessation counseling(1)
- Limit use of opiates, benzodiazepines, and other respiratory depressant agents when possible (particularly in patients with sleep apnea, obesity hypoventilation syndrome, or neuromuscular weakness).(4)(6)(9)(23)
- Use Multimodal analgesia.(1)(24)
- Pretreat with corticosteroid and antihistamine for patient at high risk of anaphylaxis (eg, prior severe anaphylaxis, beta-blocker use, cardiovascular disease) who requires contrast study.(25)
- Use pharmacologic and/or mechanical prophylaxis against venous thromboembolic disease.(26) See Venous Thrombosis and Pulmonary Embolism: Common Complications and Conditions ISC.

- Employ prophylactic measures to prevent hospital-acquired pneumonia.(27)(28)(29) See Hospital-Acquired Pneumonia and Atelectasis: Common Complications and Conditions ISC.
- Screen and treat high-risk patient for dysphagia and aspiration.(3)(30)(31) See Hospital-Acquired Pneumonia and Atelectasis: Common Complications and Conditions ISC.

Clinical Indications for Ongoing Inpatient Care

- Ongoing inpatient care is indicated for **1 or more** of the following(5)(32)(33)(34):
  - Need for acute invasive or noninvasive mechanical ventilation[C](35)
  - Respiratory distress (eg, significant new-onset Tachypnea, dyspnea, persistent heart rate 95 or greater, use of accessory muscles of respiration)[I](35)(36)
  - Altered mental status due to respiratory disease(35)
  - Airway obstruction or stridor(1)(37)(38)(39)
  - Hypoxemia
  - Significant hypoventilation, as indicated by **1 or more** of the following(33):
    - Hypercarbia ($PaCO_2$ greater than 45 mm Hg (6.0 kPa) with respiratory acidosis (pH less than 7.35))
    - Documented partial pressure of carbon dioxide ($PaCO_2$) increase greater than 5 mm Hg (0.7 kPa) from disease baseline
  - Acute or worsening neuromuscular weakness with **1 or more** of the following(2)(3):
    - Vital capacity less than 20 mL/kg of ideal body weight
    - 30% decrease in vital capacity over 24 hours(2)
    - Vital capacity less than 1 liter
    - Maximum inspiratory pressure greater than -30 cm H_2O (-2942 Pa)
    - Maximum expiratory pressure less than 40 cm H_2O (3923 Pa)
    - Nocturnal oxygen desaturation

Alternatives to Inpatient Care

- Generally not used[J][K]

Discharge

- Extended stay beyond goal length of stay for primary condition may be needed until **ALL** of the following are present(5)(32)(33)(34):
  - Evaluation of cause of respiratory insufficiency complete
  - Suctioning, pulmonary toilet, or other therapy performable at lower level of care
  - Respiratory insufficiency resolved or manageable at lower level of care
  - Anticoagulation treatment not needed or can be performed at lower level of care(46)
  - Medical comorbidities manageable at lower level of care

References

1. Palermo J, Tingey S, Khanna AK, Segal S. Evaluation and prevention of perioperative respiratory failure. Journal of Clinical Medicine 2024;13(17):DOI: 10.3390/jcm13175083. [Context Link 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12] View abstract...
2. Singh TD, Wijdicks EFM. Neuromuscular respiratory failure. Neurologic Clinics 2021;39(2):333-353. DOI: 10.1016/j.ncl.2021.01.010. [Context Link 1, 2, 3, 4] View abstract...

3. Krall JTW, Chakravartty A, Caress JB, Files DC. Identification and management of acute neuromuscular respiratory failure in the ICU. Chest 2023;164(6):1454-1461. DOI: 10.1016/j.chest.2023.09.009. [Context Link 1, 2, 3, 4] View abstract...
4. Bhat A, Dean J, Aboussouan LS. Perioperative management in neuromuscular diseases: a narrative review. Journal of Clinical Medicine 2024;13(10):Online. DOI: 10.3390/jcm13102963. [Context Link 1, 2, 3, 4, 5, 6] View abstract...
5. Rakoczy K. Acute respiratory failure. In: Gershel JC, Rauch DA, editors. Caring for the Hospitalized Child: A Handbook of Inpatient Pediatrics. 3rd ed. Elk Grove Village, IL: American Academy of Pediatrics; 2023:749-754. [Context Link 1, 2, 3, 4]
6. Chang JL, et al. International consensus statement on obstructive sleep apnea. International Forum of Allergy and Rhinology 2022;Online. DOI: 10.1002/alr.23079. [Context Link 1, 2, 3, 4, 5, 6] View abstract...
7. Huerta J, Taleu H, Norton R, Gries H, Yun P, Lam D. Use of the Snoring, Trouble Breathing, Un-Refreshed questionnaire to predict perioperative respiratory adverse events in children. Journal of Clinical Sleep Medicine 2022;18(3):695-701. DOI: 10.5664/jcsm.9582. [Context Link 1, 2] View abstract...
8. Suen C, et al. Sleep study and oximetry parameters for predicting postoperative complications in patients with OSA. Chest 2019;155(4):855-867. DOI: 10.1016/j.chest.2018.09.030. [Context Link 1, 2] View abstract...
9. Weingarten TN, Sprung J. Perioperative considerations for adult patients with obstructive sleep apnea. Current Opinion in Anaesthesiology 2022;35(3):392-400. DOI: 10.1097/ACO.0000000000001125. [Context Link 1, 2, 3, 4] View abstract...
10. Mokhlesi B, et al. Evaluation and management of obesity hypoventilation syndrome. an official American Thoracic Society Clinical practice guideline. American Journal of Respiratory and Critical Care Medicine 2019;200(3):e6-e24. DOI: 10.1164/rccm.201905-1071ST. (Reaffirmed 2025 Jul) [Context Link 1] View abstract...
11. Apfelbaum JL, et al. 2022 American Society of Anesthesiologists practice guidelines for management of the difficult airway. Anesthesiology 2022;136(1):31-81. DOI: 10.1097/ALN.0000000000004002. [Context Link 1, 2] View abstract...
12. Lusquinhos J, Tavares M, Abelha F. Postoperative pulmonary complications and perioperative strategies: a systematic review. Cureus 2023;15(5):e38786. DOI: 10.7759/cureus.38786. [Context Link 1, 2] View abstract...
13. Thille AW, et al. Effect of postextubation high-flow nasal oxygen with noninvasive ventilation vs high-flow nasal oxygen alone on reintubation among patients at high risk of extubation failure: a randomized clinical trial. Journal of the American Medical Association 2019;322(15):1465-1475. DOI: 10.1001/jama.2019.14901. [Context Link 1] View abstract...
14. Seow D, et al. High-flow nasal oxygen therapy compared with conventional oxygen therapy in hospitalised patients with respiratory illness: a systematic review and meta-analysis. BMJ Open Respiratory Research 2024;11(1):DOI: 10.1136/bmjresp-2024-002342. [Context Link 1] View abstract...
15. Guay J, Ochroch EA, Kopp S. Intraoperative use of low volume ventilation to decrease postoperative mortality, mechanical ventilation, lengths of stay and lung injury in adults without acute lung injury. Cochrane Database of Systematic Reviews 2018, (verified by Cochrane 2018 Oct), Issue 7. Art. No.: CD011151. DOI: 10.1002/14651858.CD011151.pub3. [Context Link 1, 2] View abstract...
16. Egbuta C, Mason KP. Recognizing risks and optimizing perioperative care to reduce respiratory complications in the pediatric patient. Journal of Clinical Medicine 2020;9(6):1942. DOI: 10.3390/jcm9061942. [Context Link 1, 2, 3] View abstract...
17. Lagier D, Zeng C, Fernandez-Bustamante A, Vidal Melo MF. Perioperative pulmonary atelectasis: part II. clinical implications. Anesthesiology 2022;136(1):206-236. DOI: 10.1097/ALN.0000000000004009. [Context Link 1] View abstract...
18. Rajagopal S, et al. Evaluation and management of pulmonary hypertension in noncardiac surgery: a scientific statement from the American Heart Association. Circulation 2023;147(17):1317-1343. DOI: 10.1161/CIR.0000000000001136. [Context Link 1, 2] View abstract...
19. Luedeke CM, et al. Development and validation of a score for prediction of postoperative respiratory complications in infants and children (SPORC-C). British Journal of Anaesthesia 2025;134(1):212-220. DOI: 10.1016/j.bja.2024.07.011. [Context Link 1, 2] View abstract...
20. Sullivan KA, Churchill IF, Hylton DA, Hanna WC. Use of incentive spirometry in adults following cardiac, thoracic, and upper abdominal surgery to prevent post-operative pulmonary complications: a systematic review and meta-analysis. Respiration 2021;100(11):1114-1127. DOI: 10.1159/000517012. [Context Link 1] View abstract...
21. Eltorai AEM, et al. Effect of an incentive spirometer patient reminder after coronary artery bypass grafting: a randomized clinical trial. JAMA Surgery 2019;154(7):579-588. DOI: 10.1001/jamasurg.2019.0520. [Context Link 1, 2, 3] View abstract...

22. Regli A, Sommerfield A, von Ungern-Sternberg BS. Anesthetic considerations in children with asthma. Paediatric Anaesthesia 2022;32(2):148-155. DOI: 10.1111/pan.14373. [Context Link 1] View abstract...
23. Khanna AK, et al. Opioid-induced respiratory depression increases hospital costs and length of stay in patients recovering on the general care floor. BMC Anesthesiology 2021;21(1):88. DOI: 10.1186/s12871-021-01307-8. [Context Link 1] View abstract...
24. Smith HAB, et al. 2022 Society of Critical Care Medicine clinical practice guidelines on prevention and management of pain, agitation, Neuromuscular Blockade, and Delirium in Critically Ill Pediatric Patients With Consideration of the ICU Environment and Early Mobility. Pediatric Critical Care Medicine 2022;23(2):e74-e110. DOI: 10.1097/PCC.0000000000002873. [Context Link 1] View abstract...
25. Wang C, et al. Management and prevention of hypersensitivity reactions to radiocontrast media: a consensus statement from the American College of Radiology and the American Academy of Allergy, Asthma & Immunology. Radiology 2025;315(2):e240100. DOI: 10.1148/radiol.240100. [Context Link 1] View abstract...
26. Kahn SR, et al. Prevention of VTE in nonsurgical patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest 2012;141(2 Suppl):e195S-e226S. DOI: 10.1378/chest.11-2296. (Reaffirmed 2025 Jun) [Context Link 1] View abstract...
27. Weinberger J, Cocoros N, Klompas M. Ventilator-associated events: epidemiology, risk factors, and prevention. Infectious Disease Clinics of North America 2021;35(4):871-899. DOI: 10.1016/j.idc.2021.07.005. [Context Link 1] View abstract...
28. Klompas M, et al. Strategies to prevent ventilator-associated pneumonia, ventilator-associated events, and nonventilator hospital-acquired pneumonia in acute-care hospitals: 2022 Update. Infection Control and Hospital Epidemiology 2022;43(6):687-713. DOI: 10.1017/ice.2022.88. [Context Link 1] View abstract...
29. Rosenthal VD, Memish ZA, Bearman G. Preventing ventilator-associated pneumonia: A position paper of the International Society for Infectious Diseases, 2024 update. International Journal of Infectious Disease 2025;151:107305. DOI: 10.1016/j.ijid.2024.107305. [Context Link 1] View abstract...
30. Simpson AJ, et al. BTS clinical statement on aspiration pneumonia. Thorax 2023;78(Suppl 1):s3-s21. DOI: 10.1136/thorax-2022-219699. [Context Link 1] View abstract...
31. McCarty EB, Chao TN. Dysphagia and swallowing disorders. Medical Clinics of North America 2021;105(5):939-954. DOI: 10.1016/j.mcna.2021.05.013. [Context Link 1] View abstract...
32. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention 2025 [Internet] Global Initiative for Asthma Management and Prevention (GINA). 2025 May Accessed at: https://www.ginasthma.org/. [accessed 2025 Sep 11] [Context Link 1, 2]
33. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease. 2025 report [Internet] Global Initiative for Chronic Obstructive Lung Disease (GOLD). 2025 Accessed at: https://www.goldcopd.org. [accessed 2025 Sep 11] [Context Link 1, 2, 3]
34. Humbert M, et al. 2022 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension. European Heart Journal 2022;43(38):3618-3731. DOI: 10.1093/eurheartj/ehac237. (Reaffirmed 2025 Mar) [Context Link 1, 2] View abstract...
35. Braithwaite SA, Wessel AL. Dyspnea. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:194-201.e2. [Context Link 1, 2, 3]
36. Hill NS, Garpestad E, Schumaker GL. Acute ventilatory failure. In: Broaddus VC, et al., editors. Murray & Nadel's Textbook of Respiratory Medicine. 7th ed. Elsevier Saunders; 2022:1843-1859.e5. [Context Link 1]
37. Wald O, Izhar U, Sugarbaker DJ. Lung, chest wall, pleura and mediastinum. In: Townsend CM, Beauchamp RD, Evers BM, Mattox KL, editors. Sabiston Textbook of Surgery. 21st ed. Elsevier; 2022:1584-1640.e1. [Context Link 1]
38. Rose E. Pediatric upper airway obstruction and infections. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:2078-2089.e2. [Context Link 1]
39. Brown CA, Walls RM. Airway. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:2-23.e2. [Context Link 1]
40. Pisani L, Hill NS, Pacilli AMG, Polastri M, Nava S. Management of dyspnea in the terminally ill. Chest 2018;154(4):925-934. DOI: 10.1016/j.chest.2018.04.003. [Context Link 1] View abstract...
41. Iyer AS, Sullivan DR, Lindell KO, Reinke LF. The role of palliative care in COPD. Chest 2021;Online. DOI: 10.1016/j.chest.2021.10.032. [Context Link 1] View abstract...
42. MacLean JE, Fauroux B. Long-term non-invasive ventilation in children: Transition from hospital to home. Paediatric Respiratory Reviews 2023;47:3-10. DOI: 10.1016/j.prrv.2023.01.002. [Context Link 1] View abstract...

43. Khan A, et al. Respiratory management of patients with neuromuscular weakness: an American College of Chest Physicians clinical practice guideline and expert panel report. Chest 2023;164(2):394-413. DOI: 10.1016/j.chest.2023.03.011. (Reaffirmed 2025 Jun) [Context Link 1] View abstract...

44. Wang Z, et al. Noninvasive Positive Pressure Ventilation in the Home. Technology Assessment [Internet] Agency for Healthcare Quality and Research. 2020 Feb Accessed at: https://www.ahrq.gov/. [accessed 2025 Sep 03] [Context Link 1] View abstract...

45. Macrea M, et al. Long-term noninvasive ventilation in chronic stable hypercapnic chronic obstructive pulmonary disease. An official American Thoracic Society clinical practice guideline. American Journal of Respiratory and Critical Care Medicine 2020;202(4):e74-e87. DOI: 10.1164/rccm.202006-2382ST. (Reaffirmed 2025 Mar) [Context Link 1] View abstract...

46. Stevens SM, et al. Antithrombotic therapy for VTE disease: second update of the CHEST guideline and expert panel report. Chest 2021;160(6):e545-e608. DOI: 10.1016/j.chest.2021.07.055. (Reaffirmed 2025 Jan) [Context Link 1] View abstract...

Footnotes

[A] Monitoring for neuromuscular disease may include vital capacity, maximum inspiratory pressure, maximum expiratory pressure, cough peak flow, and oximetry.(2)(3)(4) [A in Context Link 1]

[B] For adults, the STOP-Bang questionnaire has a sensitivity of 88% to 93% for detecting moderate obstructive sleep apnea and 97% for detecting severe obstructive sleep apnea. A STOP-Bang score of 3 or greater has been associated with increased risk of postoperative respiratory complications.(6) An online calculator is available at http://stopbang.ca/osa/screening.php. For children, the Snoring, Trouble Breathing, and Un-Refreshed (STBUR) scale is a simple 5-item questionnaire derived from a larger sleep apnea instrument; a score of 3 or more has been found to be an independent predictor of perioperative respiratory complications.(7) [B in Context Link 1]

[C] Ventilatory assistance includes noninvasive methods (eg, high-flow nasal cannula (HFNC), CPAP, BPAP) and invasive methods (intubation with mechanical ventilation). [C in Context Link 1, 2, 3]

[D] Preparations for a difficult airway may include access to specialized equipment (eg, video laryngoscope, guidewires or bougies, supraglottic airway device), use of noninvasive ventilation during induction, ramped positioning, awake intubation, and anticipation of possible emergent surgical airway access.(6)(11) [D in Context Link 1]

[E] A meta-analysis of 19 studies encompassing 1548 patients randomized to protective intraoperative ventilation (mean tidal volume 6 to 8 mL/kg) or nonprotective intraoperative ventilation (mean tidal volume 10 to 12 mL/kg) who underwent abdominal, cardiac, spinal, knee, or pulmonary thromboendarterectomy found that protective ventilation reduced the incidence of postoperative pneumonia, reduced the need for postoperative noninvasive ventilation, and shortened length of stay.(15) [E in Context Link 1]

[F] The ARISCAT score predicts in-hospital postoperative pulmonary complications based on factors for age, preoperative SpO_2, anemia, location and duration of surgery, and whether surgery is emergent or elective. A score greater than 26 identifies patients at intermediate risk of pulmonary complications (13% to 42%), and a score greater than 45 identifies patients at high risk of pulmonary complications (greater than 42%). A calculator is available at www.mdcalc.com/calc/10022/ariscat-score-postoperative-pulmonary-complications#use-cases.(1) [F in Context Link 1]

[G] The SPORC-C score predicts in-hospital postoperative pulmonary complications based on factors including patient younger than 2 years, American Society of Anesthesiologists physical status greater than 3, body weight (obesity or underweight), type of surgery, dose of neuromuscular blocking agent, case duration, recent airway infection, congenital abnormalities, and being born preterm or small for gestational age. A score greater than 6 identifies patients at high risk of postoperative pulmonary complications (sensitivity 76%, specificity 81%, negative predictive value 99%).(19) [G in Context Link 1]

[H] A randomized trial of 145 postoperative coronary bypass patients found that automated hourly reminders for incentive spirometry led to increased incentive spirometry usage.(21) [H in Context Link 1]

[I] Criteria based upon clinician-acquired numeric values (eg, vital signs, oxygen saturation) should be used if they are accurate reflections of the patient's condition. Transitory findings (eg, abnormal only upon initial emergency department intake or only one time out of multiple readings) that rapidly improve with no or minimal treatment usually do not reflect disease severity or risk for deterioration. This does not imply that an initial or one-time reading cannot ever be applicable. The goal is to separate erroneous or incidental findings from those that truly represent the patient's clinical picture. [I in Context Link 1]

[J] Palliative care or formal hospice enrollment may be indicated for end-stage disease.(40)(41) [J in Context Link 1]

[K] Home noninvasive or invasive ventilation may be appropriate for select patients with respiratory failure.(4)(42)(43)(44)(45) [K in Context Link 1]

Definitions

Altered mental status

- Altered mental status (ie, different from baseline), as indicated by **1 or more** of the following(1)(2)(3)(4):
  - Confusional state (eg, disorientation, difficulty following commands, deficit in attention)
  - Lethargy (eg, awake or arousable, but with drowsiness; reduced awareness of self and environment)
  - Obtundation (ie, arousable only with strong stimuli, lessened interest in environment, slowed responses to stimulation)
  - Stupor (ie, may be arousable but patient does not return to normal baseline level of awareness)
  - Coma (ie, not arousable)

References

1. Maher PJ. Confusion. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:126-131.e1.
2. Lei C, Smith C. Depressed consciousness and coma. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:117-125.e1.
3. Abraham G, Maher PJ. Delirium and dementia. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:1269-1280.e2.
4. Holler-Managan YF. Neurologic evaluation. In: Kliegman RM, et al., editors. Nelson Textbook of Pediatrics. 22nd ed. Elsevier; 2025:3550-3560.

American Society of Anesthesiologists (ASA) Physical Status Classification System

- American Society of Anesthesiologists (ASA) Physical Status Classification System[A](2)(3)(4)
  - Class I: Normal healthy patient
  - Class II: Patient with mild systemic disease
  - Class III: Patient with severe systemic disease
  - Class IV: Patient with severe systemic disease that is constant threat to life
  - Class V: Moribund patient who is not expected to survive without the operation

References

1. Sankar A, Johnson SR, Beattie WS, Tait G, Wijeysundera DN. Reliability of the American Society of Anesthesiologists physical status scale in clinical practice. British Journal of Anaesthesia 2014;113(3):424-32. DOI: 10.1093/bja/aeu100.

2. Foley C, Kendall MC, Apruzzese P, De Oliveira GS. American Society of Anesthesiologists Physical Status Classification as a reliable predictor of postoperative medical complications and mortality following ambulatory surgery: an analysis of 2,089,830 ACS-NSQIP outpatient cases. BMC Surgery 2021;21(1):Online. DOI: 10.1186/s12893-021-01256-6.
3. Horvath B, Kloesel B, Todd MM, Cole DJ, Prielipp RC. The evolution, current value, and future of the American Society of Anesthesiologists physical status classification System. Anesthesiology 2021;135(5):904-919. DOI: 10.1097/ALN.0000000000003947.
4. Mayhew D, Mendonca V, Murthy BVS. A review of ASA physical status - historical perspectives and modern developments. Anaesthesia 2019;74(3):373-379. DOI: 10.1111/anae.14569.

Footnotes

A. Note: There is no accepted standardization of terms used in this classification system.(1)

Hypoxemia

- Hypoxemia, as indicated by **1 or more** of the following(1):
  - Patient without baseline need for supplemental oxygen with oxygen saturation (SpO_2) of less than 90% or arterial blood gas partial pressure of oxygen (PaO_2) of less than 60 mm Hg (8.0 kPa) on room air[A][B]
  - Patient without baseline need for supplemental oxygen who now requires supplemental oxygen to keep SpO_2 greater than 89% or PaO_2 greater than 59 mm Hg (7.9 kPa)[A]
  - Patient with baseline need for supplemental oxygen who now requires increased supplemental oxygen to maintain oxygenation at baseline or acceptable level

References

1. Schriger DL. Approach to the patient with abnormal vital signs. In: Goldman L, Cooney KA, editors. Goldman-Cecil Medicine. 27th ed. Elsevier; 2024:32-35.
2. Jamali H, et al. Racial disparity in oxygen saturation measurements by pulse oximetry: evidence and implications. Annals of the American Thoracic Society 2022;19(12):1951-1964. DOI: 10.1513/AnnalsATS.202203-270CME.
3. Rojas-Camayo J, et al. Reference values for oxygen saturation from sea level to the highest human habitation in the Andes in acclimatised persons. Thorax 2018;73(8):776-778. DOI: 10.1136/thoraxjnl-2017-210598.

Footnotes

A. Pulse oximetry (SpO_2) may underestimate arterial saturation (SaO_2), especially in people with dark skin pigmentation, thick skin, cold body temperature, or who are wearing colored nail polish, and thus may not accurately detect hypoxemia.(2) Where appropriate, pulse oximetry should be measured after warming fingers or removing nail polish. Pulse oximetry results should be assessed within the context of the patient's clinical presentation, and performance of an arterial blood gas considered for a more accurate assessment of oxygenation if indicated.(2) Specific target values may require adjustment when care is delivered at high altitude.(3)

B. Criteria based upon clinician-acquired numeric values (eg, vital signs, oxygen saturation) should be used if they are accurate reflections of the patient's condition. Transitory findings (eg, abnormal only upon initial emergency department intake or only one time out of multiple readings) that rapidly improve with no or minimal treatment usually do not reflect disease severity or risk for deterioration. This does not imply that an initial or one-time reading cannot ever be applicable. The goal is to separate erroneous or incidental findings from those that truly represent the patient's clinical picture.

Multimodal analgesia

- Multimodal analgesia involves the utilization of 2 or more analgesic agents with different mechanisms of action in order to provide additive or synergistic pain control, while minimizing side effects and reliance on opioids.(1)(2)(3)

References

1. D'Souza RS, Johnson RL. Regional and multimodal treatments of perioperative pain. In: Benzon H, editor. Practical Management of Pain. 6th ed. Philadelphia, PA 19103-2899: Elsevier; 2023:355-373.e8.
2. George S, Johns M. Review of nonopioid multimodal analgesia for surgical and trauma patients. American Journal of Health-System Pharmacy 2020;77(24):2052-2063. DOI: 10.1093/ajhp/zxaa301.
3. Finnerup NB. Nonnarcotic methods of pain management. New England Journal of Medicine 2019;380(25):2440-2448. DOI: 10.1056/NEJMra1807061.

Tachypnea

- Tachypnea,[A][B] as indicated by **1 or more** of the following:
  - Respiratory rate greater than 20 breaths per minute in adult[A][B](1)
  - Respiratory rate greater than 18 breaths per minute in child 13 to 17 years of age[A][B](2)
  - Respiratory rate greater than 22 breaths per minute in child 6 to 12 years of age[A][B](2)
  - Respiratory rate greater than 25 breaths per minute in child 3 to 5 years of age[A][B](2)
  - Respiratory rate greater than 30 breaths per minute in child 1 or 2 years of age[A][B](2)
  - Respiratory rate greater than 40 breaths per minute in infant 6 to 11 months of age[A][B](2)
  - Respiratory rate greater than 45 breaths per minute in infant 3 to 5 months of age[A][B](2)
  - Respiratory rate greater than 55 breaths per minute in infant 1 or 2 months of age[A][B](2)

References

1. Schriger DL. Approach to the patient with abnormal vital signs. In: Goldman L, Cooney KA, editors. Goldman-Cecil Medicine. 27th ed. Elsevier; 2024:32-35.
2. Anderson CC, Kapoor S, Mark TE. Pediatric parameters and equipment. In: Anderson CC, Kapoor S, Mark TE, editors. The Harriet Lane Handbook: A Manual for Pediatric House Officers. 23rd ed. Elsevier; 2024:i-iii.

Footnotes

A. Criteria based upon clinician acquired numeric values (eg, vital signs, oxygen saturation) should be used if they are accurate reflections of the patient's condition. Transitory findings (eg, abnormal only upon initial emergency department intake or only one time out of multiple readings) that rapidly improve with no or minimal treatment usually do not reflect disease severity or risk for deterioration. This does not imply that an initial or one-time reading cannot ever be applicable. The goal is to separate erroneous or incidental findings from those that truly represent the patient's clinical picture.

B. Interpretation of respiratory rate requires clinical judgment and consideration of several patient-specific factors, such as the patient's baseline respiratory rate and whether the respiratory rate is indicative of significant underlying respiratory or other pathology. A mildly increased respiratory rate (eg, 20 to 22 breaths per minute in an adult), absent other indications of serious illness (eg, hypoxemia, metabolic acidosis, decreased tidal volume, pain), may be transitory and not clinically important. The numeric values included in this definition are provided to allow for consistency in terms of a technical definition of the term tachypnea. Whether a respiratory rate above the technical threshold is clinically meaningful is a matter of persistence, context, and clinical judgment. In addition, the measurement of the respiratory rate is subject to error. A medical textbook states that because there can be significant breath-to-breath variation in respiratory rate, the rate should be assessed for at least 30 seconds, preferably for a full minute.(1) This same textbook also states that new technologies designed to measure the respiratory rate have not proved to be clinically useful.(1)

Codes

ICD-10 Diagnosis: J41.0, J41.1, J41.8, J42, J43.0, J43.1, J43.2, J43.8, J43.9, J44.0, J44.1, J44.81, J44.89, J44.9, J45.20, J45.21, J45.22, J45.30, J45.31, J45.32, J45.40, J45.41, J45.42, J45.50, J45.51, J45.52, J45.901, J45.902, J45.909, J45.990, J45.991, J45.998, J68.4, J80, J81.0, J82.83, J95.1, J95.2, J95.3, J95.821, J95.822, J95.859, J96.00, J96.01, J96.02, J96.10, J96.11, J96.12, J96.20, J96.21, J96.22, J96.90, J96.91, J96.92, J98.01, O29.60, O29.61, O29.62, O29.63, O89.6, R06.03, R09.01, R09.2 [Hide]

MCG Health
Inpatient & Surgical Care 30th Edition

Last Update: 1/25/2026 6:32:28 AM
Build Number: 30.0.2026012500524.025256