Supplemental Guide:
Pediatric Cardiac Anesthesiology

ACGME

May 2022

TABLE OF CONTENTS

INTRODUCTION **3**

PATIENT CARE **4**

Peri-Procedural Assessment and Management 4
Technical/Procedural Skills: Airway Management and Lung Isolation 6
Technical/Procedural Skills: Vascular Access 8
Anesthetic Management of Interventional Cardiology Procedures 10
Anesthetic Management of Surgical Cardiac Procedures 12
Situational Awareness and Crisis Management 14
Circulatory Support Transitions 16

MEDICAL KNOWLEDGE **18**

Foundational Knowledge 18
Pharmacology 19
Cardiovascular and Monitoring 21

SYSTEMS-BASED PRACTICE **22**

Patient Safety and Quality Improvement 22
System Navigation for Patient-Centered Care 24
Physician Role in Health Care Systems 26

PRACTICE-BASED LEARNING AND IMPROVEMENT **28**

Evidence-Based and Informed Practice 28
Reflective Practice and Commitment to Personal Growth 29

PROFESSIONALISM **31**

Professional Behavior and Ethical Principles 31
Accountability/Conscientiousness 33
Well-Being 35

INTERPERSONAL AND COMMUNICATION SKILLS **37**

Patient- and Family-Centered Communication 37
Interprofessional and Team Communication 39
Communication within Health Care Systems 41

MILESTONES RESOURCES **43**

Milestones Supplemental Guide

This document provides additional guidance and examples for the Pediatric Cardiac Anesthesiology Milestones. This is not designed to indicate any specific requirements for each level, but to provide insight into the thinking of the Milestone Work Group.

Included in this document is the intent of each Milestone and examples of what a Clinical Competency Committee (CCC) might expect to be observed/assessed at each level. Also included are suggested assessment models and tools for each subcompetency, references, and other useful information.

Review this guide with the CCC and faculty members. As the program develops a shared mental model of the Milestones, consider creating an individualized guide (Supplemental Guide Template available) with institution/program-specific examples, assessment tools used by the program, and curricular components.

Additional tools and references, including the Milestones Guidebook, Clinical Competency Committee Guidebook, and Milestones Guidebook for Residents and Fellows, are available on the Resources page of the Milestones section of the ACGME website.

Patient Care 1: Peri-Procedural Assessment and Management **Overall Intent:** To evaluate and prepare patients with congenital heart disease for an anesthetic	
Milestones	**Examples**
Level 1 *Obtains medical and surgical history; performs physical examinations for pediatric cardiac patients* *Identifies clinical issues relevant to the preparation of pediatric cardiac patients*	● Performs a thorough history and physical on an infant with a large ventricular septal defect (VSD) and focuses on the cardiopulmonary exam when discussing case ● Recognizes that crackles on pulmonary exam for an infant with a VSD may suggest the need for optimization with cardiology guidance prior to surgery
Level 2 *With guidance, identifies disease processes and relevant medical or surgical issues and their implications on anesthetic care for pediatric patients with simple cardiac lesion* *With guidance, prepares pediatric patients with simple cardiac lesion receiving anesthetic care*	● Reports historical findings of difficulty feeding and weight gain in a patient with a loud holosystolic murmur and demonstrates understanding of the relatedness of these two processes after a pre-operative discussion with supervising faculty members ● Proposes using small doses of diuretics to manage volume overload in an infant with crackles on pulmonary exam and large VSD but requires guidance from a supervising faculty member or cardiologist to determine dosing and administration
Level 3 *Identifies disease processes and relevant medical or surgical issues and their implications on anesthetic care for pediatric patients with simple cardiac lesion* *Optimizes preparation of pediatric patients with simple cardiac lesion*	● Expresses concern for magnitude of VSD and its impact on physiology when reporting historical findings of difficulty feeding and weight gain in a patient with a loud holosystolic murmur and can explain how these two processes are related ● Ensures proper volume status through balance of maintenance fluids and diuretics in an infant with a large VSD in need of surgical repair
Level 4 *Performs a complete assessment of complex or critically ill pediatric cardiac patients* *Optimizes preparation of complex or critically ill children across all age groups*	● Performs a thorough history and physical and uses supporting information such as cardiac imaging and catheterization data to develop a plan for an infant receiving corrective surgery for hypoplastic left heart syndrome ● Based on information gleaned on history and physical and other objective data, ensures adequate volume status and preload in a toddler with Fontan physiology who has recently had gastrointestinal illness and requires an anesthetic
Level 5 *Independently serves as a consultant to other members of the health care team regarding optimal pre-anesthetic preparation*	● Works with the interdisciplinary team to justify the pre-anesthetic preparation and communicates findings of the history and physical
Assessment Models or Tools	● Direct observation ● Mock orals

	● Objective structured clinical examination (OSCE) ● Simulation
Curriculum Mapping	●
Notes or Resources	● Andropoulos D, Stayer S, Mossad EB, Miller-Hance WC eds. *Anesthesia for Congenital heart disease.* Third edition. Wiley Blackwell; 2015. ● Berenstain LK, Spaeth JP, eds. Chapter 1: A congenital heart disease primer. In: *Congenital Cardiac Disease-A Case-based Approach.* Cambridge University Press; 2021. ● Nasr VG, DiNardo JA. Chapter 3: preoperative evaluation. In: *The Pediatric Cardiac Anesthesia Handbook*. First edition. Wiley Blackwell; 2017.

Patient Care 2: Technical/Procedural Skills: Airway Management and Lung Isolation **Overall Intent:** To manage complex airways and lung isolation techniques in patients with cardiac lesions	
Milestones	**Examples**
Level 1 *Recognizes unique characteristics of pediatric cardiac anatomy and airway management in pediatric patients with cardiac lesions*	● Describes the balance of oxygenation and ventilation on the airway management for infants and children with cardiac disease to maintain systemic and pulmonary vascular resistance
Level 2 *Performs airway management across the age spectrum from neonates to adults with cardiac lesions* *Recognizes the need for and complications of lung isolation techniques in pediatric patients with cardiac lesions*	● Plans airway management with appropriately sized tube and equipment for an infant receiving repair of a vascular ring ● Suggests the use of a smaller endotracheal tube and maintenance of spontaneous ventilation in the induction of an infant with a vascular ring due to possible tracheal narrowing and airway collapse associated with a double aortic arch ● Suggests the anesthetic may require right mainstem intubation in an infant with a double aortic arch repair to enable surgical exposure and correction
Level 3 *Identifies the need for advanced airway management and identifies possible complications with airway management in patients with cardiac lesions* *Manages lung isolation techniques for pediatric patients with cardiac lesions, with guidance*	● Uses fiberscope for positioning of endotracheal tube to enable lung isolation for double aortic arch repair ● Adjusts intra-operative ventilator settings for lung isolation during the case taking into account the cardiorespiratory interactions
Level 4 *Identifies and corrects problems and complications associated with airway management of complex cardiac patients* *Manages lung isolation techniques for pediatric patients with cardiac lesions*	● Recognizes that lung isolation is incomplete and develops plan for re-positioning of endotracheal tube during double aortic arch repair using a fiberscope ● Adjusts intra-operative ventilator settings for lung isolation during the case taking into account intrathoracic pressure and its impact on pre-load and pulmonary vascular resistance
Level 5 *Independently identifies and corrects problems and complications of advanced airway management* *Independently supervises and provides consultation to other members of the health care team for lung isolation in pediatric patients with cardiac lesions*	● Develops and executes an anesthetic plan for double aortic arch repair with a more junior fellow or resident ● Recommends ways to troubleshoot ineffective lung isolation during a case to another member of the team and maintains communication with the surgical team

Assessment Models or Tools	● Direct observation ● Mock orals ● OSCE ● Simulation
Curriculum Mapping	●
Notes or Resources	● Fiadjoe JE, Stricker PA, Litman RS. Chapter 14: pediatric airway management. In: Gregory GA, Andropoulos DB eds. *Gregory's Pediatric Anesthesia.* 5th edition. Wiley; 2012. ● Foz C, Peyton J, Staffa SJ, Kovatsis P, Park R, DiNardo JA, Nasr VG. Airway Abnormalities in Patients With Congenital Heart Disease: Incidence and Associated Factors. *J Cardiothorac Vasc Anesth.* 2021 Jan;35(1):139-144. doi: 10.1053/j.jvca.2020.07.086. Epub 2020 Aug 6. PMID: 32859491.

Patient Care 3: Technical/Procedural Skills: Vascular Access **Overall Intent:** To know the vascular anatomy and to place arterial and venous access to cardiac patients	
Milestones	**Examples**
Level 1 *Performs basic radial artery cannulation procedures* *Performs basic right internal jugular central venous cannulation procedures* *Identifies relevant vascular access anatomy and uses ultrasound in vascular access procedures*	● Places a radial arterial line in a toddler with isolated ventricular septal defect for repair ● Inserts an ultrasound guided central line in the internal jugular vein without difficulty in a toddler undergoing repair of atrial septal defect
Level 2 *Performs complex radial artery cannulation procedures* *Performs complex right internal jugular central venous cannulation procedures* *Interprets ultrasound to optimize technique and reduce complications in vascular access procedures*	● Places a radial arterial line with ultrasound in an infant who has had several arterial lines placed and is known to be a difficult cannulation ● Inserts a central line with ultrasound guidance in a patient with history of several central lines that requires troubleshooting due to difficult cannulation ● Uses the ultrasound to scan different arteries for cannulation and obtains flow-related images to guide arterial cannulation in a child who has had multiple arterial cannulations and subsequent thrombus
Level 3 *Performs arterial cannulation at various locations (e.g., femoral, brachial, axillary)* *Performs central venous cannulation at various locations (e.g., subclavian, left internal jugular, femoral)* *Independently conducts and interprets complex vascular access ultrasound (e.g., intravenous)*	● Weighs the risks and benefits of a brachial artery cannulation and places a brachial arterial line with ultrasound guidance to minimize injury ● Inserts a femoral central venous line with ultrasound guidance ● Uses ultrasound to identify thrombosed vein and guide decision-making for location of venous cannulation
Level 4 *Performs complex arterial cannulation at various locations (e.g., femoral, brachial, axillary)* *Performs complex central venous cannulation at various locations (e.g., subclavian, left internal jugular, femoral)*	● Places a brachial arterial line with ultrasound guidance in the setting of multiple thrombosed vessels ● Inserts a femoral central venous line with ultrasound guidance in a child with complex cardiac disease and thrombosed neck veins

Advises and supervises others with ultrasound for vascular access	
Level 5 *Serves as a departmental resource for challenging arterial cannulation procedures* *Serves as a departmental resource for challenging central venous cannulation procedures* *Serves as a departmental resource for challenging vascular access ultrasound*	• Teaches ultrasound guided arterial and venous line placement to faculty, fellows, and residents
Assessment Models or Tools	● Direct observation ● Simulation
Curriculum Mapping	●
Notes or Resources	● Andropoulos DB. Chapter 17: monitoring and vascular access. In: Gregory GA, Andropoulos DB eds. *Gregory's Pediatric Anesthesia*. 5th edition. Wiley; 2012. ● Ma T, Zhang Y, Meng J, Yang F, Zhang H, Li B, Ji G, Zhang H, Ma H. Correlation between dorsalis pedis and radial arterial invasive blood pressure during induction of general anaesthesia: a prospective, observational study. *Br J Anaesth.* 2022 Mar 4:S0007-0912(22)00077-0. doi: 10.1016/j.bja.2022.02.010. Epub ahead of print. PMID: 35256152.

Patient Care 4: Anesthetic Management of Interventional Cardiology Procedures **Overall Intent:** To develop and implement a patient/procedure-specific anesthetic plan	
Milestones	**Examples**
Level 1 *Differentiates between diagnostic and interventional procedures*	● Plans appropriately for a procedure involving diagnosis versus treatment of pulmonary vein stenosis (e.g., laryngeal mask airway versus endotracheal tube)
Level 2 *Develops anesthetic plan for routine intra- and post-operative management of cardiac patients in the catheterization and electrophysiology laboratories*	● Develops a thorough anesthetic plan for a routine heart biopsy involving a patient following heart transplantation
Level 3 *Conducts intra- and post-operative care for patients with simple cardiac lesions in the catheterization and electrophysiology laboratories*	● Manages the anesthetic care of a patient undergoing atrial septal defect device closure
Level 4 *Conducts intra- and post-operative care for patients with complex cardiac lesions in the catheterization and electrophysiology laboratories*	● Manages the anesthetic care of a patient with transposition of the great arteries undergoing a balloon atrial septostomy
Level 5 *Serves as a consultant for complex intra- and post-operative care in the catheterization and electrophysiology laboratories*	● Leads pediatric advanced life support (PALS) management for a patient with a cardiac arrest on induction
Assessment Models or Tools	● Direct observation ● Mock orals ● Multisource feedback ● OSCE ● Simulation
Curriculum Mapping	●
Notes or Resources	● American Society of Anesthesiologists. Standards for Basic Anesthetic Monitoring. https://www.asahq.org/standards-and-guidelines/standards-for-basic-anesthetic-monitoring. Accessed 2020. ● Topjian AA, Raymond TT, Atkins D, Chan M, Duff JP, Joyner BL Jr, Lasa JJ, Lavonas EJ, Levy A, Mahgoub M, Meckler GD, Roberts KE, Sutton RM, Schexnayder SM; Pediatric Basic and Advanced Life Support Collaborators. Part 4: Pediatric Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation.* 2020 Oct 20;142(16_suppl_2):S469-S523. doi: 10.1161/CIR.0000000000000901. Epub 2020 Oct 21. PMID: 33081526.

	● American Society of Anesthesiologists. ASA Physical Status Classification System. https://www.asahq.org/standards-and-guidelines/asa-physical-status-classification-system. Accessed 2020. ● Apfelbaum J, Hagberg C, Connis R, 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.

Patient Care 5: Anesthetic Management of Surgical Cardiac Procedures **Overall Intent:** To develop and implement a patient/procedure-specific anesthetic plan	
Milestones	**Examples**
Level 1 *Differentiates anesthetic plan for surgical procedures with and without cardiopulmonary bypass (CPB)* *Recognizes presence of peri-operative cardiopulmonary and hematologic complications*	● Develops the anesthetic plan and sets up operating room appropriately for atrial septal defect repair (bypass) or pacemaker (without bypass) relative to the procedural strategy ● Recognizes acute onset of supraventricular tachycardia (SVT)
Level 2 *Develops anesthetic plan with consideration of underlying clinical conditions; past medical history; and patient, anesthetic, and surgical risk factors for routine intra- and post-operative management of cardiac patients in the operating room* *Identifies and manages peri-operative cardiopulmonary and hematologic complications, with direct supervision*	● Develops the anesthetic plan and sets up operating room accordingly for a patient scheduled for a Blalock-Taussig (BT) shunt ● Recognizes SVT and develops therapeutic plan based on hemodynamic status with the attending
Level 3 *Conducts intra- and post-operative care for patients with simple cardiac lesions in the operating room* *Identifies and manages peri-operative cardiopulmonary and hematologic complications, with indirect supervision*	● Manages the anesthetic care of a patient undergoing ventricular septal defect repair ● Recognizes SVT and independently proposes appropriate therapeutic plan based on hemodynamic status
Level 4 *Conducts intra- and post-operative care for patients with complex cardiac lesions in the operating room* *Identifies and manages peri-operative cardiopulmonary and hematologic complications*	● Manages the anesthetic care of a patient with hypoplastic left heart syndrome undergoing a Norwood procedure ● Recognizes SVT and implements appropriate therapeutic plan based on hemodynamic status
Level 5 *Serves as a consultant for complex intra- and post-operative care in the operating room* *Serves as a consultant to manage peri-operative cardiopulmonary and hematologic complications*	● Leads PALS management for a patient with a cardiac arrest on induction

Assessment Models or Tools	● Direct observation ● Mock orals ● Multisource feedback ● OSCE ● Simulation
Curriculum Mapping	●
Notes or Resources	● American Society of Anesthesiologists. Standards for Basic Anesthetic Monitoring. https://www.asahq.org/standards-and-guidelines/standards-for-basic-anesthetic-monitoring. Accessed 2020. ● American Society of Anesthesiologists. ASA Physical Status Classification System. https://www.asahq.org/standards-and-guidelines/asa-physical-status-classification-system. Accessed 2020. ● Apfelbaum J, Hagberg C, Connis R, 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.

Patient Care 6: Situational Awareness and Crisis Management **Overall Intent:** To recognize and respond to the dynamic milieu of the operating environment	
Milestones	**Examples**
Level 1 *Demonstrates vigilance during clinical care*	● Limits use of personal electronic devices to calculate fluids, medication doses, or other patient care activities in the operating room ● Demonstrates continuous survey of the environment that includes monitors and surgical field
Articulates causes of common peri-operative crisis situations	● Describes differential diagnosis for hypoxemia
Responds to crisis situations as a reliable team member	● Actively seeks ways to assist in care of the unstable cardiac patient
Level 2 *Demonstrates awareness of case flow and developments throughout a procedure*	● Informs attending of acute hemodynamic changes
Recognizes crisis situations; calls for help	● Identifies unintended tracheal extubation and immediately calls for help
Participates in management during crisis situations	● Establishes adequate intravenous access in the care of the unstable cardiac patient
Level 3 *Demonstrates awareness of case flow and developments throughout a procedure, including those outside of one's immediate control, with supervision*	● Informs attending of arrhythmias and considers differential diagnosis requiring changes in the anesthetic plan
Anticipates an impending crisis and identifies possible etiologies, with supervision	● Recognizes subtle signs of excessive blood loss and prepares for transfusion, with supervision
Initiates management and resolves crisis situations, with supervision	● Initiates transfusion protocols and executes balanced resuscitation, with supervision
Level 4 *Independently demonstrates awareness of case flow and developments throughout a procedure, including those outside of one's immediate control*	● Manages arrhythmias requiring change in the anesthetic plan and after considering a differential diagnosis, and makes adjustments in anesthesia provided
Independently anticipates an impending crisis and identifies possible etiologies	● Independently recognizes subtle signs of excessive blood loss and prepares for transfusion

Independently initiates management and resolves crisis situations	● Independently activates transfusion protocols and executes balanced resuscitation
Level 5 *Leads the health care team in the management of crisis situations*	● In the setting of conflicting opinions, recognizes acute surgical blood loss and initiates crisis response
Assessment Models or Tools	● Direct observation ● Mock orals ● Multisource feedback ● OSCE ● Simulation
Curriculum Mapping	●
Notes or Resources	● Anesthesia Patient Safety Foundation. Distractions in the Operating Room: An Anesthesia Professional's Liability? https://www.apsf.org/article/distractions-in-the-operating-room-an-anesthesia-professionals-liability/. Accessed 2020. ● Athlos Academies. Top 10 Takeaways from Crucial Conversations. https://athlosacademies.org/top-10-takeaways-from-crucial-conversations/. Accessed 2020. ● McIlvaine WB. Situational awareness in the operating room: A primer for the anesthesiologist. Seminars Anesthesia Perioperative. *Med Pain*. 2007;26:167-172. doi:10.1053/j.sane.

Patient Care 7: Circulatory Support Transitions **Overall Intent:** To evaluate and manage patients undergoing circulatory support transitions (e.g., initiation or weaning from extracorporeal membrane oxygenation (ECMO))	
Milestones	**Examples**
Level 1 *Discusses the basic principles and indications for CPB* *Discusses the basic principles and indications for circulatory assist devices*	● Describes components and function of the cardiopulmonary bypass (CPB) machine ● Explains when CPB is required for cardiac surgery ● Describes how ECMO differs from CPB ● Discusses venoarterial (VA) versus venousvenous (VV) ECMO and indications ● Discusses the principles of and indications for mechanical circulatory support devices
Level 2 *Guides a patient on and off CPB with assistance* *Uses available hemodynamic data to guide a patient onto and off circulatory assist devices, with assistance*	● Appropriately manages hemodynamic goals during aortic cannulation ● Utilizes the pre-CPB separation checklist ● With assistance guides cardiac volume status and decreasing CPB flows ● Integrates mean arterial pressure, central venous pressure (CVP) and other intracardiac monitoring to guide volume status and inotropic support while initiating or decreasing mechanical circulatory support
Level 3 *Guides a patient on and off routine CPB* *Integrates available hemodynamic and echocardiographic data to guide a patient onto and off circulatory assist devices, with assistance*	● Guides perfusionist to appropriately increase intracardiac volume and decrease CPB flows without assistance ● Interprets arterial, CVP, intracardiac lines, and pulmonary artery (PA) waveforms along with values to assess volume status and to assess cardiac function during the initiation of cardiac support
Level 4 *Guides a patient on and off complex CPB* *Integrates available hemodynamic and echocardiographic data to guide a patient onto and off circulatory assist devices*	● Uses echocardiography data to assess cardiac function and volume status during initiation and removal of ECMO, CPB, and other mechanical circulatory support devices • Guides separation from CPB and appropriately manages hemodynamic instability (initiates vasopressors and inotropes)
Level 5 *Develops policies with the interdisciplinary team to guide institutional CPB protocols*	● Acts as a consultant for evidence-based practice protocols for CPB, ECMO, and other mechanical support devices
Assessment Models or Tools	● Direct observation ● Multisource feedback
Curriculum Mapping	●
Notes or Resources	● Gertler R, Androopoulos DB. Chapter 7: cardiopulmonary bypass. In: Andropoulos D, Stayer S, Mossad EB, Miller-Hance WC eds. *Anesthesia for Congenital heart disease.* Third edition. Wiley Blackwell; 2015.

	● Nasr VG, DiNardo JA. Chapter 6: cardiopulmonary bypass. In: *The Pediatric Cardiac Anesthesia Handbook*. First edition. Wiley Blackwell; 2017. ● Nasr VG, DiNardo JA. Chapter 7: mechanical support devices. In: *The Pediatric Cardiac Anesthesia Handbook*. First edition. Wiley Blackwell; 2017. ● Skinner A, Stephen HB, Motta P, Stayer S. Chapter 32: mechanical support of the circulation. In: Andropoulos D, Stayer S, Mossad EB, Miller-Hance WC eds. *Anesthesia for Congenital heart disease.* Third edition. Wiley Blackwell; 2015. ● Zaleski KL, Nasr VG. ECMO Primer for the Pediatric Anesthesiologist. *Int Anesthesiol Clin.* 2019 Fall;57(4):72-83. doi: 10.1097/AIA.0000000000000249. PMID: 31503097.

Medical Knowledge 1: Foundational Knowledge **Overall Intent:** To understand the cardiac anatomy and physiology from fetal to adult in a normal state and in the presence of lesions	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of cardiac anatomy and physiology and treatment of medical and surgical conditions*	● Articulates the cardiac chambers, inflow and outflow, and the heart-lung interactions; recognizes the embryological origin and transition from fetal to postnatal physiology
Level 2 *Demonstrates knowledge of common medical and surgical disease, treatments, and populations as relates to anesthetic care*	● Demonstrates understanding of atrial septal defect and the four types, the patch repair, or suture closure
Level 3 *Demonstrates knowledge of complex medical and surgical disease, treatments, and populations as relates to anesthetic care*	● Articulates a treatment plan for spells in patients with tetralogy of Fallot and understand the underlying mechanism; explains a right ventricular outflow tract (RVOT) patch repair
Level 4 *Demonstrates comprehensive knowledge of medical and surgical disease as relates to the full spectrum of a patient's peri-operative care*	● Understands the single ventricle physiology and options for surgical palliation: Blalock-Thomas-Taussig (BTT) versus Sano versus Hybrid procedures
Level 5 *Demonstrates scientific knowledge of uncommon, atypical, or complex conditions as relates to the full spectrum of a patient's peri-operative care*	● Understands the options for Fontan procedures in adult patients and the long-term sequalae of Fontan physiology; recognizes the emerging treatments such as biventricular repair for patients with borderline single ventricle (SV)
Assessment Models or Tools	● Direct observation ● Direct communication ● Mock orals ● Multisource feedback
Curriculum Mapping	●
Notes or Resources	● Kussman BD and Miller-Hance WC. Chapter 4: development of the cardiovascular system and nomenclature for congenital heart disease. In: Andropoulos D, Stayer S, Mossad EB, Miller-Hance WC eds. *Anesthesia for Congenital heart disease.* Third edition. Wiley Blackwell; 2015. ● Andropoulos, DB. Chapter 5: physiology and cellular biology of the developing circulation. In: Andropoulos DB, Stayer S, Mossad EB, Miller-Hance WC eds. *Anesthesia for Congenital heart disease.* Third edition. Wiley Blackwell; 2015. ● Jolley M, Colan SD, Rhodes J, DiNardo J. Fontan physiology revisited. *Anesth Analg.* 2015 Jul;121(1):172-182. doi: 10.1213/ANE.0000000000000717. PMID: 26086514. ● Nasr VG, DiNardo JA. *The Pediatric Cardiac Anesthesia Handbook.* 1st ed. Wiley Blackwell; 2017.

Medical Knowledge 2: Pharmacology **Overall Intent:** To understand the pharmacokinetic and pharmacodynamic of sedatives, analgesics, and cardiac medications in the setting of congenital and acquired heart disease	
Milestones	**Examples**
Level 1 *Demonstrates basic knowledge of pharmacologic principles of inhaled and/or intravenous anesthetic, vasoactive, and inotropic drugs to routine patient management*	● Describes the depressant effect of sevoflurane during induction in patients with heart failure
Level 2 *Demonstrates advanced knowledge of pharmacologic principles of inhaled and/or intravenous anesthetic, vasoactive, and inotropic drugs for management of pediatric patients with cardiac lesions*	● Recognizes the need for inotropic support (e.g., dopamine, epinephrine) at induction and onset ● Recognizes cardiac stable induction medications and titration
Level 3 *Demonstrates basic knowledge of pharmacokinetics and pharmacodynamics and selection and dosing of inhaled and/or intravenous anesthetic, vasoactive, and inotropic drugs for management of pediatric patients with cardiac lesions, including indications, contraindications, side effects, and complications*	● Explains the mechanism of action (e.g., Milrinone: vasodilation and inotropy)
Level 4 *Demonstrates advanced knowledge of pharmacokinetics and pharmacodynamics and selection and dosing of anesthetic, vasoactive, and inotropic drugs for management of pediatric patients with cardiac lesions*	● Discusses the impact of cardiopulmonary bypass on drug sequestration and increased volume of distribution
Level 5 *Is recognized (through scholarship or education) as an expert resource in advanced understanding of pharmacokinetics and pharmacodynamics of inhaled and/or intravenous anesthetic, vasoactive, and inotropic drugs to management of pediatric patients with cardiac lesions*	● Act as a consultant to colleagues in the intensive care unit when sedating or inducing patients with cardiac disease
Assessment Models or Tools	● Direct observation ● Direct communication ● Mock orals ● Multisource feedback
Curriculum Mapping	●

Notes or Resources	● Androupoulos DB and Mossad EB. Chapter 6: anesthetic agents and their cardiovascular effects. In: Andropoulos D, Stayer S, Mossad EB, Miller-Hance WC eds. *Anesthesia for Congenital Heart Disease.* Third edition. Wiley Blackwell; 2015. ● Kuntz MT, Pereira LM, Matte GS, Connor K, Staffa SJ, DiNardo JA, Nasr VG. Sequestration of Midazolam, Fentanyl, and Morphine by an Ex Vivo Cardiopulmonary Bypass Circuit. *ASAIO J.* 2021 Dec 1;67(12):1342-1348. doi: 10.1097/MAT.0000000000001506. PMID: 34415712. ● Lucas SS, Nasr VG, Ng AJ, Joe C, Bond M, DiNardo JA. Pediatric Cardiac Intensive Care Society 2014 Consensus Statement: Pharmacotherapies in Cardiac Critical Care: Sedation, Analgesia and Muscle Relaxant*. Pediatr Crit Care Med*. 2016 Mar;17(3 Suppl 1):S3-S15. doi: 10.1097/PCC.0000000000000619. PMID: 26945327.

Medical Knowledge 3: Cardiovascular Imaging and Monitoring **Overall Intent:** To interpret the data from cardiopulmonary monitoring and imaging, recognize abnormal values and proceed with clinical decision making	
Milestones	**Examples**
Level 1 *Interprets data from cardiopulmonary imaging and monitoring to guide routine clinical decision-making, with guidance*	● Interprets chest x-ray and confirms appropriate line placement
Level 2 *Interprets data from cardiopulmonary imaging and monitoring to guide routine clinical decision making*	● Identifies pericardial effusion on echocardiogram and explains its impact on hemodynamics at induction
Level 3 *Integrates data from cardiopulmonary imaging and monitoring to guide advanced clinical decision making*	● Interprets echocardiogram information to guide weaning from bypass
Level 4 *Integrates data from cardiopulmonary imaging and monitoring, including tools used infrequently outside of cardiothoracic surgery, to guide advanced clinical decision making*	● Interprets the number and the required intervention based on a decrease in near infrared spectroscopy (NIRS)
Level 5 *Is recognized (through scholarship or education of others) as an expert resource in peri-operative monitoring*	● Teaches colleagues and fellows the benefit of wave form monitoring and interpretation (e.g., an increase in CVP following bypass onset and concern for poor drainage from superior vena cava (SVC))
Assessment Models or Tools	● Direct observation ● Direct communication ● Mock orals ● Multisource feedback
Curriculum Mapping	●
Notes or Resources	● Lai WW, Mertens LL, Cohen MS, Geva T. *Echocardiography in Pediatric and Congenital Heart Disease: From Fetus to Adult.* 3rd ed. Wiley; 2021. ● Zaleski KL, Kussman BD. Near-Infrared Spectroscopy in Pediatric Congenital Heart Disease. *J Cardiothorac Vasc Anesth*. 2020 Feb;34(2):489-500. doi: 10.1053/j.jvca.2019.08.048. Epub 2019 Sep 3. PMID: 31582201.

Systems-Based Practice 1: Patient Safety and Quality Improvement (QI) **Overall Intent:** To engage in the analysis and management of patient safety events, including relevant communication with patients, families, and health care professionals; to conduct a QI project	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of common events that impact patient safety*	● Lists patient misidentification or medication errors as common patient safety events
Demonstrates knowledge of how to report patient safety events	● Explains how to report errors in own health system
Demonstrates knowledge of basic quality improvement methodologies and metrics	● Describes fishbone tool
Level 2 *Identifies system factors that lead to patient safety events*	● Identifies a recent change to the transfusion requisition form that did not include space for two-person verification to avoid an error ● Identifies that a regional anesthesia consent form does not include laterality
Reports patient safety events through institutional reporting systems (simulated or actual)	● Reports lack of compliance with antibiotic administration through departmental or institutional reporting systems
Describes departmental quality improvement initiatives	● Summarizes protocols to decrease surgical site infections
Level 3 *Participates in analysis of patient safety events (simulated or actual)*	● Assimilates patient data, evaluates the root cause, and presents the findings of a patient safety event
Participates in disclosure of patient safety events to patients and patients' families (simulated or actual)	● Through simulation, communicates with patients and their families about a medication administration error
Participates in department quality improvement initiatives	● Participates in a root cause analysis of duplicate acetaminophen administration in PACU
Level 4 *Conducts analysis of patient safety events and offers error prevention strategies (simulated or actual)*	● Collaborates with a team to conduct the analysis of intra-operative antibiotic administration errors and presents suggested policy and electronic health record (EHR) design changes at a department meeting
Discloses patient safety events to patients and patients' families (simulated or actual)	● Discusses with patient and family an inadvertent double-dose of acetaminophen administration given to them due to hand-off error

Demonstrates the skills required to identify, develop, implement, and analyze a quality improvement project	● Initiates and develops a resident quality improvement project to improve peri-operative hand-offs and presents findings to the department
Level 5 *Actively engages teams and processes to modify systems to prevent patient safety events* *Role models or mentors others in the disclosure of patient safety events* *Creates, implements, and assesses quality improvement initiatives at the institutional level or above*	● Assumes a leadership role at the departmental or institutional level for patient safety ● Conducts a simulation for disclosing patient safety events ● Initiates and completes a QI project to improve disclosure of serious adverse events to patients and their families and shares results with stakeholders
Assessment Models or Tools	● Direct observation ● E-module multiple choice tests ● Multisource feedback ● Portfolio ● OSCE ● Reflection ● Simulation
Curriculum Mapping	●
Notes or Resources	● Anesthesia Patient Safety Foundation. Patient Safety Initiatives. https://www.apsf.org/patient-safety-initiatives/. Accessed 2020. ● Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. Accessed 2020.

Systems-Based Practice 2: System Navigation for Patient-Centered Care **Overall Intent:** To effectively navigate the health care system, including the interdisciplinary team and other care providers; to adapt care to a specific patient population to ensure high-quality patient outcomes	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of care coordination*	● For a critically ill cardiac patient and their family, identifies the surgeons, anesthesiologists, nurses, social workers, and intensive care unit (ICU) pharmacist as members of the team
Identifies key elements for safe and effective transitions of care and hand-offs	● Lists the essential components of a standardized tool for sign-out, care transition, and hand-offs
Demonstrates knowledge of population and community health needs and inequities	● Identifies that inpatients may have different needs than ambulatory patients; identifies barriers to discharge home for ambulatory patients ● Identifies barriers in refilling medications for members of underserved populations
Level 2 *Coordinates care of patients in routine clinical situations effectively using the roles of interprofessional team members*	● Coordinates care with the post-anesthesia care unit (PACU) and primary medical team on arrival to PACU
Performs safe and effective transitions of care/hand-offs in routine clinical situations	● Routinely uses a standardized tool for a stable patient during PACU sign-out
Identifies specific population and community health needs and inequities for the local population	● Identifies challenges in communicating with patients with communication barriers (e.g., non-English-speaking patients and families; hearing, visual, or cognitive impairment;)
Level 3 *Coordinates care of patients in complex clinical situations effectively using the roles of interprofessional team members*	● Works with the patient, family, and members of the peri-operative team to coordinate the care of a patient with a do-not-resuscitate order
Performs safe and effective transitions of care/hand-offs in complex clinical situations	● Routinely uses a standardized tool when transferring a patient to and from the ICU
Uses institutional resources effectively to meet the needs of a patient population and community	● Follows institutional guidelines to provide safe care for a Jehovah's Witness patient undergoing bypass surgery
Level 4 *Role models effective coordination of patient-centered care among different disciplines and specialties*	● During ICU rounds, leads team members in approaching consultants to review cases/recommendations and arranges multidisciplinary rounds for the team

Role models and advocates for safe and effective transitions of care/hand-offs within and across health care delivery systems *Participates in changing and adapting practice to provide for the needs of specific populations*	● Prior to rotating off the ICU service, proactively informs the incoming resident about a plan of care for a patient awaiting a heart transplant with multiple studies pending ● Assists in the design of protocols for discussing and managing blood product usage in patients and families who refuse blood products for religious reasons
Level 5 *Analyzes the process of care coordination and participates in the design and implementation of improvements* *Improves quality of transitions of care within and across health care delivery systems to optimize patient outcomes* *Advocates for populations and communities with health care inequities in the peri-operative setting*	● Develops a program to arrange for pre-operative assessment of medically fragile patients ● Devises a protocol to improve transitions from ICU to step down or monitored unit ● Partners with the multidisciplinary health care team to create an innovative approach to support disadvantaged patients and families in refilling medications
Assessment Models or Tools	● Direct observation ● Medical record (chart) audit ● Multisource feedback ● OSCE ● Quality metrics and goals mined from EHRs ● Review of sign-out tools, use and review of checklists
Curriculum Mapping	●
Notes or Resources	● CDC. Population Health Training in Place Program (PH-TIPP). https://www.cdc.gov/pophealthtraining/whatis.html. Accessed 2020. ● Kaplan KJ. In pursuit of patient-centered care. March 2016. http://tissuepathology.com/2016/03/29/in-pursuit-of-patient-centered-care/#axzz5e7nSsAns. Accessed 2020. ● Skochelak SE, Hawkins RE, Lawson LE, Starr SR, Borkan JM, Gonzalo JD. *AMA Education Consortium: Health Systems Science.* 1st ed. Philadelphia, PA: Elsevier; 2016. https://commerce.ama-assn.org/store/ui/catalog/productDetail?product_id=prod2780003.

Systems-Based Practice 3: Physician Role in Health Care Systems **Overall Intent:** To understand the physician's role in the complex health system and how to optimize the system to improve patient care and the health system's performance	
Milestones	**Examples**
Level 1 *Identifies key components of the complex health care system (e.g., hospital, skilled nursing facility, finance, personnel, technology)* *States factors impacting the costs of anesthetic care*	● Articulates differences between outpatient and inpatient hospital facilities ● Identifies that notes and records must meet billing and coding requirements ● Explains relative cost of anesthetic medications, monitors, and supplies
Level 2 *Describes how components of a complex health care system are interrelated, and how they impact patient care* *Documents anesthetic detail to facilitate accurate billing and reimbursement*	● Prioritizes planning for discharge echocardiogram prior to discharge to a skilled nursing facility ● Ensures anesthetic procedure accurately reflects procedure performed ● Documents all Centers for Medicare and Medicaid Services (CMS)-required components of anesthetic care performed during procedure
Level 3 *Discusses how individual practice affects the broader system (e.g., length of stay, readmission rates, clinical efficiency)* *Explains the impact of documentation on billing and reimbursement*	● Ensures that patients with post-operative nausea and vomiting receive adjusted anesthetic plans and adequate prophylaxis to avoid unnecessary hospitalization ● Discusses the necessity of including the ultrasound image for an ultrasound guided procedure to receive reimbursement
Level 4 *Manages various components of the complex health care system to provide efficient and effective patient care and transitions of care* *Practices and advocates for cost-effective patient care*	● Effectively works with the social work team to ensure interpretive services are available for non-English-speaking patients and families both pre- and post-operatively ● Effectively plans and implements anesthetic to promote enhanced recovery and rapid discharge
Level 5 *Advocates for or leads systems change that enhances high-value, efficient, and effective patient care* *Engages in external activities related to advocacy for cost-effective care*	● Works with peri-operative teams to develop and implement enhanced recovery protocols for surgical service lines ● Improves informed consent process for non-English-speaking patients and families requiring interpreter services
Assessment Models or Tools	● Direct observation ● Medical record (chart) audit

	● Patient satisfaction data ● Portfolio
Curriculum Mapping	●
Notes or Resources	● Agency for Healthcare Research and Quality. Measuring the Quality of Physician Care. https://www.ahrq.gov/talkingquality/measures/setting/physician/index.html. Accessed 2020. ● AHRQ. Major Physician Measurement Sets. https://www.ahrq.gov/talkingquality/measures/setting/physician/measurement-sets.html. Accessed 2020. ● Andreae MH, Gabry JS, Goodrich B, White RS, Hall C. Antiemetic prophylaxis as a marker of health care disparities in the National Anesthesia Clinical Outcomes Registry. *Anesth Analg*. 2018;126(2):588-599. https://journals.lww.com/anesthesia-analgesia/Fulltext/2018/02000/Antiemetic_Prophylaxis_as_a_Marker_of_Health_Care.35.aspx. 2020. ● Dzau VJ, McClellan M, Burke S, et al. Vital directions for health and health care: priorities from a National Academy of Medicine Initiative. *NAM Perspectives*. Discussion Paper, National Academy of Medicine, Washington, DC. https://nam.edu/vital-directions-for-health-health-care-priorities-from-a-national-academy-of-medicine-initiative/. Accessed 2020. ● Teja BJ, Sutherland TN, Barnett SR, Talmor DS. Cost-effectiveness research in anesthesiology. *Anesth Analg.* 2018;127(5):1196-1201. https://pubmed.ncbi.nlm.nih.gov/29570150/. Accessed 2020.

Practice-Based Learning and Improvement 1: Evidence-Based and Informed Practice **Overall Intent:** To incorporate evidence and patient values into clinical practice	
Milestones	**Examples**
Level 1 *Accesses and uses evidence in routine patient care*	● Reviews the most recent practice advisory for pre-anesthesia evaluation and applies it in the pre-operative evaluation clinic
Level 2 *Articulates clinical questions and elicits patient preferences and values to guide evidence-based care*	● In a patient with congestive heart failure, calculates and discusses peri-operative surgical risk, and solicits the patient's and their family's perspective regarding peri-operative care
Level 3 *Locates and applies the best available evidence, integrated with patient preference, to the care of complex patients*	● Obtains, discusses, and applies evidence for the peri-operative management of a patient with congenital heart disease ● Understands and appropriately uses clinical practice guidelines for the peri-operative management of a patient with obstructive sleep apnea while eliciting the patient's and their family's preferences
Level 4 *Appraises and applies evidence, even in the face of uncertainty and conflicting evidence, to guide individualized care*	● Accesses the primary literature to discuss current evidence about anesthesia and the developing brain and guide peri-operative care ● Reviews primary literature regarding administration of blood products in the peri-operative setting
Level 5 *Coaches others to appraise and apply evidence for complex patients and/or participates in the development of guidelines*	● Leads clinical teaching on application of best practices in peri-operative blood product management outside the operative room ● Reviews evidence and develops processes to lower environmental contamination and decrease waste in the operating room and perioperative arena ● As part of a team, develops airway protocols and rapid response teams for hospitals
Assessment Models or Tools	● Direct observation ● Oral or written examinations ● Oral presentations ● Research and quality improvement projects
Curriculum Mapping	●
Notes or Resources	● ASA. Standards and Guidelines. https://www.asahq.org/standards-and-guidelines. Accessed 2020. ● Practice Advisory for Preanesthesia Evaluation: An updated report by the American Society of Anesthesiologists Task Force on Preanesthesia Evaluation. *Anesthesiology.* 2012;116(3):522-538. https://anesthesiology.pubs.asahq.org/article.aspx?articleid=2443414&_ga=2.145847356.943651402.1584821665-1121124875.1575478514. ● U.S. National Library of Medicine. PubMed Online Training. https://www.nlm.nih.gov/bsd/disted/pubmedtutorial/cover.html. Accessed 2020.

Practice-Based Learning and Improvement 2: Reflective Practice and Commitment to Personal Growth **Overall Intent:** To seek clinical performance information with the intent to improve care; to reflect on all domains of practice, personal interactions, and behaviors, and their impact on colleagues and patients and families (reflective mindfulness); to develop clear objectives and goals for improvement in some form of a learning plan	
Milestones	**Examples**
Level 1 *Accepts responsibility for personal and professional development by establishing goals*	● Completes self-reflective goals prior to meeting with the program director
Identifies the factors that contribute to performance deficits	● Identifies gaps in knowledge of mechanisms of drug action ● Identifies that fatigue, stressors and perceived life-work imbalance contribute to performance deficits
Actively seeks opportunities to improve	● Asks for feedback from patients, families, and patient care team members ● Uses institutional provided resources to balance personal/professional commitments and obligations
Level 2 *Demonstrates openness to performance data (feedback and other input) to inform goals*	● Integrates feedback to adjust peri-operative management of patients with history of post-operative nausea and vomiting
Analyzes and acknowledges the factors that contribute to performance deficits	● Assesses time management skills and how they impact turnovers and on-time starts
Designs and implements a learning plan, with prompting	● When prompted, develops individual education plan to improve their evaluation of patients with a history of post-operative nausea and vomiting
Level 3 *Seeks performance data episodically, with adaptability and humility*	● Obtains chart data to determine incidence of post-operative nausea and vomiting in own patients, in association with post-operative nausea and vomiting preventative medications
Institutes behavioral change(s) to improve performance	● Completes focused literature review before providing anesthesia
Independently creates and implements a learning plan	● Implements strategies that improve behaviors such as trust, interdependence, genuineness, empathy, risk, team building, and success
Level 4 *Intentionally seeks performance data consistently, with adaptability and humility*	● Obtains a quarterly chart audit to determine incidence of post-operative nausea and vomiting in own patients and alters practice accordingly
Considers alternatives to improve performance	● After patient and family encounter, debriefs with the attending and other patient care team members to optimize future collaboration in the care of the patient and family
Integrates performance data to adapt the learning plan	● Based on audit of incidence of post-operative nausea and vomiting in own patients, identifies knowledge gaps and reads current practice guidelines to improve care

Level 5 *Role models consistently seeking performance data with adaptability and humility* *Models reflective practice* *Facilitates the design and implementation of learning plans for others*	● Shares instances of near misses with more junior learners ● Shares own performance gaps and adapted plan with other learners ● Identifies and shares strategies to improve central line placement based on previously received feedback ● Assists learners in developing their individualized learning plans
Assessment Models or Tools	● Direct observation ● Review of learning plan
Curriculum Mapping	●
Notes or Resources	● Burke AE, Benson B, Englander R, Carraccio C, Hicks PJ. Domain of competence: practice-based learning and improvement. *Acad Pediatr.* 2014;14:S38-S54. https://pubmed.ncbi.nlm.nih.gov/24602636/. ● Hojat M, Veloski JJ, Gonnella JS. Measurement and correlates of physicians' lifelong learning. *Academic Medicine.* 2009;84(8):1066-1074. https://journals.lww.com/academicmedicine/fulltext/2009/08000/Measurement_and_Correlates_of_Physicians__Lifelong.21.aspx.. ● Lockspeiser TM, Schmitter PA, Lane JL, Hanson JL, Rosenberg AA, Park YS. Assessing residents' written learning goals and goal writing skill: validity evidence for the learning goal scoring rubric. *Academic Medicine*. 2013;88(10):1558-1563. https://journals.lww.com/academicmedicine/fulltext/2013/10000/Assessing_Residents__Written_Learning_Goals_and.39.aspx. ● Reed S, Lockspeiser TM, Burke A, et al. Practical suggestions for the creation and use of meaningful learning goals in graduate medical education. *Academic Pediatrics*. 2016;16(1):20-24. https://www.academicpedsjnl.net/article/S1876-2859(15)00333-2/pdf.

Professionalism 1: Professional Behavior and Ethical Principles **Overall Intent:** To recognize and address lapses in ethical and professional behavior, demonstrates ethical and professional behaviors, and use appropriate resources for managing ethical and professional dilemmas	
Milestones	**Examples**
Level 1 *Identifies potential triggers for professionalism lapses* *Describes when and how to report lapses in professionalism* *Demonstrates knowledge of the ethical principles underlying patient care*	● Describes the impact of fatigue on clinical performance ● Recognizes that personal "bias" may interfere with professionalism ● Identifies fatigue and lists available resources to mitigate impact from fatigue ● Describes institutional safety reporting systems to report a near miss, a process problem or patient event ● Articulates how the principle of "do no harm" applies to a patient who may not need a central line even though the learning opportunity exists ● Discusses the basic principles underlying ethics (e.g., beneficence, nonmaleficence, justice, autonomy) and professionalism (e.g., professional values and commitments), and how they apply in various situations (e.g., informed consent process)
Level 2 *Demonstrates insight into professional behavior in routine situations* *Takes responsibility for one's own professionalism lapses* *Analyzes straightforward situations using ethical principles*	● Respectfully approaches a resident who is late to call shift about the importance of being on time ● Maintains patient confidentiality in public situations ● Notifies appropriate supervisor in a timely way when unable to fulfill a responsibility ● Identifies and applies ethical principles involved in informed consent when the fellow is unclear of all the risks
Level 3 *Demonstrates professional behavior in complex or stressful situations* *Recognizes need to seek help in managing and resolving complex interpersonal situations* *Analyzes complex situations using ethical principles*	● Appropriately responds to a distraught family member following a peri-operative complication ● Appropriately handles conversations in the operating room during stressful situations such as acute blood loss and hemodynamic instability ● After noticing a colleague's inappropriate social media post, reviews policies related to posting of content and seeks guidance ● Offers treatment options for a terminally ill patient, free of bias, while recognizing own limitations, and consistently honoring the patient's and family's choice
Level 4 *Recognizes situations that may trigger professionalism lapses and intervenes to prevent lapses in oneself*	● Actively solicits the perspectives of others ● Models respect for patients and families and promotes the same from colleagues, when a patient has been waiting an excessively long time for their surgery

Actively solicits help and acts on recommendations to resolve complex interpersonal situations *Recognizes and uses resources for managing and resolving ethical dilemmas*	● Recognizes and uses ethics consults, literature, and risk-management/legal counsel to resolve ethical dilemmas ● Obtains institutional guidance on obtaining a consent for blood transfusion in pediatric Jehovah's Witness patients
Level 5 *Coaches others when their behavior fails to meet professional expectations* *Identifies and seeks to address system-level factors that induce or exacerbate ethical problems or impede their resolution*	● Coaches others when their behavior fails to meet professional expectations and creates a performance improvement plan to prevent recurrence ● Identifies and seeks to address system-wide factors or barriers to promoting a culture of ethical behavior through participation in a work group, committee, or taskforce (e.g., ethics committee or an ethics subcommittee, risk management committee, root cause analysis review, patient safety or satisfaction committee, professionalism work group, Institutional Review Board, resident grievance committee)
Assessment Models or Tools	● Direct observation ● Global evaluation ● Multisource feedback ● Oral or written self-reflection ● OSCE ● Simulation
Curriculum Mapping	●
Notes or Resources	● ASA. ASA Code of Ethics. https://www.asanet.org/code-ethics. Accessed 2020. ● American Medical Association. Ethics. https://www.ama-assn.org/delivering-care/ama-code-medical-ethics. Accessed 2020. ● Byyny RL, Papadakis MA, Paauw DS. *Medical Professionalism Best Practices*. Menlo Park, CA: Alpha Omega Alpha Medical Society; 2015. https://www.alphaomegaalpha.org/monographs/#monograph-2015. Accessed 2019. ● Domen RE, Johnson K, Conran RM, et al. Professionalism in pathology: a case-based approach as a potential education tool. *Arch Pathol Lab Med.* 2017; 141:215-219. https://pubmed.ncbi.nlm.nih.gov/27763788/. ● Levinson W, Ginsburg S, Hafferty FW, Lucey CR. *Understanding Medical Professionalism*. 1st ed. New York, NY: McGraw-Hill Education; 2014.

Professionalism 2: Accountability/Conscientiousness **Overall Intent:** To take responsibility for one's own actions and the impact on patients, their families, and other members of the health care team	
Milestones	**Examples**

Level 1 *Responds promptly to requests or reminders to complete tasks* *Takes responsibility for failure to complete tasks*	● Responds promptly to reminders from program administrator to complete work hour logs ● Attends conferences and other educational activities on time ● Apologizes to team member(s) for unprofessional behavior without prompting
Level 2 *Performs tasks and responsibilities in a timely manner* *Recognizes situations that may impact one's own ability to complete tasks and responsibilities in a timely manner*	● Completes administrative tasks, documents safety modules, procedure review, and licensing requirements by specified due date ● Before going out of town, completes tasks in anticipation of lack of computer access while traveling
Level 3 *Performs tasks and responsibilities in a timely manner with appropriate attention to detail in routine situations* *Takes responsibility for tasks not completed in a timely manner and identifies strategies to prevent recurrence*	● Notifies attending of multiple competing demands on call, appropriately triages tasks, and asks for assistance from other residents or faculty members as needed ● Appropriately notifies residents and fellows on day service about overnight call events during transition of care or hand-off to avoid patient safety issues and compromise of patient care ● Apologizes to team member(s) for unprofessional behavior without prompting; offers restitution if possible and through self-reflection identifies root cause of failure
Level 4 *Prioritizes tasks and responsibilities in a timely manner with appropriate attention to detail in complex or stressful situations* *Proactively implements strategies to ensure that the needs of patients and their families, teams, and systems are met*	● Takes responsibility for inadvertently omitting key patient information during hand-off and professionally discusses with the patient, family, and interprofessional team ● Follows up with a patient's family and care team of a patient who had a vascular injury during central line placement
Level 5 *Designs and implements an institutional systems approach to ensure timely task completion and shared responsibility*	● Coordinates a multidisciplinary team to facilitate ICU transfers throughout the institution ● Leads multidisciplinary team in peri-operative root cause analysis to improve system practices around infection control
Assessment Models or Tools	● Compliance with deadlines and timelines ● Direct observation ● Global evaluations ● Multisource feedback ● Self-evaluations and reflective tools ● Simulation
Curriculum Mapping	●
Notes or Resources	● ASA. ASA Code of Ethics. https://www.asanet.org/code-ethics. Accessed 2020. ● Code of conduct from fellow/resident institutional manual

	● Expectations of residency program regarding accountability and professionalism

Professionalism 3: Well-Being **Overall Intent:** To identify, use, manage, improve, and seek help for personal and professional well-being for self and others	
Milestones	**Examples**
Level 1 *Recognizes the importance of addressing personal and professional well-being*	● Acknowledges own response to patient's fatal genetic diagnosis ● Is receptive to feedback on missed emotional cues after a family meeting ● Discusses well-being concerns as they might affect performance
Level 2 *Lists available resources for personal and professional well-being* *Describes institutional resources that are meant to promote well-being*	● Independently identifies and communicates impact of a personal family tragedy ● Completes e-learning modules (or other modality) related to fatigue management ● Demonstrates how to access an institutional crisis line ● Independently identifies the stress of relationship issues, difficult patients and families, and financial pressures, and seeks help
Level 3 *With assistance, proposes a plan to promote personal and professional well-being* *Recognizes which institutional factors affect well-being*	● With the multidisciplinary team, develops a reflective response to deal with personal impact of difficult patient and family encounters and disclosures ● Identifies institutionally sponsored wellness programs ● Integrates feedback from the multidisciplinary team to develop a plan for identifying and responding to emotional cues during the next family meeting ● With supervision, assists in developing a personal learning or action plan to address factors potentially contributing to burnout
Level 4 *Independently develops a plan to promote personal and professional well-being* *Describes institutional factors that positively and/or negatively affect well-being*	● Independently identifies ways to manage personal stress ● Self-assesses and seeks additional feedback on skills responding to emotional cues during a family meeting ● Works to prevent, mitigate, and intervene early during stressful periods in the resident peer group
Level 5 *Creates institutional-level interventions that promote colleagues' well-being* *Describes institutional programs designed to examine systemic contributors to burnout*	● Assists in organizational efforts to address clinician well-being after patient diagnosis/prognosis/death ● Works with multidisciplinary team to develop a feedback framework for learners around family meetings ● Establishes a mindfulness program open to all employees
Assessment Models or Tools	● Direct observation ● Group interview or discussions for team activities ● Individual interview ● Institutional online training modules

	● Self-assessment and personal learning plan
Curriculum Mapping	●
Notes or Resources	● This subcompetency is not intended to evaluate a fellow's well-being, but to ensure each fellow has the fundamental knowledge of factors that impact well-being, the mechanisms by which those factors impact well-being, and available resources and tools to improve well-being. ● ACGME. Well-Being Tools and Resources. https://dl.acgme.org/pages/well-being-tools-resources. Accessed 2022. ● Hicks PJ, Schumacher D, Guralnick S, Carraccio C, Burke AE. Domain of competence: personal and professional development. *Acad Pediatr*. 2014;14(2 Suppl):S80-97. https://linkinghub.elsevier.com/retrieve/pii/S1876-2859(13)00332-X. ● Local resources, including Employee Assistance Plan (EAP)

Interpersonal and Communication Skills 1: Patient- and Family-Centered Communication **Overall Intent:** To deliberately use language and behaviors to form constructive relationships with patients and families, to identify communication barriers including self-reflection on personal biases, and minimize them in the doctor-patient relationships; to organize and lead communication around shared decision making	
Milestones	**Examples**
Level 1 *Communicates with patients and their families in an understandable and respectful manner*	● Introduces self and faculty member, identifies patient and others in the room, and engages all parties in health care discussion
Provides timely updates to patients and patients' families	● Provides updates to the family after an unanticipated ICU admission
Level 2 *Customizes communication in the setting of personal biases and barriers with patients and patients' families*	● Avoids medical jargon and restates patient's and family's perspective when discussing general anesthesia for cardiopulmonary bypass
Actively listens to patients and patients' families to elicit patient preferences and expectations	● Responds to questions regarding the risks of central and arterial line placement
Level 3 *Explains complex and difficult information to patients and patients' families*	● Acknowledges patient's and family's request for a do not resuscitate order in the operating room and explains the options
Uses shared decision-making to make a personalized care plan	● Following a discussion of the risks and benefits of general anesthesia, elicits patient and family concerns; documents discussion and preference in emergency medical room
Level 4 *Facilitates difficult discussions with patients and patients' families*	● Explains the risks of neurocognitive dysfunction to parents of a neonate prior to administration of anesthesia
Effectively negotiates and manages conflict among patients, patients' families, and the health care team	● Explains to a patient and their family medical reasoning behind canceling their procedure ● Explains causes and treatment of a corneal abrasion during post-operative visits
Level 5 *Mentors others in the facilitation of crucial conversations*	● Leads a discussion group on personal experience of moral distress
Mentors others in conflict resolution	● Develops a residency curriculum on health care disparities which addresses unconscious bias ● Serves on a hospital bioethics committee
Assessment Models or Tools	● Direct observation ● OSCE ● Self-assessment including self-reflection exercises ● Standardized patients

Curriculum Mapping	●
Notes or Resources	● Laidlaw A, Hart J. Communication skills: an essential component of medical curricula. Part I: Assessment of clinical communication: AMEE Guide No. 51. *Med Teach*. 2011;33(1):6-8. https://www.tandfonline.com/doi/full/10.3109/0142159X.2011.531170. ● Makoul G. Essential elements of communication in medical encounters: The Kalamazoo consensus statement. *Acad Med*. 2001;76:390-393. https://pubmed.ncbi.nlm.nih.gov/11299158/. ● Makoul G. The SEGUE Framework for teaching and assessing communication skills. *Patient Educ Couns*. 2001;45(1):23-34. https://pubmed.ncbi.nlm.nih.gov/11602365/. ● Symons AB, Swanson A, McGuigan D, Orrange S, Akl EA. A tool for self-assessment of communication skills and professionalism in residents. *BMC Med Educ*. 2009;9:1. https://bmcmededuc.biomedcentral.com/articles/10.1186/1472-6920-9-1.

Interpersonal and Communication Skills 2: Interprofessional and Team Communication **Overall Intent:** To effectively communicate with the health care team, including consultants, in both straightforward and complex situations	
Milestones	**Examples**
Level 1 *Respectfully requests or receives consultations*	● Consults cardiology for a patient with a history of angina and limited exercise capacity, relays the diagnosis, and respectfully requests a pharmacological stress test
Uses language that values all members of the health care team	● Receives an acute pain consult request, asks clarifying questions politely, and expresses appreciation for the motivation behind the consult request
Respectfully receives feedback from the health care team	● Acknowledges the contribution of each member of the patient care team to the patient and their family members
Level 2 *Clearly, concisely, and promptly requests or responds to a consultation*	● Communicates pre-operative plans with the attending anesthesiologist concisely in a timely manner
Communicates information effectively with all health care team members	● Communicates intra-operative events to the surgical staff members and attending anesthesiologist clearly, concisely, and in an organized and timely manner
Solicits feedback on performance as a member of the health care team	● Conducts post-operative visits and discusses patient complications with supervising attending while reflecting on personal role in the patient's care
Level 3 *Uses closed-loop communication to verify understanding*	● While leading an intra-operative resuscitation, clearly delegates tasks and asks if team members understand their roles ● Asks other members of the health care team to repeat back recommendations to ensure understanding
Adapts communication style to fit team needs	● When receiving treatment recommendations from an attending physician, repeats back the plan to ensure understanding
Communicates concerns and provides feedback to peers and learners	● Provides constructive feedback to a medical student during IV insertion
Level 4 *Coordinates recommendations from different members of the health care team to optimize patient care*	● Collaborates with surgical colleagues to plan for post-operative analgesia in a patient with anxiety related to a re-operative cardiac surgery
Maintains effective communication in crisis situations	● Explains rationale for institution of the massive transfusion protocol during intra-operative hemorrhage
Communicates constructive feedback to superiors	● Alerts to a breech in sterility for a line placement by a faculty member ● Cautions faculty member about an imminent medication administration error

Level 5 *Role models flexible communication strategies that value input from all health care team members, resolving conflict when needed* *Leads an after-event debrief of the health care team* *Facilitates regular health care team-based feedback in complex situations*	● Mediates a conflict resolution between different members of the health care team ● Leads a post-code team debriefing ● Prompts a post-case sign-out after a case requiring a massive transfusion and ICU care
Assessment Models or Tools	● Direct observation ● Global assessment ● Medical record (chart) audit ● Multisource feedback ● Simulation
Curriculum Mapping	●
Notes or Resources	● AHRQ. Curriculum Materials. https://www.ahrq.gov/teamstepps/curriculum-materials.html. Accessed 2020. ● Dehon E, Simpson K, Fowler D, Jones A. Development of the faculty 360. *MedEdPORTAL*. 2015;11:10174. https://www.mededportal.org/publication/10174/. 2020. ● Green M, Parrott T, Cook G., Improving your communication skills. *BMJ*. 2012;344:e357. https://www.bmj.com/content/344/bmj.e357. 2020. ● Henry SG, Holmboe ES, Frankel RM. Evidence-based competencies for improving communication skills in graduate medical education: a review with suggestions for implementation. *Med Teach*. 2013;35(5):395-403. https://www.tandfonline.com/doi/full/10.3109/0142159X.2013.769677. ● Roth CG, Eldin KW, Padmanabhan V, Freidman EM. Twelve tips for the introduction of emotional intelligence in medical education. *Med Teach.* 2018:1-4. https://www.tandfonline.com/doi/full/10.1080/0142159X.2018.1481499. 2020. ● Waisel DB, Lamiani G, Sandrock NJ, Pascucci R, Truog RD, Meyer EC. Anesthesiology trainees face ethical, practical, and relational challenges in obtaining informed consent. *Anesthesiology.* 2009 Mar;110(3):480-6. Doi: 10.1097/ALN.0b013e318197ff46. PMID: 19225393.

Interpersonal and Communication Skills 3: Communication within Health Care Systems **Overall Intent:** To effectively communicate using a variety of methods	
Milestones	**Examples**
Level 1 *Accurately records information in the patient record; demonstrates judicious use of documentation shortcuts*	● Documentation is accurate but may include extraneous information
Safeguards patients' personal health information	● Avoids talking about patients in the elevator, public spaces, or on social media
Communicates through appropriate channels as required by institutional policy	● Identifies institutional and departmental communication hierarchy for concerns and safety issues ● Only uses secure communication modalities when sharing protected health information
Level 2 *Accurately records information in the anesthetic record for basic cases*	● Completes all components of the intra-operative record in a timely manner
Documents required data in formats specified by institutional policy	● Completes intubation note for an urgent ICU intubation using the appropriate template and correct elements ● Correctly uses the institutional system to file a report of a safety issue
Respectfully communicates concerns about the system	● Recognizes that a communication breakdown has happened and respectfully brings the breakdown to the attention of the chief resident or faculty member
Level 3 *Accurately records information in the anesthetic record and communicates complex care decisions for complex cases*	● Documents critical event notes in the medical record concisely and in a timely manner
Appropriately selects direct and indirect forms of communication based on context	● Follows-up with a patient and family in person regarding a difficult intubation ● Provides a written handout on risks of sugammadex and contraception
Respectfully communicates concerns about the system and contributes to solutions	● Knows when to direct concerns locally, departmentally, or institutionally, i.e.., appropriate escalation
Level 4 *Uses medical record functionality to highlight challenges in anesthetic care to facilitate future peri-operative management*	● Creates consistently accurate, organized, and concise documentation, frequently incorporating anticipatory guidance
Models exemplary written or verbal communication	● Creates exemplary pre-operative assessments that are used by a more senior resident to teach others

Uses appropriate channels to offer clear and constructive suggestions to improve the system	● Talks directly to an emergency department physician (or surgical colleague) about breakdowns in communication to prevent recurrence
Level 5 *Explores innovative uses of the medical record to facilitate peri-operative management* *Guides departmental or institutional policies and procedures around communication* *Initiates difficult conversations with appropriate stakeholders to improve the system*	● Leads a task force established by the hospital QI committee to develop a plan to improve house staff hand-offs ● Actively participates in a committee to develop a pandemic disaster response plan ● Contacts hospital leadership to discuss ways to improve learner well-being
Assessment Models or Tools	● Direct observation ● Medical record (chart) audit ● Multisource feedback ● OSCE ● Simulation
Curriculum Mapping	●
Notes or Resources	● APSF. Improving Post Anesthesia Care Unit (PACU) Handoff By Implementing a Succinct Checklist. https://lhatrustfunds.com/wp-content/uploads/2015/07/PACU-handoff.pdf. Accessed 2020. ● Bierman JA, Hufmeyer KK, Liss DT, Weaver AC, Heiman HL. Promoting responsible electronic documentation: validity evidence for a checklist to assess progress notes in the electronic health record. *Teach Learn Med.* 2017;29(4):420-432. https://www.tandfonline.com/doi/full/10.1080/10401334.2017.1303385. ● Haig KM, Sutton S, Whittington J. SBAR: a shared mental model for improving communication between clinicians. *Jt Comm J Qual Patient Saf*. 2006;32(3):167-175. https://www.jointcommissionjournal.com/article/S1553-7250(06)32022-3/fulltext. ● Starmer AJ, et al. I-pass, a mnemonic to standardize verbal handoffs. *Pediatrics*. 2012;129(2):201-204. https://pediatrics.aappublications.org/content/129/2/201?sso=1&sso_redirect_count=1&nfstatus=401&nftoken=00000000-0000-0000-0000-000000000000&nfstatusdescription=ERROR%3a+No+local+token.

Available Milestones Resources

Milestones 2.0: Assessment, Implementation, and Clinical Competency Committees Supplement, 2021 - *https://meridian.allenpress.com/jgme/issue/13/2s*

Milestones Guidebooks: https://www.acgme.org/milestones/resources/

- *Assessment Guidebook*
- *Clinical Competency Committee Guidebook*
- *Clinical Competency Committee Guidebook Executive Summaries*
- *Implementation Guidebook*
- *Milestones Guidebook*

Milestones Guidebook for Residents and Fellows: https://www.acgme.org/residents-and-fellows/the-acgme-for-residents-and-fellows/

- Milestones Guidebook for Residents and Fellows
- Milestones Guidebook for Residents and Fellows Presentation
- Milestones 2.0 Guide Sheet for Residents and Fellows

Milestones Research and Reports: https://www.acgme.org/milestones/research/

- *Milestones National Report*, updated each fall
- *Milestones Predictive Probability Report,* updated each fall
- *Milestones Bibliography*, updated twice each year

Developing Faculty Competencies in Assessment courses - https://www.acgme.org/meetings-and-educational-activities/courses-and-workshops/developing-faculty-competencies-in-assessment/

Assessment Tool: Direct Observation of Clinical Care (DOCC) - https://dl.acgme.org/pages/assessment

Assessment Tool: Teamwork Effectiveness Assessment Module (TEAM) - https://team.acgme.org/

Improving Assessment Using Direct Observation Toolkit - https://dl.acgme.org/pages/acgme-faculty-development-toolkit-improving-assessment-using-direct-observation

Remediation Toolkit - https://dl.acgme.org/courses/acgme-remediation-toolkit

Learn at ACGME has several courses on Assessment and Milestones - https://dl.acgme.org/