

# *Pediatric Critical Care Medicine* Content Outline

In-Training, Certification, and  
Maintenance of Certification Exams

*Effective for examinations administered January 1, 2020, and after*

## Table of Contents

Overview .....	1
Development of the Pediatric Critical Care Medicine Content Outline.....	1
Content Domains .....	1
Universal Tasks .....	1
Development and Classification of Exam Questions .....	2
Exam Weights.....	3
Detailed Content Outline .....	4
Domain 1: Normal Organ System Development and Function, Anatomy and Physiology, Pharmacology, and Pharmacokinetics .....	4
Domain 2: Common Conditions .....	4
Domain 3: Sedation and Analgesia .....	5
Domain 4: Organ Support Therapies and Monitoring.....	6
Domain 5: Procedures .....	6
Domain 6: End of Life .....	7
Domain 7: PICU Management and Coordination of Care.....	7
Domain 8: Professionalism, Leadership, Advocacy, and Education.....	7
Domain 9: Clinical Ethics.....	7
Domain 10: Core Knowledge in Scholarly Activities .....	7

## Overview

This content outline was developed to serve as the blueprint for the pediatric critical care medicine (PCCM) in-training, initial certification, and maintenance of certification examinations. This outline identifies for all important stakeholders (eg, prospective candidates, diplomates, the public, training programs, professional associations) the knowledge areas being measured by these exams.

This outline takes effect on January 1, 2020. All pediatric critical care medicine (PCCM) examinations administered after this date will adhere to the specifications within this outline.

### DEVELOPMENT OF THE PEDIATRIC CRITICAL CARE MEDICINE CONTENT OUTLINE

The initial draft of this content outline was developed by a diverse, representative panel of practicing PCCM subspecialists. The panel identified the knowledge required of PCCM subspecialists in clinical practice and categorized that knowledge into content domains and subdomains. All Board-certified PCCM subspecialists (N = 2,535) were then invited to provide feedback via an online survey. A total of 619 PCCM subspecialists (24%) rated the frequency and criticality of the content domains and subdomains. The survey also collected open-ended comments from respondents in order to identify any important content areas that were not included in the initial draft.

The survey results were used to make final revisions to the outline and to establish the exam weights (ie, the percentage of exam questions associated with each content domain). The content domains that were rated as highly critical and frequently required in practice have been weighted more heavily than the domains rated as less critical and/or less frequently required. Establishing the exam weights in this manner helps to ensure that the ABP's PCCM exams are measuring the full breadth of knowledge required for clinical practice, while also placing an appropriate amount of emphasis on the content domains that were identified by practicing subspecialists as being critically important.

### CONTENT DOMAINS

The knowledge for safe and effective practice as a PCCM subspecialist has been categorized into 10 content domains, presented in the table below. A more detailed breakdown of the knowledge within each domain is reflected in the detailed content outline, beginning on page 4. Each exam question included on a

PCCM exam (in-training, initial certification, and maintenance of certification) is classified according to the content domain and subdomain to which it is most closely aligned. If an exam question does not align with one of the content subdomains, it is removed from the question pool and is not included on an exam.

#### Pediatric Critical Care Medicine Content Domains

1.	Normal Organ System Development and Function, Anatomy and Physiology, Pharmacology, and Pharmacokinetics
2.	Common Conditions
3.	Sedation and Analgesia
4.	Organ Support Therapies and Monitoring
5.	Procedures
6.	End of Life
7.	PICU Management and Coordination of Care
8.	Professionalism, Leadership, Advocacy, and Education
9.	Clinical Ethics
10.	Core Knowledge in Scholarly Activities

### UNIVERSAL TASKS

To help ensure the clinical relevance of the PCCM exams, the practice analysis panel identified a set of four *universal tasks* that reflect the primary ways in which medical knowledge can be applied in clinical practice: (1) core science, physiology, and pathophysiology, (2) epidemiology and risk assessment, (3) diagnosis, testing, and monitoring, and (4) management and treatment. Each exam question that falls within content domain 2 (common conditions) is classified according to the universal task to which it is most closely aligned. If a test question within domain 2 does not align with one of the universal tasks, it is removed from the question pool and is not included on an exam. The universal tasks are described more fully below.

Universal Tasks for Pediatric Critical Care Medicine	
Universal Task	Description
1. <b>Core science, physiology, and pathophysiology</b>	Understanding and applying anatomy, physiology, and pathophysiology to the care of critically ill children in an age-specific developmental context
2. <b>Epidemiology and risk assessment</b>	Recognizing patterns of health and disease and understanding the variables that influence those patterns, including risk factors, risk stratification, natural history, and conditions that affect outcomes
3. <b>Diagnosis, testing, and monitoring</b>	Using available information (eg, patient history, physical exam, laboratory tests, imaging, and other tests) to formulate differential diagnoses, choose appropriate tests, and monitor disease evolution, response to treatment, and complications
4. <b>Management and treatment</b>	Formulating a comprehensive management and/or treatment plan, including appropriate organ-supportive therapeutic modalities, consultation, and reevaluation, taking into account multiple options for care, co-morbidities, organ system interactions, relevant pharmacology, and evolving clinical status

### DEVELOPMENT AND CLASSIFICATION OF EXAM QUESTIONS

Although the field of pediatric critical care medicine is continually evolving, the content domains and subdomains within this outline should be viewed as broad categories of knowledge that are likely to remain relatively stable over time. The detailed knowledge within the content domains and subdomains, however, is likely to change as the field continues to advance. Because exam questions may assess a PCCM subspecialist's knowledge of a specific element within a content domain/subdomain, it is the responsibility of the test taker to ensure that his or her knowledge within each knowledge area is current and up to date.

To ensure all PCCM exam questions are current and up to date, the ABP follows a rigorous question development and approval process. Each exam question is written by a board-certified subspecialist. Questions that fall within content domain 2 (common conditions) are also classified to a universal task.

Once a question has been written, it is then discussed and revised, if necessary, by the ABP's PCCM Subboard, a large, diverse panel of practicing PCCM subspecialists. During the revision process, each question is also reviewed multiple times by a medical editor to ensure accuracy and by ABP editors who standardize question style, format, and terminology; correct grammar; and eliminate ambiguity and technical flaws, such as cues to the answer.

Once the subboard has approved a question, it is included in the question pool and is made available for future exams. All approved questions in the pool are reviewed periodically for accuracy, currency, and relevance.

### SAMPLE QUESTION

To illustrate how exam questions are classified, consider the following sample question:

*A 13-year-old, 50-kg boy with Crohn disease who has been following a prescribed regimen of daily corticosteroid therapy is admitted to the intensive care unit (ICU) following a 3-hour laparotomy, during which he lost 500 mL of blood. Anesthetic agents included isoflurane, 5 mg of morphine, and vecuronium; 3 mg of neostigmine and 0.6 mg of glycopyrrolate were administered at the end of surgery. Intraoperatively, the patient received 1000 mL of lactated Ringer solution and two 100-mg boluses of hydrocortisone. On admission to the ICU, he is extubated and has the following vital signs: pulse rate 150/min, respiratory rate 18/min, and blood pressure 80/45 mm Hg.*

*Which of the following is the most likely explanation for these vital signs?*

- A. Acute adrenal insufficiency*
- B. Glycopyrrolate toxicity*
- C. Hypovolemia*
- D. Residual isoflurane effect*

*Correct answer = C. Hypovolemia*

The question above would be classified as shown below:

Content Domain/ Subdomain*	2. Common Conditions C. Cardiovascular system 4. Shock states (hypovolemic, distributive, obstructive, cardiogenic, septic)
Universal Task	3. Diagnosis, testing, and monitoring

\*Note: Content subdomain 2.C.4 can be found on page 4

## Exam Weights

The tables below indicate the exam weights (ie, the percentage of exam questions associated with each content domain and with each universal task) for the ABP's PCCM in-training, initial certification, and maintenance of certification exams. Please note that the weights reflect the content of a *typical* exam and are approximate; actual content may vary.

Content Domains		Exam Weight
1. Normal Organ System Development and Function, Anatomy and Physiology, Pharmacology, and Pharmacokinetics		16.0%
2. Common Conditions*		54.0%
A. Multi-organ dysfunction/failure and organ system interactions	5.0%	
B. Respiratory system	6.0%	
C. Cardiovascular system	6.0%	
D. Neurologic system	6.0%	
E. Inflammatory, immunologic, and infectious syndromes and diseases	5.0%	
F. Kidney disease, fluid, and electrolyte disturbances	5.0%	
G. Hematologic disorders and neoplasms	4.0%	
H. Endocrinologic and metabolic conditions	4.0%	
I. Hepatobiliary and gastrointestinal disease, and nutrition for critically ill and injured children	4.0%	
J. Trauma	4.0%	
K. Toxicologic illness and envenomations	4.0%	
L. Behavioral health/commonly encountered psychiatric conditions	1.0%	
3. Sedation and Analgesia		6.0%
4. Organ Support Therapies and Monitoring		9.0%
5. Procedures		4.0%
6. End of Life		4.0%
7. PICU Management and Coordination of Care		1.0%
8. Professionalism, Leadership, Advocacy, and Education		1.0%
9. Clinical Ethics		1.0%
10. Core Knowledge in Scholarly Activities		4.0%
* Questions that fall within content domain 2 are also classified to a universal task (see below).		100%

Universal Tasks *	Exam Weight
1. Core science, physiology, and pathophysiology	20.0%
2. Epidemiology and risk assessment	5.0%
3. Diagnosis, testing, and monitoring	40.0%
4. Management and treatment	35.0%
* Universal task classifications and exam weights apply only to questions within content domain 2.	100%

## Detailed Content Outline

### Domain 1: Normal Organ System Development and Function, Anatomy and Physiology, Pharmacology, and Pharmacokinetics

- A. Respiratory system
- B. Cardiovascular system
- C. Neurologic system
- D. Inflammatory and immunologic response system
- E. Kidney function and fluid/electrolyte homeostasis
- F. Hematologic system
- G. Endocrinologic and metabolic systems
- H. Hepatobiliary and gastrointestinal systems
- I. Pharmacology and pharmacokinetics

### Domain 2: Common Conditions

*The questions in this domain will be classified to both a content subdomain and a universal task. The content subdomains reflect the common conditions that pediatric intensivists must know, and the universal tasks reflect the primary ways in which knowledge is applied in clinical practice.*

Universal Task	Description
1. <b>Core science, physiology, and pathophysiology</b>	Understanding and applying anatomy, physiology, and pathophysiology to the care of critically ill children in an age-specific developmental context
2. <b>Epidemiology and risk assessment</b>	Recognizing patterns of health and disease and understanding the variables that influence those patterns, including risk factors, risk stratification, natural history, and conditions that affect outcomes
3. <b>Diagnosis, testing, and monitoring</b>	Using available information (eg, patient history, physical exam, laboratory tests, imaging, and other tests) to formulate differential diagnoses, choose appropriate tests, and monitor disease evolution, response to treatment, and complications
4. <b>Management and treatment</b>	Formulating a comprehensive management and/or treatment plan, including appropriate organ-supportive therapeutic modalities, consultation, and reevaluation, taking into account multiple options for care, co-morbidities, organ system interactions, relevant pharmacology, and evolving clinical status

- A. Multi-organ dysfunction/failure and organ system interactions
- B. Respiratory system
  - 1. Acute respiratory distress syndrome (ARDS)
  - 2. Upper respiratory tract disorders
  - 3. Lower respiratory tract disorders
  - 4. Pulmonary circulation (includes pulmonary hypertension)
  - 5. Disorders of gas exchange (including blood gas analysis)
  - 6. Other disorders of the respiratory system (eg, diaphragmatic dysfunction, central control of respiration)
- C. Cardiovascular system
  - 1. Congenital heart disease
  - 2. Acquired heart disease
  - 3. Rhythm disturbances
  - 4. Shock states (hypovolemic, distributive, obstructive, cardiogenic, septic)
  - 5. Cardiac arrest
- D. Neurologic system
  - 1. Acute CNS disorders
  - 2. Chronic CNS disorders

3. Peripheral nervous system disorders (including neuromuscular)
4. Neurologic and neuropsychiatric complications of critical illness
- E. Inflammatory, immunologic, and infectious syndromes and diseases
  1. Sepsis and related conditions
  2. Infectious syndromes and diseases
  3. Transplant medicine
  4. Autoimmune and inflammatory conditions
  5. Primary and secondary immunodeficiencies
  6. Other immunologic conditions and infection-associated syndromes (rheumatic heart disease, anaphylaxis, toxic shock, etc)
- F. Kidney disease, fluid, and electrolyte disturbances
  1. Acute and chronic, primary and secondary kidney dysfunction
  2. Fluids and electrolytes
- G. Hematologic disorders and neoplasms
  1. Hematologic disorders (includes coagulopathy, thrombosis, cytopenias, cell line abnormalities [quantitative and qualitative], etc)
  2. Neoplasms and complications (includes stem cell transplantation, tumor lysis syndrome, hyperleukocytosis, chemotherapies and their complications, etc)
- H. Endocrinologic and metabolic conditions
  1. Primary and secondary endocrinologic disorders (includes adrenal, thyroid, pituitary, pancreatic, parathyroid, etc)
  2. Primary and secondary metabolic disturbances (includes glucose homeostasis, inborn errors of metabolism, etc)
- I. Hepatobiliary and gastrointestinal disease, and nutrition for critically ill and injured children
  1. Hepatobiliary disease
  2. Gastrointestinal dysfunction
  3. Nutrition for critically ill and injured children
- J. Trauma
  1. Traumatic brain injury
  2. Penetrating injury, blunt injury
  3. Burn injury
  4. Environmental injury (includes heat stroke, lightning, etc)
  5. Child abuse
  6. Other (hanging, drowning, etc)
- K. Toxicologic illness and envenomations
  1. Toxidromes
  2. Envenomations
  3. Inhalation injury and hydrocarbon ingestion
- L. Behavioral health/commonly encountered psychiatric conditions

### Domain 3: Sedation and Analgesia

- A. Different levels of sedation, potential complications, and steps for patient rescue
- B. Classes of anesthetics, sedatives, analgesics, and neuromuscular blocking agents, including mechanisms of action, indications, duration of action, side effects, and contraindications
- C. Equipment and monitoring needed to provide safe and effective sedation during critical illness and for procedural support

#### Domain 4: Organ Support Therapies and Monitoring

*The content subdomains listed below represent categories of organ support therapy and monitoring technologies. The questions in this domain may assess any of the following: (1) indications, contraindications, complications, and alternatives; (2) graphical output (normal and abnormal tracings) and interpretation, including radiologic studies; (3) foundational principles for device mechanics; (4) troubleshooting; or (5) common perturbations*

- A. Medical and mechanical support of failing organs
  - 1. Oxygen delivery systems, noninvasive ventilation, invasive mechanical ventilation
  - 2. Mechanical circulatory support devices, including ECMO and ventricular support
  - 3. Renal replacement therapy
- B. Monitoring modalities
  - 1. Invasive cardiorespiratory monitoring
  - 2. Noninvasive cardiorespiratory monitoring
  - 3. Invasive neurologic monitoring
  - 4. Noninvasive neurologic monitoring

#### Domain 5: Procedures

*The questions associated with “Commonly performed procedures” (subdomain A) may assess any of the following: (1) relevant anatomy and physiology, (2) indications and contraindications, (3) risks, (4) technical aspects, or (5) complications. The questions associated with “Commonly assisted procedures” (subdomain B) may assess any of the following: (1) risks; (2) technical aspects, including positioning and monitoring of the patient; or (3) potential complications.*

- A. Commonly performed procedures
  - 1. Airway management (eg, airway adjuncts, bag-valve-mask ventilation, tracheal intubation, management of the difficult airway)
  - 2. Arterial catheterization
  - 3. Central venous catheterization
  - 4. Intraosseous cannulation
  - 5. Thoracentesis/thoracostomy tube placement
  - 6. Pericardiocentesis
  - 7. Abdominal paracentesis
  - 8. Defibrillation/cardioversion
  - 9. Cardiac pacing
- B. Commonly assisted procedures
  - 1. Flexible bronchoscopy
  - 2. Endoscopy of body viscera
  - 3. Bone marrow aspiration/bone marrow biopsy
  - 4. Plasmapheresis and other plasma-based therapies, and exchange blood transfusion
  - 5. Peritoneal dialysis
  - 6. Initiation of hemodialysis, including continuous renal replacement therapy (CRRT)
  - 7. Cricothyroidotomy
  - 8. Tracheostomy
  - 9. Intracranial pressure monitor placement
  - 10. ECMO cannulation



## Domain 6: End of Life

- A. Defining and determining death
- B. Pharmacologic and nonpharmacologic methods to manage pain/discomfort at the end of life
- C. Legal, ethical, and scientific practices during end-of-life care (eg, organ donation, terminal extubation)
- D. Advanced directives, assent as developmentally appropriate, and competence in decision making

## Domain 7: PICU Management and Coordination of Care

- A. Principles of triage
- B. Transport management
- C. Common isolation requirements
- D. Risk factors for and complications associated with hospital-acquired conditions
- E. Factors associated with patient readmission to the PICU
- F. Cost/benefit considerations for diagnostic and therapeutic interventions, including judicious use of interventions (including antibiotic stewardship)
- G. Transfer of patient care within and between institutions, including issues related to referral recommendations, protocols, and regulatory requirements
- H. Handoff principles and tools
- I. Sequelae of critical illness
- J. Legal aspects of practice

## Domain 8: Professionalism, Leadership, Advocacy, and Education

- A. Signs and symptoms of professional burnout
- B. Principles of crisis resource management
- C. Principles of leadership, including leadership styles
- D. Principles of change management
- E. Health equity and health disparities
- F. Key principles of adult learning theory with an understanding of inherent assumptions

## Domain 9: Clinical Ethics

- A. Core principles of medical ethics
- B. Ethical and legal principles regarding futile or potentially inappropriate care
- C. Principles of consent and assent

## Domain 10: Core Knowledge in Scholarly Activities

- A. Principles of biostatistics in research
  1. Types of variables (eg, continuous, ordinal, nominal)
  2. Distribution of data (eg, mean, standard deviation, skewness)
  3. Hypothesis testing (eg, type I and type II errors, P values, statistical power)
  4. Common statistical tests (eg, ANOVA, chi-square, nonparametric tests)
  5. Measurement of association and effect (eg, correlation, relative risk, odds ratio)
  6. Regression (eg, linear, logistic, survival analysis)
  7. Diagnostic tests (eg, sensitivity and specificity, predictive values, disease prevalence, receiver operating characteristic [ROC] curves)
  8. Systematic review and meta-analysis
- B. Principles of epidemiology and clinical research design
  1. Study design, performance, and analysis (internal validity)
  2. Generalizability (external validity)

3. Bias and confounding
  4. Causation
  5. Incidence and prevalence
  6. Screening
  7. Cost benefit, cost effectiveness, and outcomes
  8. Measurement (eg, validity, reliability)
- C. Ethics in Research
1. Professionalism and misconduct in research (eg, conflicts of interest, falsification)
  2. Principles of research involving human subjects
  3. Principles of consent and assent
- D. Quality Improvement
1. Project design (eg, models, aims, key drivers, tools, Plan-Do-Study-Act [PDSA] cycle)
  2. Data and measurement (eg, outcomes, balancing measures, run charts, control charts, common cause and special cause variation)