

# *Pediatric Pulmonology*

## Content Outline

In-Training, Initial Certification, and  
Maintenance of Certification Exams

*Effective for exam administered  
beginning November 1, 2018*

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## Overview

This content outline was developed to serve as the blueprint for the ABP's pediatric pulmonology in-training, initial certification, and maintenance of certification exams. This outline identifies for all important stakeholders (eg, prospective candidates, diplomates, training programs, professional associations, the public) the knowledge areas being measured by these exams. This outline takes effect on November 1, 2018. All pediatric pulmonology exams administered after this date will adhere to the specifications within this outline.

### DEVELOPMENT OF THE PEDIATRIC PULMONOLOGY CONTENT OUTLINE

The initial draft of this content outline was developed by the Pediatric Pulmonology Subboard of the American Board of Pediatrics (ABP), and is comprised of a diverse, representative panel of practicing pediatric pulmonologists. The panel identified the knowledge required of pediatric pulmonologists in clinical practice and categorized that knowledge into content domains and subdomains. All board-certified pediatric pulmonologists (N = 1,031) were then invited to provide feedback via online survey. A total of 332 pediatric pulmonologists (32%) rated the importance of the content domains and subdomains. The survey also collected open-ended comments from respondents 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/subdomain). The content domains and subdomains that were rated as highly important have been weighted more heavily than those rated as less important. Establishing the exam weights in this manner helps to ensure that the pediatric pulmonology exams are measuring the full breadth of knowledge required for clinical practice, while also placing an appropriate amount of emphasis on each content domain.

### CONTENT DOMAINS

The knowledge for safe and effective practice as a pediatric pulmonologist has been categorized into four content domains: (1) normal lung development and physiology, (2) clinical entities, (3) core principles of pulmonary diagnosis and monitoring techniques, and (4) core knowledge in scholarly activities. A full listing of the subdomains within each domain is presented in the detailed content outline, beginning on page 5.

Each exam question included on a pediatric pulmonology exam 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 domains/subdomains, it is removed from the question pool and is not included on an exam. The content domain and subdomain exam weights are presented on page 3.

The clinical entities domain (Content Domain 2) warrants special attention. A majority (77%) of exam questions on all pediatric pulmonology exams fall within this domain (see content domain weights table on page 3). The questions within this domain pertain to the diseases, disorders, and conditions that are commonly encountered by pediatric pulmonologists and/or critical to the practice of pediatric pulmonology. To help ensure that questions within this domain are reflective of practice, each question within this domain is also classified to a second taxonomy referred to as *Universal Tasks*, described in the next section.

### UNIVERSAL TASKS

The ways in which knowledge of pulmonological clinical entities is applied in practice has been categorized into four universal tasks, described below:

1. **Basic science and pathophysiology:** Understanding the basic science and pathophysiologic basis of pediatric pulmonary conditions in an age-specific developmental context.
2. **Epidemiology and risk assessment:** Recognizing patterns of health and disease and understanding the variables that influence those patterns, including risk factors for conditions and for poorer outcomes.
3. **Diagnosis and monitoring:** Using available information (patient history, physical exam, pulmonary function tests, polysomnography, imaging, and other tests) to formulate differential diagnoses and monitor disease progression, response to treatment, and complications. Newborn screening is included in this universal task.
4. **Management and treatment:** Formulating comprehensive management and/or treatment plans in inpatient and outpatient settings with multiple options for care, including immunizations, nutritional support, systemic medications, inhaled medications, airway clearance, supplemental oxygen, and noninvasive and invasive ventilation.

In addition to being classified to a content domain and subdomain, each exam question that falls within the clinical entities content domain is also classified according to the universal task to which it is most closely aligned. The universal task weights are presented on page 4.

## DEVELOPMENT AND CLASSIFICATION OF EXAM QUESTIONS

Although the field of pediatric pulmonology 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 assess a pediatric pulmonologist's knowledge of a specific element within a content domain/subdomain, it is important to note that it is the ABP's responsibility to ensure the accuracy, currency, and relevance of the exam questions, and it is the responsibility of the test takers to ensure that their knowledge within each knowledge area is up to date.

The ABP follows a rigorous development and approval process to ensure all pediatric pulmonology exam questions are current, accurate, and relevant. Each exam question is written by a board-certified practitioner or academician who has received additional training on how to write high-quality questions. Each question is classified according to the content domain/subdomain to which it is most closely aligned, and each question within the clinical entities domain is also classified according to the universal task to which it is most closely aligned. Questions that do not align with a content domain/subdomain and a universal task (if applicable) are removed from the question pool and are not included on an exam.

Once a question has been developed, it is then discussed and revised, if necessary, by the Pediatric Pulmonology Subboard. During the revision process, each question is also reviewed multiple times by a medical editor to ensure accuracy and by staff 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, including questions that have been used previously on an exam, are reviewed periodically for accuracy, currency, and relevance.

## SAMPLE QUESTION

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

*A 3-month-old infant is being evaluated for noisy breathing. The noise has increased since birth, but decreases during sleep. The infant occasionally gags with feeding, but is thriving and developing normally. Inspiratory stridor is noted on physical examination. The cry is vigorous, and no expiratory sounds are noted.*

*Which of the following is the most likely cause of the stridor?*

- A. Unilateral vocal cord paralysis*
- B. Laryngomalacia*
- C. Partial laryngeal web*
- D. Subglottic stenosis*

*Correct answer = B. Laryngomalacia*

The question above would most likely be classified as shown in the table below. Because this question falls within the clinical entities content domain, it is also classified according to a universal task, as shown below.

Item Classification	
Content Domain/Subdomain*	2. Clinical Entities D. Congenital malformations of the airways and lungs 1. Extrathoracic
Universal Task	3. Diagnosis and Monitoring

**\*Note: Content domain/subdomain 2.D.1 can be found on page 6 of this document (within the detailed content outline).**

## Exam Weights

The content domain and subdomain weights (page 3) and the universal task weights (page 4) specify the target percentage of exam questions associated with each content domain, subdomain, or universal task. When new versions of the pediatric pulmonology exams are assembled, the actual percentage of questions assigned to each domain, subdomain, or universal task may deviate from the target weight by up to one percent (plus or minus). This practice allows the flexibility to select the highest quality exam questions from the question pool while maintaining the fairness and content validity of these exams.

## Content Domain and Subdomain Weights

The table below specifies the exam weights (ie, the percentage of exam questions associated with each content domain) for the ABP's pediatric pulmonology exams (in-training, initial certification, and maintenance of certification). Because the clinical entities domain comprises such a large percentage of the exam questions (77%), weights have also been specified at the subdomain level to ensure appropriate balance across the major knowledge categories within that particular domain.

Content Domain/Subdomain	Exam Weights	
1. Normal Lung Development and Physiology		10%
2. Clinical Entities		77%
A. Common signs and symptoms	6%	
B. Respiratory distress in the newborn infant	4%	
C. Pulmonary complications related to prematurity	4%	
D. Congenital malformations of the airways and lungs	5%	
E. Respiratory infections	5%	
F. Cystic fibrosis (CF)	6%	
G. Non-CF bronchiectasis	3%	
H. Asthma	6%	
I. Sleep-disordered breathing and control of breathing disorders	4%	
J. Restrictive disease	4%	
K. Respiratory failure	4%	
L. Lung transplantation	2%	
M. Interstitial lung disease	4%	
N. Pulmonary vascular and lymphatic diseases	4%	
O. Pulmonary complications of diseases of other organ systems	5%	
P. Environmental injuries and exposures (acute and thoracic)	3%	
Q. Respiratory system under stress	3%	
R. Other	5%	
3. Core Principles of Pulmonary Diagnosis and Monitoring Techniques		8%
4. Core Knowledge in Scholarly Activities		5%
		100%

The table above only displays the domains and subdomains for which exam weights have been specified. A full listing of all subdomains and sub-subdomains within each domain is presented in the detailed content outline, beginning on page 5.

## Universal Task Weights

The table below indicates the universal task weights for the ABP's pediatric pulmonology exams (in-training, initial certification, and maintenance of certification).

Each exam question that falls within the clinical entities content domain (#2) is also classified according to the universal task to which it is most closely aligned. Because questions from the clinical entities content domain make up 77% of the exam, the weights for the four universal tasks sum to 77%. Questions that fall within the other three content domains (#1, #3, and #4) are not explicitly assigned to a universal task, so there are no universal task weights for the other content domains.

The table on the previous page (page 3) specified content domain and subdomain weights for the clinical entities domain. It is important to note that the universal task weights specified below do not apply to each subdomain within the clinical entities domain. Rather, the universal task weights below reflect the percentage of exam questions associated with each universal task across all subdomains within the clinical entities domain.

Content Domains	Universal Task Weights				Content Domain Weights
	1. Basic science & Pathophysiology	2. Epidemiology & Risk Assessment	3. Diagnosis & Monitoring	4. Management & Treatment	
1. Normal Lung Development and Physiology	--	--	--	--	10%
2. Clinical Entities	10%	7%	22%	38%	77%
3. Core Principles of Pulmonary Diagnosis and Monitoring Techniques	--	--	--	--	8%
4. Core Knowledge in Scholarly Activities	--	--	--	--	5%
					100%

When reviewing the universal task weights, it is important to note that the purpose of the universal tasks is to help ensure the clinical relevance of the ABP's pediatric pulmonary exams by establishing an appropriate level of balance across those categories. Feedback from the validation survey (described briefly on page 1), for example, indicated that a majority of questions on the exam should assess a pediatric pulmonologist's applied knowledge in the areas of diagnosis and monitoring (universal task #3) and management and treatment (universal task #4). The universal task weights specified above reflect that feedback.

It is also worth noting that although questions in the other content domains (#1, #3, and #4) are not explicitly classified to a universal task, many of the questions in those other domains would naturally fall within one of the universal task categories if they were to be classified. For example, most questions that fall within normal lung development and physiology (content domain #1) would naturally fall within the basic science and pathophysiology universal task. And most, if not all, questions within core principles of pulmonary diagnosis and monitoring techniques (content domain #3) would naturally fall within the diagnosis and monitoring universal task.

As a result, the actual percentage of questions that measure knowledge pertaining to each universal task *for the entire exam* will differ from the universal task weights specified in the table above, which only apply to the clinical entities domain. It is likely that the total percentage of exam questions that assess knowledge pertaining to basic science and pathophysiology (which includes questions from normal lung development and physiology) will be roughly 20% (10% + 10%). Similarly, the total percentage of exam questions that assess knowledge pertaining to diagnosis and monitoring will be roughly 30% (22% + 8%).

## Detailed Content Outline

### Domain 1: Normal Lung Development and Physiology (10%)

- A. Lung morphogenesis, fetal, perinatal, and postnatal growth and development
- B. Structure of the respiratory system
- C. Lung defense mechanisms
  - 1. General
  - 2. Modifications of inspired air
  - 3. Respiratory tract cilia
  - 4. Airway secretions
  - 5. Cough
  - 6. Respiratory reflexes and defense of the lung
  - 7. Pulmonary lymphatics
  - 8. Air-blood barrier
  - 9. Innate immunity
  - 10. Adaptive immunity
- D. Gas exchange, ventilation-perfusion distribution, acid-base reaction
  - 1. Gas exchange
  - 2. Carbon dioxide transport
  - 3. Acid-base balance
- E. Respiratory mechanics
  - 1. Static respiratory system mechanics
  - 2. Airway mechanics
  - 3. Work of breathing
- F. Control of breathing
  - 1. Peripheral chemoreceptors
  - 2. Central chemoreceptors
  - 3. Central neuronal control
  - 4. Developmental changes in breathing patterns
- G. Pulmonary vascular physiology
  - 1. Pulmonary vasculature
  - 2. Bronchial vasculature

### Domain 2: Clinical Entities (77%)

- A. Common signs and symptoms (6%)
  - 1. Chronic cough
  - 2. Recurrent wheeze
  - 3. Noisy breathing/stridor
  - 4. Chest pain
  - 5. Dyspnea/exercise intolerance
  - 6. Recurrent pneumonia
  - 7. Dysphagia
- B. Respiratory distress in the newborn infant (4%)
  - 1. Infant respiratory distress syndrome
    - a. Preterm infant
    - b. Term infant
  - 2. Transient tachypnea of the newborn
  - 3. Meconium aspiration
  - 4. Neonatal pneumonia
- C. Pulmonary complications related to prematurity (4%)
  - 1. Bronchopulmonary dysplasia



2. Acquired lesions of the extra- and intra-thoracic airway
- D. Congenital malformations of the airways and lungs (5%)
  1. Extrathoracic
  2. Intrathoracic
  3. Diaphragmatic
- E. Respiratory infections (5%)
  1. Extrathoracic
    - a. Bacterial
    - b. Viral
  2. Intrathoracic
    - a. Bacterial
    - b. Viral
    - c. Fungal
    - d. Parasitic
    - e. Mycobacterial
  3. Immunocompromised host
    - a. Primary immunodeficiency
    - b. Acquired immune deficiency syndrome (AIDS)
    - c. Immunosuppressed
      - i. Bone marrow transplant
      - ii. Solid organ transplant
      - iii. Chemotherapy
      - iv. Other immunosuppressive agents
- F. Cystic fibrosis (CF) (6%)
  1. Sinopulmonary disease
    - a. Lung disease
    - b. Sinusitis/polyposis
    - c. Complications
  2. Gastrointestinal (GI)/nutrition
  3. Endocrine
  4. Other (eg, mental health, fertility)
- G. Non-CF bronchiectasis (3%)
  1. Primary ciliary dyskinesia
  2. Postinfectious
  3. Other
- H. Asthma (6%)
  1. Preschool age
  2. School age
  3. Adolescent
  4. Severe asthma
  5. Acute exacerbations
  6. Exercise-induced bronchospasm/bronchoconstriction
  7. Vocal cord dysfunction
- I. Sleep-disordered breathing and control of breathing disorders (4%)
  1. Sudden unexpected infant death/sudden infant death syndrome
  2. Brief sudden unexplained events/acute life-threatening events



3. Disordered control of breathing and central sleep apnea syndrome including congenital central hypoventilation syndrome
4. Obstructive sleep apnea syndrome
5. Apnea of prematurity
- J. Restrictive disease (4%)
  1. Neuromuscular disease (congenital and acquired)
    - a. Pulmonary manifestations
    - b. Extrapulmonary manifestations
  2. Disorders of the spine, chest wall, and diaphragm
    - a. Scoliosis
    - b. Rib and sternum disorders
    - c. Diaphragm eventration, paralysis, weakness
    - d. Abdominal wall
- K. Respiratory failure (4%)
  1. Acute
  2. Chronic/technology-dependent child
    - a. Chronic noninvasive ventilation
    - b. Tracheostomy
    - c. Chronic mechanical ventilation
- L. Lung transplantation (2%)
- M. Interstitial lung disease (4%)
  1. Child
  2. Other
- N. Pulmonary vascular and lymphatic diseases (4%)
  1. Pulmonary hypertension
    - a. Primary
    - b. Secondary
  2. Pulmonary vein stenosis
  3. Pulmonary embolism
  4. Arteriovenous malformations
  5. Lymphatic disorders
- O. Pulmonary complications of diseases of other organ systems (5%)
  1. Congenital heart disease
  2. Gastrointestinal diseases
  3. Rheumatologic diseases
  4. Sickle cell
  5. Sarcoid
  6. Noninfectious complications of bone marrow transplant and solid organ transplant
- P. Environmental injuries and exposures (acute and chronic) (3%)
  1. Smoke and thermal inhalation injury
  2. Exposure to tobacco products
  3. Hydrocarbon aspiration
  4. Drowning
  5. Air pollution and irritants
- Q. Respiratory system under stress (3%)
  1. Altitude
  2. Diving
  3. Exercise

4. Trauma
5. Obesity
6. Pregnancy
- R. Other (5%)
  1. Bronchiolitis obliterans
  2. Pulmonary hemorrhage/hemoptysis
  3. Pulmonary edema
  4. Atelectasis
  5. Noninfectious disorders of the pleural space
    - a. Fluid
    - b. Air
  6. Eosinophilic lung diseases
  7. Alpha-1-antitrypsin deficiency
  8. Tumors and masses in the airway, parenchyma, and mediastinum
  9. Glycogen storage diseases
  10. Plastic bronchitis
  11. Foreign body

### Domain 3: Core Principles of Pulmonary Diagnosis and Monitoring Techniques (8%)

- A. Pulmonary function tests
  1. Spirometry
  2. Plethysmography
  3. Diffusing capacity
  4. Resistance and compliance
  5. Bronchodilator testing
  6. Bronchoprovocation testing
  7. Respiratory muscle testing
  8. Exercise testing
  9. Infant pulmonary function testing
  10. Inert gas washout
  11. Measures of central respiratory drive
- B. Polysomnography
- C. Bronchoscopy and bronchoalveolar lavage
- D. Genetic testing
- E. Lung imaging

### Domain 4: Core Knowledge in Scholarly Activities (5%)

- A. Principles of biostatistics in research
  1. Types of variables
  2. Distribution of data
  3. Hypothesis testing
  4. Common statistical tests
  5. Measurement of association and effect
  6. Regression
  7. Diagnostic tests
  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
- C. Ethics in research
  - 1. Professionalism and misconduct in research
  - 2. Principles of research involving human subjects
  - 3. Principles of consent and assent
- D. Quality improvement
  - 1. Project design
  - 2. Data and measurement