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## Curriculum

1. The program must provide a description of the skills and competencies the fellow will be able to demonstrate at the conclusion of the program to fellows and faculty at least annually, in either written or electronic form.

2. ACGME Competencies (See summary by Mullon, CHEST 2017; 151(5):1114-1121)

Interventional pulmonology involves the care patients with both non-malignant and malignant airway, pleural, mediastinal and parenchymal lung diseases. Accredited training programs in interventional pulmonology must provide a broad exposure to patients suffering from both malignant and non-malignant diseases of the thorax.

The program must integrate the following ACGME competencies into the curriculum:

### 2.a) Medical Knowledge

Fellows must demonstrate in depth knowledge of IP-related disease processes as well as established and evolving biomedical, clinical, epidemiological and social-behavioral sciences, and demonstrate the ability to apply this knowledge to patient care. A didactic lecture series is required with a minimum of once monthly lectures delivered by faculty.

Fellows must:

2.a).(1) demonstrate knowledge of the scientific method of problem solving and evidence-based decision making. This must include knowledge of study design, research ethics, and medical biostatistics.

2.a).(2) demonstrate a knowledge of indications, contraindications, limitations, complications, techniques, and interpretation of results of those diagnostic and therapeutic procedures integral to the discipline, including the appropriate indication for and use of screening tests/procedures as well as the risks and benefits of alternative procedures;

2.a).(3) demonstrate knowledge of anatomic, physiologic, and physical principles as they pertain to the practice of IP. Included is an understanding of:

2.a).(3).(i) detailed tracheal, bronchial, vascular, lymphatic, pulmonary, and cardiac anatomy, physiology and pathophysiology;

2.a).(3).(ii) pathophysiology of central airway obstruction;

2.a).(3).(iii) wound healing and host factor responses to injury

2.a).(3).(iv) Properties of endobronchial thermal and ablative treatment technologies to include:

I. Laser therapy (Nd:YAG, KTP, CO<sub>2</sub>, YAP, etc)

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- II. Electrocautery
- III. Argon plasma coagulation
- IV. Cryotherapy
- V. Photodynamic therapy

.2.a).(3).(v) Principles and physical properties of airway stents

2.a).(3).(vi) Principles of advanced airway, mediastinal, and lung parenchymal imaging enhancement techniques to include but not limited to:

- I. Autofluorescence
- II. Narrow band imaging
- III. Confocal bronchoscopy
- IV. Optical coherence tomography
- V. Endoscopic radial and convex ultrasound
- VI. Transthoracic ultrasound

.2.a).(3).(vii) Thoracic imaging modalities to include CT, MRI, PET, thoracic ultrasound

2.a).(3).(viii) Pathophysiology and natural history of tracheal stenosis, tracheobronchomalacia, and excessive dynamic airway collapse

.2.a).(3).(ix) Diagnosis, staging, and natural history of thoracic malignancies to include, but not limited to, lung cancer, mesothelioma, thymoma

2.a).(3).(x) Basic principles of radiotherapy to include brachytherapy

2.a).(3).(xi) Basic principles of chemotherapy as they apply to thoracic malignancies

2.a).(3).(xii) Evaluation, diagnosis, and management of pleural disease to include malignant pleural effusion, recurrent benign pleural effusion and pleuritis, pneumothorax, pleural space infection

2.a).(3).(xiii). Managing moderate sedation

2.a).(4) must demonstrate knowledge of the prevention, evaluation, and management of both inpatients and outpatients with specific disease entities pertinent to the practice of IP. Included in this is knowledge of:

2.a).(4).(i) malignant airway obstruction, secondary to:

- I. Intrinsic/endoluminal tumor
- II. Extrinsic/extraluminal compression by tumor
- III. Mixed intrinsic and extrinsic obstructing tumor

2.a).(4).(ii) non-malignant airway obstruction secondary to but not limited to:

- I. Foreign body

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- II. Vocal cord disorders
  - III. Tracheal/bronchial obstruction secondary to, for example, granulomatosis with polyangiitis, post-intubation/tracheostomy, tuberculosis, sarcoidosis, amyloidosis, recurrent respiratory papillomatosis, broncholithiasis, Tracheal/bronchial malacia / excessive dynamic airway collapse secondary to relapsing polychondritis, Mounier-Kuhn syndrome, COPD
  - IV. Airway complications following airway surgery/lung transplant to include anastomotic strictures/granulation
  - V. Airway stent-associated granulation tissue
  - VI. Extrinsic compression from, for example, goiter, mediastinal cyst, lymphadenopathy
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- 2.a).(4).(iii) Loss of airway integrity secondary to but not limited to:
    - I. Anastomotic dehiscence
    - II. Tracheo/bronchial-esophageal fistula
    - III. Bronchopleural / alveolar-pleural fistula
  - 2.a).(4).(iv) Pre-malignant and early stage malignant airway disease
  - 2.a).(4).(v) The guidelines, principles, and practice of thoracic malignancy screening
  - 2.a).(4).(vi) Undiagnosed mediastinal and hilar lymphadenopathy
  - 2.a).(4).(vii) Massive hemoptysis
  - 2.a).(4).(viii) Solitary pulmonary nodules
  - 2.a).(4).(ix) Undiagnosed pleural effusions
  - 2.a).(4).(x) Pneumothorax
  - 2.a).(4).(xi) Parapneumonic effusion / Empyema
  - 2.a).(4).(xii) Malignant pleural effusion
  - 2.a).(4).(xiii) Chylothorax
  - 2.a).(4).(xiv) Hepatic hydrothorax / effusions due to refractory congestive heart failure
- 2.a).(5) must demonstrate competence in the prevention and management of mechanical complications of interventional pulmonary procedures, which may include:
- 2.a).(5).(i). Simple and tension pneumothorax, hemothorax
  - 2.a).(5).(ii). Airway disruption, perforation, tear
  - 2.a).(5).(iii). Massive hemoptysis

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2.a).(5).(iv). Refractory hypoxia / respiratory failure

2.a).(5).(v). Injury to adjacent organs, e.g. esophageal perforation during percutaneous dilational tracheostomy placement

2.a).(5).(vi). Airway fire

2.a).(5).(vii). Secondary tracheal stenosis (post tracheostomy) and secondary bronchial/tracheal strictures from laser/EC /mechanical trauma/ anastomotic complications

2.a).(6). must demonstrate knowledge of the safety, administrative, and business aspects pertinent to the practice of IP, to include:

2.a).(6).(i). Procedural quality control management. Pursuant to this the fellow must maintain and produce a comprehensive procedural log that includes underlying diagnosis, outcomes, diagnostic yield, and complications.

2.a).(6).(ii). Equipment maintenance and procedural suite design

2.a).(6).(iii). OSHA and infection control regulations and policies as they pertain to procedural suite design, ventilation, and isolation

2.a).(6).(iv) radiation physics, biology, and safety related to the use of x-ray imaging equipment;

2.a).(6).(v) laser physics and safety

2.b) Patient Care and Procedural Skills

Technical and procedural skills comprise a principle component of IP.

Fellows must:

2.b).(1) demonstrate proficiency in the understanding and communicate the indications, contraindications, technical aspects, available alternative treatment options, and complications of IP procedures.

2.b).(2) be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health

2.b).(3). demonstrate an understanding of the principles of palliative care and end of life decision making

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2.b).(4) demonstrate competence in the practice of health promotion, disease prevention, diagnosis, care, and treatment of patients of each gender, from adolescence to old age, during health and all stages of illness

2.b).(5) Fellows must be able to competently perform all medical, diagnostic, and surgical procedures considered essential for the practice of IP. The program director is responsible for determining fellow procedural competence based on, for example, a combination of case presentations and procedural planning, direct procedural observation, faculty evaluations, outcomes and complications tracking, procedural exposure accumulated during prior training. When available, validated assessment tools should be further utilized and documented in assessing procedural competence. To maintain staff and faculty expertise and adequate fellow exposure to relevant patient factors and complications, minimum institutional procedural volumes are required to accredit interventional pulmonology fellowship programs (appendix 1). There is no expectation that individual fellows need to meet or exceed those institutional procedural volumes for any single procedure, nor do those volumes represent metrics for an individual's competency for any given procedure. Where designated, procedures must be performed by or under the direction of designated fellowship faculty. Institutional procedural volumes are not intended to replace institutional quality assurance programs and surveillance or other processes that assess and ensure quality care.

Fellows must be able to competently perform all medical, diagnostic and surgical procedures considered essential for the practice of interventional pulmonology. The following procedures are considered essential to the current practice of IP and IP fellows must master all essential procedures. However, competence in some of these procedures may be acquired during a preceding pulmonary or pulmonary and critical care medicine fellowship.

2.b).(5).(i) Rigid bronchoscopy with the following associated procedures. Rigid intubation without a subsequent qualifying associated procedure is insufficient.

- I. Rigid core and mechanical debulking
- II. Placement and removal of endobronchial stents (silicone, hybrid, dynamic)
- III. Rigid sequential dilation
- IV. Foreign body removal
- V. Management of massive hemoptysis

2.b).(5).(ii) Endobronchial stenting, silicone or self-expanding)

2.b).(5).(iii) Thoracoscopy

2.b).(5).(iv) Bronchoscopic navigation by one or a combination of, but not limited to the following techniques

- I. Electromagnetic / virtual bronchoscopic navigation
- II. Radial endobronchial ultrasound
- III. CT-correlated computer-assisted

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2.b).(5).(v) Endobronchial ablative techniques (employed via rigid or flexible bronchoscope) using one or more of, although not limited to the following devices

- I. Laser
- II. Argon plasma coagulation
- III. Electrocautery
- IV. Cryotherapy
- V. Photodynamic therapy

2.b).(6) The following procedures are essential to the current practice of IP; however, competence in these procedures is often acquired during a preceding pulmonary or pulmonary and critical care medicine fellowship. As with all procedural aspects of IP outlined in this standard, it remains the responsibility of the program director to ensure and document competence in these procedures. In situations where the IP fellow is not yet competent to perform the following procedures, special care must be taken to ensure the training of the IP fellow does not interfere with the training of the Pulmonary/Pulmonary and Critical Care fellows at the program institution. In this situation, careful coordination between the IP fellowship and Pulmonary/Pulmonary and Critical Care fellowship directors is required to maintain quality training for both the IP and Pulmonary/Pulmonary and Critical Care Fellows.

2.b).(6).(i) Mediastinal and hilar lymph node sampling using convex endobronchial ultrasound

2.b).(6).(ii) Ultrasound-guided thoracostomy tube placement and management

2.b).(5).(iii) Tunneled indwelling pleural catheter placement

2.b).(7) In addition to the above required procedures, IP fellowships may choose to train fellows in the following procedures. If a program wishes to certify its IP fellows as competent in these procedures, they must obtain permission to convey that from the AABIP/AIPPD fellowship accreditation committee. This will be contingent on documentation of sufficient institutional volumes (see Appendix A) to support training in that procedure. As noted above, competence in some of these procedures may be acquired during a preceding pulmonary or pulmonary and critical care medicine fellowship.

2.b).(7).(i) Percutaneous dilational tracheostomy placement, management

2.b).(7).(ii) Percutaneous endoscopic gastrostomy tube placement

2.b).(7).(iii) Bronchial thermoplasty

2.b).(7).(iv) Endobronchial management of bronchopleural fistula or bronchoscopic lung volume reduction

2.b).(7).(v) Endoscopic Ultrasound (EUS)

2.b).(7).(vi) Transtracheal oxygen catheter placement and management

2.b).(7).(vii) Image-guided percutaneous needle biopsy

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2.b).(8) All fellows must longitudinally maintain and be prepared to present their individual HIPPA compliant procedure log which, at a minimum, must include comprehensive data pertaining to:

- I. Specific procedural volumes
- II. Diagnostic yield
- III. Patient outcomes, including complications
- IV. Supervising attending

2.c) Practice-based Learning and Improvement

Fellows are expected to develop skills and habits to be able to meet the following goals:

2.c).(1) systematically analyze practice using quality improvement methods, and implement changes with the goal of practice improvement; and,

2.c).(2) locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems.

2.d) Interpersonal and Communication Skills

Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals.

2.d).(1) Fellows must demonstrate competence in providing consultation and obtaining informed consent.

2.d).(2) Fellows must demonstrate competence in addressing end of life discussions.

2.e) Professionalism

Fellows must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles.

2.e).(1) Fellows must demonstrate high standards of ethical behavior, including maintaining appropriate professional boundaries and relationships with patients, other physicians, and other health care team members, and avoiding conflicts of interest.

2.f) Systems-based Practice

2.f).(1) Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care.

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2.f).(2) Fellows must be knowledgeable about the organization or a bronchoscopy/advanced procedural suite including business and personnel management, care and maintenance of equipment, quality control, and specimen handling.