

**BRIDGEPORT HOSPITAL
PULMONARY DISEASE FELLOWSHIP
CURRICULUM**

Updated: December, 2009

OVERVIEW

Bridgeport Hospital's Pulmonary Disease Fellowship Program is a two-year training program. The curriculum will enable internal medicine-trained physicians to master the intellectual and procedural skills of Pulmonary Medicine. Graduates of the program will have acquired the skills and experience required to sit for the American Board of Internal Medicine Examination in Pulmonary Medicine.

TRAINING SITES

Bridgeport Hospital is the primary training site at which fellows spend >85% of their training. Other training sites have included Yale New Haven Hospital (YNHH) and the Hospital for Special Care (HSC). Trainees also have performed electives in the private offices of Pulmonary and Internal Medicine Associates.

FACULTY

Full-time, hospital-based faculty:

David Kaufman, MD, Section Chief of Pulmonary Medicine. ABIM certified in Internal Medicine, Pulmonary Disease and Critical Care Medicine.

Constantine Manthous, MD, Chief of Medical Intensive Care Section, Program Director Internal Medicine Training Program, and Associate Clinical Professor at Yale. ABIM certified in Internal Medicine and Critical Care Medicine.

Armand Wolff, MD, Director Pulmonary Medicine Fellowship. Medical Director Sleep Center. ABIM certified in Internal Medicine, Pulmonary Medicine, and Critical Care Medicine. ABSM certified in Sleep Medicine.

Jeffrey Kwon, MD, Assistant Medical Director Sleep Center. ABIM certified in Internal Medicine, Pulmonary Medicine, and Critical Care Medicine.

Private practice faculty:

Arthur Turetsky, MD, Senior Attending. ABIM certified in Internal Medicine and Pulmonary Medicine, and ABSM certified in Sleep Medicine.

Daniel Rudolph, MD, Senior Attending ABIM certified Internal Medicine, Pulmonary Disease, and Critical Care Medicine.

Adil Salam, MD, Junior Attending. ABIM certified Internal Medicine and Pulmonary Disease., and ABSM certified in Sleep Medicine.

John Ayala, MD, Junior Attending. ABIM certified in Internal Medicine, Pulmonary Medicine, and Critical Care Medicine.

Part-time faculty

Arthur Kotch, MD, Senior Attending, ABIM certified in Internal Medicine and Pulmonary Medicine, and ABSM certified in Sleep Medicine.

EDUCATIONAL OBJECTIVES – FORMAL CURRICULUM

At the beginning of training, fellows receive a hardcopy of the entire 2-year curriculum. Prior to each rotation, fellows are given a copy of the specific educational objectives of each rotation (including a summary of their responsibilities and schedule). After reviewing the objectives, they attest to having done so by signing the objectives. These are kept in the personal file of each trainee. The overall curriculum and objectives of each rotation are reviewed periodically in Section meetings.

Certain educational experiences (i.e. outpatient pulmonary medicine, allergy-immunology) are achieved through longitudinal sessions conducted throughout the fellowship. Likewise instruction in Sleep Medicine is provided longitudinally, with the fellows assisting in Sleep Laboratory activities throughout the fellowship. Other educational objectives (e.g. RRC essentials) are covered systematically by emphasis during discussions, review, and formal reading assignments associated with each rotation. Consultations on patients with disease processes emphasized during a particular block will be used as points of departure to emphasize teaching points in the formal reviews and readings. Additionally, trainees are exposed to other pulmonary diseases in the course of patient care/consultations.

The included curriculum is an outline of subjects covered formally and serves as a guide for self-study and structured discussions of pathophysiology topics during rounds. The curriculum includes all aspects required for pulmonary training as outlined in the Residency Review Committee's Essentials.

Structure/Schedule of Training (in 4 week-blocks)

| | | |
|-----|--------------------------------------|------------|
| F1: | Pulmonary Consultation Service (PCS) | 7 months |
| | Critical Care (CCM) | 3.5 months |
| | Ambulatory/Research/Elective | 1.5 months |
| F2: | Pulmonary Consultation Service | 5.5 months |
| | Critical Care | 2.5 months |
| | Pulmonary Rehabilitation/HSC | 1 month |
| | Ambulatory/Research/Elective | 3 months |

LINES OF RESPONSIBILITY AND SUPERVISION

Pulmonary Consultation Service

The fellow will respond within 24 hours to provide consultations requested of the Pulmonary Consultation Service. The fellow will perform a history and physical examination, formulate a differential diagnosis and develop a plan for further evaluation and management.

This evaluation will be discussed with the supervising pulmonary specialist. Formal recommendations will be communicated via a consultation note and, if appropriate, by direct discussion with the referring physicians. The patient will also be informed of the attending pulmonologist's clinical impression and recommendations. The fellow is expected to establish the urgency and priority the patients' problems and respond accordingly. The role of the attending is to verify the historical facts and physical findings related by the fellow, review laboratory tests and imaging studies, critique the presentation, and further discuss the findings and recommendations. The attending will personally evaluate all new consultation patients in a timely fashion.

When an Internal Medicine resident or medical student is on the consult service they will be supervised by the fellow and/or the attending. They will have the opportunity to evaluate the patients and write preliminary consultation notes. They will see their patients in follow up as needed, and discuss their findings with the fellow and attending.

Should the patient require diagnostic or therapeutic procedures it is the fellow's responsibility to optimize the patient's condition in preparation for that procedure, inform the patient of the rationale for the procedure as well as the associated risks and benefits, and obtain appropriate written informed consent. The fellow will order appropriate premedication and discuss conscious sedation with the attending physician. The fellow will follow up on the results and ascertain the patient's clinical stability post procedure. All procedures are to be supervised by an attending except in cases of emergency.

During their rotation on the Pulmonary Consultation Service, the trainee will interpret all pulmonary function studies and discuss them with the attending. The Pulmonary Consult and PIMA fellows are expected to attend all scheduled conferences. They will also attend the longitudinal outpatient clinics as assigned. The ICU fellow is excused from the didactic sessions (but should attend if at all possible) and from the weekly clinic.

Critical Care Medicine

Fellows in the MICU work closely with the assigned pulmonologist/intensivist in the MICU alongside the patients' primary care physicians to provide comprehensive care. The fellow is directly responsible to the critical care attending. They will also for oversee residents and students in evaluation, resuscitation, and management of the patients.

Policy on non-teaching service patients

The fellow has no responsibility to take part in the care of non-teaching service patients. As there are no non-teaching patients on the Team Care Consult Service or in the Medical Intensive Care Unit, this will not be encountered. On the Private (PIMA) Consult Service, there may at times be patients without pulmonary disease issues, and the fellows shall not be expected to be involved in their care. This is a requirement of the ACGME and is the official policy of the Section of Pulmonary, Critical Care, and Sleep Medicine. Fellows are expected to assist with and actively participate in the care of patients in severe distress and with life-threatening emergencies anywhere in the hospital if such assistance is requested by anyone at anytime.

In-patient Pulmonary Consultation Service (PCS)

| | Monday | Tuesday | Wednesday | Thursday | Friday |
|---------------------------|---|--|--|--|--|
| 7 - 8 | | SLEEP TOPICS: PSG INTERPS, LECTURES, BOARD REVIEW QUESTIONS (OPTIONAL) | | PULMONARY BOARD REVIEW SERIES (OPTIONAL) | |
| 8 - 12 | 8 - 11 PULMONARY ROUNDS 11 - 12 MEDICAL MORNING REPORT | 8-11 PULMONARY ROUNDS 11 -12 MEDICAL MORNING REPORT | 8 - 12 PULMONARY ROUNDS | 8 - 11 PULMONARY ROUNDS 11 -12 MEDICAL MORNING REPORT | 8:30 - NOON PULMONARY CONTINUITY CLINC |
| Noon Lecture Series | DEPT INT MED RESEARCH CONFERENCE 1 ST MONDAY RESEARCH UPDATE AND JOURNAL CLUB OTHER MONDAYS | PULMONARY PATHO- PHYSIOLOGY CONFERENCE | 1 ST WEEK PULMONARY PATHOLOGY- RADIOLOGY SERIES 2 nd WEEK PATHOLOGY REVIEW WITH PATHOLOGIST OTHER WEEKS CASE PRESENTATION LECTURE SERIES | MEDICINE GRAND ROUNDS | |
| 1-5 | DICTATED BY FELLOWS' ASSIGNMENT DEVOTED TO RESEARCH ACTIVITY UNLESS OTHER DUTIES SUPERCEDE | DICTATED BY FELLOWS' ASSIGNMENT DEVOTED TO RESEARCH ACTIVITY UNLESS OTHER DUTIES SUPERCEDE | 2:30 - 5:00 YALE STATE CHEST CONFERENCE | DICTATED BY FELLOWS' ASSIGNMENT DEVOTED TO RESEARCH ACTIVITY UNLESS OTHER DUTIES SUPERCEDE | 1:00 - 2:00 CLINIC WRAP UP DISCUSSION OF INTERESTING OR CHALLENGING CASES FROM THE CLINIC FOLLOWED BY INFORMAL MEETING WITH PROGRAM DIRECTOR AS REQUIRED |

The lecture series and the State Chest Conference at Yale become the Pulmonology Core Lecture Series July-September.

OVERVIEW OF THE PULMONARY MEDICINE CURRICULUM

No curriculum can illuminate ALL of the content that a Pulmonary fellow must learn in order to become a proficient and compassionate clinician. The Pulmonary Consultation Service rotations are the center of the clinical fellowship; through them the fellows are exposed to most diseases in Pulmonary Medicine over the course of their 2 years of training during:

- a. PCS consultations (in which diseases/pathophysiology are discussed case-by-case and recorded in the Fellow's case log-book),
- b. Discussions of pulmonary cases in Morning Report and Pulmonary conferences,
- c. Didactics,
- d. Formal, systematic review of the PCS and cardiopulmonary critical care curricula.

Rare diseases/syndromes may not be encountered during clinical rotations. These will be discussed through literature reviews and didactic lecture series. They may also be encountered through outpatient exposure.

Pulmonary physiology topics will be discussed during conferences and informal discussions. A more practical exposure will be derived through interaction with the pulmonary function testing (PFT) laboratory and with the respiratory therapy staff.

Exposure to Sleep Medicine topics will occur during didactic sessions as well as consultative services in both the inpatient and outpatient settings. Practical knowledge will be obtained through interaction with the Sleep Center staff. The fellow will also participate in Sleep Center outpatient activities while on the ambulatory block.

The systematic review of Pulmonary Medicine topics is taken directly from the RRC list of essentials. Although the clinical cases encountered over the course of the fellows' PCS rotations will vary, each rotation will "focus" on broad areas of the curriculum.

Fellows will be required to review and present state-of-the-art articles on topics from the curriculum. This will occur during the course of daily rounds as well as Journal Club and other conferences. These articles are listed as "essential readings" in the curriculum. They are NOT meant to be the only self-study the fellow does. Rather, they will serve as points of departure for additional reading in the various areas of Pulmonary Medicine.

Fellows will be exposed to a variety of clinical problems as they see new consultations. In addition to the systematic "areas of emphasis" for each rotation, fellows are expected to read on the problems/diseases of patients as they perform consultations (and document the exposures in their case log-books).

PULMONARY MEDICINE CURRICULUM: OTHER GENERAL CONSIDERATIONS

Chest Radiology

Radiology studies will be interpreted as part of the daily care of patients. An excellent on-line resource is <http://mypacs.net>. Also helpful, radiologyeducation.com offers an array of multiple sites with free resources to complement self-study. Fraser and Pare's, *Disease of the Chest* is also a valuable resource of differential chest radiography. Other specific Radiology textbooks are available as a source in the Pulmonary Fellow Library.

Furthermore, Radiology topics will be reviewed during the course of formal didactics as well as during rounds. A monthly combined Pathology/Radiology/Pulmonary conference also will provide a venue for review of chest radiography. Also, it may be possible for fellows to spend time individually in the radiology department.

Pulmonary Pathology

Each month there is a combined Pathology/Radiology/Pulmonary case conference as a focused pulmonary pathology slide review with a staff Pathologist. On a more informal basis review of pulmonary pathology specimens will be undertaken with a staff pathologist as practicable.

Procedures (in general, all procedures should be supervised by an attending)

1. Fiberoptic bronchoscopy (FOB) - Minimum of 4 hours performing FOB with the artificial lung, using the atlas of anatomy. Observe 2-3 FOB and then perform 20 under direct attending supervision, documenting experience in a procedure logbook. This includes procedures such as bronchoalveolar lavage, endo- and trans-bronchial biopsy, and transtracheal needle aspiration of lymph nodes. Performance of a minimum of 20 FOB (and sub-procedures) and certification of proficiency by Program Director are required to perform independently.
2. Thoracentesis – For those entering the program already ABIM certified in thoracentesis, performance of 3 procedures observed by Pulmonary Section faculty is required to obtain certification of proficiency by the Program Director. For those fellows who are not already ABIM certified, a minimum of 5 directly observed thoracenteses will be required.
3. Central venous lines and pulmonary artery catheters – For those entering the program already certified, a minimum of 3 procedures directly supervised by the Pulmonary Section faculty will be required before they can be performed independently. Pulmonary artery catheterization will always require supervision by the faculty.
4. Chest tube thoracostomy, endotracheal intubation, pulmonary artery catheterization and pleural biopsy will only be performed under direct supervision of an attending physician.

As the fellow progresses through training, more independence will be afforded them. However, **ALL PROCEDURES MUST BE DISCUSSED WITH THE ATTENDING STAFF PRIOR TO PERFORMANCE, EVEN IF THE FELLOW IS CERTIFIED TO PERFORM THEM INDEPENDENTLY.** The fellows will be responsible for instructing the residents in performing procedures as directed by the attending staff.

OVERVIEW OF THE PULMONARY MEDICINE CURRICULUM

Although the Curriculum is broken down into rotations with specific topics of study and areas of emphasis, there are commonalities found during each rotation/activity pertaining to the six ACGME core competencies:

Medical Knowledge - Expand on the medical knowledge obtained during residency to include more specifics relating to Pulmonary Medicine. This will include topics within Critical Care Medicine as they relate to the pulmonary and cardiovascular systems. Fellows will be expected to read independently the literature pertaining to the disease states encountered while providing consultative services as well as the general Pulmonary Medicine textbooks and literature. Knowledge will be demonstrated during rounds, formal didactic sessions, as well as informal discussions. With progress through the program, fellows will be expected to develop a deeper understanding of pulmonary pathophysiology and to show “higher level” processing of information. Also, the fellows will be responsible for teaching their co-fellows as well as residents and students in both formal and informal environments. Many of the didactic conferences are fellow driven with input from the attending staff.

Patient care – Arrive at 6-7 AM (as required by patient load), pre-round on established patients and begin evaluation of new consultations. Coordinate residents and students on the service to assist. Using pre-rounds as an opportunity to teach residents (both on and off the service) about patients’ problems. Perform initial assessments and develop plans as appropriate with residents and students prior to discussing with attending staff. In general, attending rounds will be held between 9-11 AM, as dictated by the needs of the service. Attending rounds will provide an opportunity for education as well as refining the assessments and care-plans established during pre-rounds. As the fellow progresses through training, higher levels of processing and increasing responsibility for patient care and teaching will be expected.

Interpersonal communication skills – Continue to develop skills required for therapeutic relationships with patients and their families. During the early phase of training, fellows should be observed by the attending staff (i.e. CEX) at least 2-3 times while performing the history and physical exam. This provides an opportunity to refine bedside skills with direct feedback. The fellow will initially observe the attending conduct discussions with family members; as they progress in their training, the fellow will take more of an active role in leading these discussions (initially under the supervision of the attending staff and ultimately without supervision).

Professionalism – The fellow will act as a “junior attending” by coordinating the team’s activities. They will provide timely updates, as appropriate and required, to the attending staff. Begin asserting surrogate leadership in “all areas Pulmonary” in the absence of the attending, especially with the residents and students. The level of leadership expected will increase as the fellow progresses through training. The fellow will, at all times, be expected to present themselves professionally as a member of the section of Pulmonary, Critical Care, and Sleep Medicine. This will include interactions with patients, their family members, and their primary physicians, as well as the hospital’s physician and non-physician staff members.

Practice-based learning and improvement – The fellow will be expected to show a dedication to self-improvement as well as continuing medical education. Throughout their training, fellows will be provided with both formal and informal feedback and constructive criticism; they will be expected to incorporate this into their daily practice. The fellows will attend all conferences offered by the section, will attend the Joint Resident conferences on Scientific Methods, Medical Statistics and Critical Appraisal of the Medical Literature, and will be encouraged to attend Medical Morning Report, Grand Rounds, and other departmental conferences as allowed by clinical schedules. The fellow will assist the attending physician in teaching residents as per the residents' curriculum, and will provide the team with appropriate state-of-the-art articles on patient management germane to cases.

Systems-based learning – The fellow will attend meetings (one each) of the Quality Council and Risk Mortality Committee over the first 6 months of their training. They will attend multidisciplinary rounds regarding their patients as appropriate. They will meet with discharge planners and representatives of Respiratory Therapy Services to evaluate and understand resources available for patients with lung disease. The fellow will spend time with personnel from the Pulmonary Function Laboratory, Respiratory Therapy Department, Pulmonary Rehabilitation, and the Sleep Center to learn the particulars of these aspects of Pulmonary Medicine. The fellow will be expected to participate in some form of quality improvement project either within the Section or the Hospital.

Fellows will be expected to take on greater responsibility for patient care and management as well as educational pursuits during the course of their training. Their level of performance of and progress within each of these areas of core competency will be regularly evaluated by the attending staff, residents and students, the nursing staff, and other staff as appropriate.

| Expectations for Progression of ACGME Competencies for Pulmonary Fellows | | | |
|--|---|--|--|
| Competency | 0 – 6 months | 6 – 18 months | 18 – 24 months |
| Medical Knowledge | That of a skilled internist | Progressively more in-depth regarding pulmonary medicine | That of a specialist in pulmonary medicine |
| Patient Care | That of a skilled internist with little supervision | Progressively more independent | That of an independent consultant |
| IPCS | That of a skilled internist | Progressively more specialized | That of an independent consultant |
| Professionalism | That of a skilled internist | Commensurate with level of experience | That of an independent consultant |
| PBL and I | That of a skilled internist | Progressively more involved in pulmonary topics | Dedication to life long learning as a consultant |
| SBL | That of a skilled internist | That of a developing specialist | That of an independent consultant |

ACGME Competencies Further Defined:

Patient Care

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

Medical Knowledge

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents are expected to:

Practice-based Learning and Improvement

Residents must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. Residents are expected to develop skills and habits to be able to meet the following goals:

1. Identify strengths, deficiencies, and limits in one's knowledge and expertise;
2. set learning and improvement goals;
3. Identify and perform appropriate learning activities;
4. Systematically analyze practice using quality improvement methods, and implement changes with the goal of practice improvement;
5. Incorporate formative evaluation feedback into daily practice;
6. Locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems;
7. Use information technology to optimize learning; and,
8. Participate in the education of patients, families, students, residents and other health professionals.

Interpersonal and Communication Skills

Residents must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. Residents are expected to:

1. Communicate effectively with patients, families, and the public, as appropriate, across a broad range of socioeconomic and cultural backgrounds;
2. Communicate effectively with physicians, other health professionals, and health related agencies;
3. Work effectively as a member or leader of a health care team or other professional group;
4. Act in a consultative role to other physicians and health professionals; and,
5. Maintain comprehensive, timely, and legible medical records, if applicable.

Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. Residents are expected to demonstrate:

1. Compassion, integrity, and respect for others;
2. Responsiveness to patient needs that supersedes self-interest;
3. Respect for patient privacy and autonomy;
4. Accountability to patients, society and the profession; and,
5. Sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation.

Systems-based Practice

Residents 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. Residents are expected to:

1. Work effectively in various health care delivery settings and systems relevant to their clinical specialty;
2. Coordinate patient care within the health care system relevant to their clinical specialty;
3. Incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population-based care as appropriate;
4. Advocate for quality patient care and optimal patient care systems;
5. Work in multidisciplinary teams to enhance patient safety and improve patient care quality; and
6. Participate in identifying system errors and implementing potential systems solutions.

The above are as approved by the ACGME 2/13/2007 and are copied from their web site (acgme.org). They are subject to change from time to time as revised and amended by the ACGME.

I have been given a printed copy of the entire fellowship curriculum, understand its goals, and will work to achieve its objectives:

Fellow's Signature

Date

FELLOWSHIP YEAR 1

ROTATION PCS 1 & PCS 2: GENERAL CHEST RADIOGRAPHY, PULMONARY FUNCTION PHYSIOLOGY/CARDIOPULMONARY EXERCISE TESTING, OBSTRUCTIVE LUNG DISEASE, AND INTRODUCTION TO SLEEP MEDICINE

Although included as part of PCS 1 and PCS 2, the learning of these topics will be longitudinal throughout the fellowship and the fellows' abilities and knowledge will be expected to progress over the course of their training.

Chest Radiography:

Normal Anatomy

1. Name and define the three zones of the airways (West 1-3, ? 4);
2. Define a secondary pulmonary lobule;
3. Define an acinus;
4. List the lobar and segmental bronchi of both lungs;
5. Identify the following structures on the posteroanterior (PA) chest radiograph:
 - a. Lungs – the lobes of each lung;
 - b. Fissures – minor, superior accessory, inferior accessory, azygous;
 - c. Airway – trachea, carina, main bronchi;
 - d. Heart – right atrium, left atrial appendage, left ventricle, right ventricle, location of valves;
 - e. Pulmonary arteries – main, right, left, interlobar;
 - f. Aorta – ascending, arch, descending;
 - g. Veins – superior vena cava, azygous, left superior intercostal (“aortic nipple”);
 - h. Bones – spine, ribs, clavicles, scapulae, humerus;
 - i. Right paratracheal stripe;
 - j. Junction lines – anterior, posterior;
 - k. Aortopulmonary window;
 - l. Azygoesophageal recess;
 - m. Paraspinal lines;
 - n. Left subclavian artery;
6. Identify the following structures on the lateral chest radiograph:
 - a. Lungs – right, left, right upper, middle and lower lobes, left upper and lower lobes, lingula;
 - b. Fissures – major, minor, superior accessory;
 - c. Airway – trachea, upper lobe bronchi, posterior wall of bronchus intermedius;
 - d. Heart – right ventricle, right ventricular outflow tract, left atrium, left ventricle, the location of the four cardiac valves;
 - e. Pulmonary arteries – right, left;
 - f. Aorta – ascending, arch, descending;
 - g. Veins – SVC, IVC, left brachiocephalic (innominate), pulmonary vein confluences;
 - h. Bones – spine, ribs, scapulae, humerus;
 - i. Retrosternal space;
 - j. Posterior tracheal stripe;
 - k. Right and left hemidiaphragms;
 - l. Brachiocephalic (innominate artery).

Additional Anatomical Structures:

- Pleura and extrapleural fat;
- Pericardium – including pericardial recesses;
- Arteries - brachiocephalic (innominate), common carotid, subclavian, axillary, vertebral, internal mammary;
- Veins – pulmonary, superior vena cava, inferior vena cava, brachiocephalic, subclavian, internal jugular, external jugular, azygous, hemiazygous, left superior intercostal (aortic nipple), internal mammary;
- Esophagus;
- Thymus;
- Thyroid;
- Muscles – sternocleidomastoid, anterior and middle scalene, strap, pectoralis (major and minor), deltoid, trapezius, infraspinatus, supraspinatus, subscapularis, latissimus dorsi, serratus anterior;
- Azygoesophageal recess;
- Gastrohepatic ligament.

Skills:

- Demonstrate ability to recognize normal chest anatomy;
- Demonstrate ability to diagnose common conditions (e.g. collapsed lobes) and life threatening conditions (e.g. pneumothorax) on chest radiographs;
- Demonstrate appropriate use of chest radiography as part of a diagnostic and/or treatment plan;
- Demonstrate the proper use of radiological equipment such as fluoroscopy equipment and special radiographic views (e.g. decubitus views and lordotic views and films in expiration);
- Demonstrate understanding of normal and abnormal cardiac and great vessel anatomy;
- Demonstrate understanding of the physiologic basis for common diseases (e.g. congestive heart failure, pulmonary hypertension, pericardial effusions with tamponade, and coarctation of the aorta), as well as the CXR and CT findings in common diseases of the heart and great vessels;
- Demonstrate knowledge of the use, placement, appropriate position, and complications of the following:
 - Endotracheal tube;
 - Central venous catheter (subclavian, internal jugular, peripheral, PAC);
 - Feeding tube;
 - Nasogastric tube;
 - Chest tubes (including pericardial drains);
 - Intra-aortic balloon pump (including how it works);
 - Pacemaker and pacemaker leads;
 - Automatic implantable cardiac defibrillator;
 - Left ventricular assist device;
 - Intraesophageal manometer, temperature probe or pH probe;
 - Tracheal, bronchial, and endovascular stent.

Skills:

Be able to define, identify, and state the significance of the following:

- Air bronchogram – indicates a parenchymal process, including non-obstructive atelectasis, as distinguished from pleural or mediastinal processes;
- Air crescent sign – indicates a lung cavity often due to fungal infection;
- Deep sulcus sign on a supine radiograph – indicates pneumothorax;
- Continuous diaphragm sign – indicates pneumomediastinum;
- Ring around the artery sign (around pulmonary artery on lateral chest radiograph) – indicates pneumomediastinum;
- Fallen lung sign – indicates a fractured bronchus;
- Flat waist sign – indicates left lower lobe collapse;
- Gloved finger sign – indicates bronchial impaction;
- Golden S sign – indicates lobar collapse with a central mass, suggesting an obstructing bronchogenic carcinoma in an adult;
- Luftsichel sign – indicates upper lobe collapse, potentially due to an obstructing bronchogenic carcinoma in an adult;
- Hampton's hump – indicates a pulmonary infarct;
- Silhouette sign – loss of the contour of the heart or diaphragm used to localize a parenchymal process (e.g. a process involving the medial segment of the right middle lobe obscures the right heart border; a lingular process obscures the left heart border; a basilar segmental lower lobe process obscures the diaphragm);
- Cervicothoracic sign – a mediastinal opacity that projects above the clavicles is retrotracheal and posteriorly situated, while an opacity effaced along its superior aspect and projecting at or below the clavicles is situated anteriorly;
- Tapered margins sign – a lesion in the chest wall, mediastinum or pleura will have smooth tapered borders and obtuse angles with the chest wall or mediastinum while parenchymal lesions usually form acute angles;
- Figure 3 sign – abnormal contour of the descending aorta, indicating coarctation of the aorta;
- Fat pad sign or sandwich sign – indicates pericardial effusion on lateral chest radiograph;
- Hilum overlay sign and hilum convergence sign – used to distinguish a hilar mass from a non-hilar mass.

Chest CT Scans:

Be able to identify the following on a CT scan of the chest:

- Lungs – all lobes and segments; secondary pulmonary lobules;
- Fissures – major, minor, azygous, accessory;
- Airway – lobar and segmental bronchi;
- Inferior pulmonary ligament;
- Cardiac structures (chambers, valves, coronary arteries);
- Pulmonary arteries (main, right, left, lobar, segmental);
- Bony structures (spine and spinous processes, ribs, scapulae, humeri);
- Diaphragms;
- Upper abdominal structures including liver, spleen, stomach, and adrenals.

Other imaging modalities important for the pulmonologist:

1. Know the uses of ultrasound for evaluating pleural effusions and pneumothorax;
2. Know the utility of PET scan evaluation for various lung processes including malignancy.
3. Know the utility of MRI imaging of the chest.

Pulmonary Function Testing:

1. Spend 2 hours with Respiratory Therapy Staff (Joe Horne *et al.*) to learn the actual mechanics and physical principles of pulmonary function testing;
2. Understand the physical principles of spirometry and of body-box vs. gas dilution volume determinations;
3. Understand the physical principles of measuring the diffusing capacity of carbon monoxide (DLCO) and reasons for corrections;
4. Understand the indications for obtaining pulmonary function tests;
5. Master the seminal features of obstructive lung disease on spirometric and lung volume measurements.

Cardiopulmonary exercise testing:

1. Understand how cardiopulmonary exercise testing can help evaluate individuals with dyspnea and or with performance limitations;
2. Know the indications for cardiopulmonary exercise testing;
3. Review important aspects of exercise physiology, methodology, and protocols used in exercise testing;
4. Review the conceptual basis and practical applications of selected measurements used in the interpretation of cardiopulmonary exercise testing results;
5. Recognize usual patterns of exercise response in patients with COPD, interstitial lung disease, vascular disease, heart failure, obesity, and deconditioning.

Obstructive Lung Diseases (OLD)

General knowledge:

1. Understand the respiratory mechanics of OLD (airflow resistance and dynamic hyperinflation);
2. Be familiar with the PFT's of OLD and the physiologic basis of abnormalities seen;
3. Know the pathophysiology of asthma, COPD, bronchiolitis, and bronchiectasis;
4. Management of OLD (medical, surgical, and other);
5. Special cases OLD: cystic fibrosis, alpha-1 antitrypsin disease, allergic bronchopulmonary aspergillosis, Churg Strauss, cardiogenic asthma.

Basic science:

1. Know including the role of inflammatory cells mediators in the cause and sequelae of each disease state;
2. Understand the genetics of asthma and COPD (especially alpha-one antitrypsin);
3. Understand the mechanism of medications used to treat OLD including the effects of the medications at the molecular/receptor level as well as the physiologic effects of surgical interventions;
4. Understand the genetics and role of the cystic fibrosis transmembrane regulator;
5. Understand the role of inflammatory mediators on the pathophysiology of bronchiectasis.

Radiographic Findings of OLD:

1. Recognize patterns of complete and partial (including combinations) collapse of the right or left lung on a chest radiograph, and list an appropriate differential diagnosis for the etiology of the collapse;
2. Distinguish lung collapse from massive pleural effusion on a frontal chest radiograph;
3. Name the four types of bronchiectasis, and identify each type on a chest CT;
4. Name common causes of bronchiectasis;
5. Recognize the typical appearance of cystic fibrosis on a radiograph and chest CT;
6. Name the important things to look for on a chest radiograph when the patient history is "asthma";
7. Define and recognize tracheomegaly;
8. Recognize tracheal and bronchial stenosis on chest CT, and name the most common causes;
9. Name the three types of pulmonary emphysema, and identify each type on a chest CT;
10. Recognize alpha-1-antitrypsin deficiency on a chest radiograph and chest CT;
11. Recognize Kartagener's syndrome on a chest radiograph, and name the three components of the syndrome;
12. Define the term giant bulla, differentiate giant bulla from pulmonary emphysema and state the role of imaging in patient selection for bullectomy;
13. State the imaging findings used to identify surgical candidates for giant bullectomy and for lung volume reduction surgery.

Sleep Medicine:

1. Learn how to do a sleep clinic patient intake (focused history and physical examination) and how to order studies appropriately;
2. Review parameters measured in polysomnography;
3. Identify different stages of sleep (physiology/EEG) using the most up-to-date scoring criteria;
4. Understand clinical prediction rules for OSA;
5. Recognize patients at risk for OSA and CSA;
 - a. Be aware of familial aggregations of both.
 - b. Know the genetic basis of congenital central hypoventilation syndrome (PHOX2B gene).
6. Be able to explain OSA at a physiologic level (i.e. the concept of the Starling resistor and Pcrit).
7. Be able to enumerate the sequelae of OSA;
 - a. Sleepiness and its consequences.
 - b. Increased risk for cardiovascular morbidity and mortality.
 - c. Metabolic consequences.
 - d. Endocrine dysfunction that may predispose to or eventuate from OSA.
8. Recognize symptoms of restless leg syndrome and periodic limb movements of sleep and be aware of the differences between the two and the association with other medical conditions;
 - a. Be aware of the genetics of RLS/PLMS.
 - b. Understand the role of the iron – dopamine system in these disorders.
 - c. Recognize the similar pathogenesis of these disorders and Parkinson's disease.

9. Know the treatment of RLS/PLMS (medical and adjunctive); including the effects of the medications at the molecular/receptor level as well as the physiologic effects of surgical interventions;
10. Know the manifestations of narcolepsy and understand their pathophysiology;
 - a. Be aware of the genetics of narcolepsy.
 - b. Understand the role of the hypocretin/orexin system in this disorder.
 - c. Be aware of the literature regarding animal models of narcolepsy.
11. Know the appropriate diagnostic strategy for and management of narcolepsy;
12. Develop understanding of the neural control of sleep (including brain areas and neurotransmitters involved in each stage) and the pathophysiologic abnormalities involved in various sleep disorders (especially the hypocretin/orexin system involved in narcolepsy and the neurologic/neuromuscular involvement in RLS/PLMS).

Required Reading:

Fellows are required to read, at a minimum, the seminal articles listed below and present at least one of them to the team each week. Additional systematic “area of emphasis reading” can be found in the textbooks listed below and seminal articles can be found for these areas at: <http://www.thoracic.org/fellows/syllabusintro.asp>. Most textbooks are in the fellows’ conference room on the 6th floor.

Articles:

1. Webb, W.R., *Radiology of obstructive pulmonary disease*. AJR Am J Roentgenol, 1997;169(3):637-47.
2. Austin, J.H., et al., *Glossary of terms for CT of the lungs: recommendations of the Nomenclature Committee of the Fleischner Society*. Radiology, 1996;200(2):327-31.
3. Beckh, S., Bolcskei, P.L., and Lessnau, K.E., *Real-time chest ultrasonography: a comprehensive review for the pulmonologist*. Chest 2002;122(5):1759-73.
4. Diacon, A.H., Theron, J., and Bolliger, C.T., *Transthoracic ultrasound for the pulmonologist*. Curr Opin Pulm Med, 2005;11(4):307-12.
5. Nelson HS. B-Adrenergic bronchodilators. NEJM 1995; 333: 499-506.
6. Drazen, J.M., E. Israel, and P.M. O’Byrne, *Treatment of asthma with drugs modifying the leukotriene pathway*. N Engl J Med, 1999. 340(3):197-206.
7. Salpeter, S.R., et al., *Meta-analysis: effect of long-acting beta-agonists on severe asthma exacerbations and asthma-related deaths*. Ann Intern Med, 2006. 144(12): 904-12.
8. Boushey, H.A. et al., *Daily versus as-needed corticosteroids for mild persistent asthma*. N Engl J Med 2005. 352(15): 1519-28.
9. Suissa, S., et al., *Low-dose inhaled corticosteroids and the prevention of death from asthma*. N Engl J Med, 2000. 343(5): 332-6.
10. Nelson, H.S. et al., *The Salmeterol Multicenter Asthma Research Trial: a comparison of usual pharmacotherapy for asthma or usual pharmacotherapy plus salmeterol*. Chest, 2006; 129(1): 15-26.
11. Rodrigo, G.J., Rodrigo, C., and Hall, J.B., *Acute asthma in adults: a review*. Chest, 2004; 125(3): 1081-102.
12. NIH Guidelines for Asthma:
<http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.htm>
13. Bilton, D., *Update on non-cystic fibrosis bronchiectasis*. Curr Opin Pulm Med, 2008. 14(6): 595-9.

14. O'Donnell, A.E., *Bronchiectasis*. Chest, 2008 134(4): 815-23
15. Celli BR. *Update on the Management of COPD*. Chest, 2008. 133 (6): 1451-62.
16. Pauwels RA, Buist AS, Calverley PMA et al. *Global strategy for the diagnosis, management, and prevention of COPD: GOLD workshop summary*. AJRCCM 2001.163(5):1256-76.
17. *Continuous or nocturnal oxygen therapy in hypoxemic COPD*. The NOTT group. Ann Intern Med 1980;93(3):391-8.
18. Niewoehner DE, Erbland ML, Deupree RH, et al. *Effect of systemic glucocorticoids on exacerbations of COPD*. NEJM 1999;340(25):1941-7.
19. Brochard L, Mancebo J, Wysocki M, et al. *Noninvasive ventilation for acute exacerbations of COPD*. NEJM 1995;333:817-22.
20. Barnes, P.J., *Against the Dutch hypothesis: asthma and chronic obstructive pulmonary disease are distinct diseases*. Am J Respir Crit Care Med, 2006. 174(3): 240-3; discussion 243-4.
21. Barr, R.G., et al., *Tiotropium for stable chronic obstructive pulmonary disease: A meta-analysis*. Thorax, 2006; 61(10): 854-62.
22. Calverley, P.M., et al., *Salmeterol and fluticasone propionate and survival in chronic obstructive pulmonary disease*. N Engl J Med, 2007; 356(8): 775-89.
23. Fishman, A., et al., *A randomized trial comparing lung-volume-reduction surgery with medical therapy for severe emphysema*. N Engl J Med, 2003; 348(21): 2059-73.
24. Ingenito, E.P., Wood, D.E., and Utz, J.P., *Bronchoscopic lung volume reduction in severe emphysema*. Proc Am Thorac Soc, 2008;5(4):454-60.
25. Aurora, P., Carby, M., and Sweet, S., *Selection of cystic fibrosis patients for lung transplantation*. Curr Opin Pulm Med, 2008; 14(6): 589-94.
26. Rowe, S.M., Miller, S., and Sorscher, E.J., *Cystic fibrosis*. N Engl J Med, 2005; 352(19): 1992-2001.
27. Yankaskas, J.R., et al., *Cystic fibrosis adult care: consensus conference report*. Chest, 2004; 125(1 Suppl): 1S-39S.
28. Irwin R, S., et al., *Diagnosis and management of cough executive summary: ACCP evidence-based clinical practice guidelines*. Chest, 2006; 129(1 Suppl):1S-23S.
29. Pratter, M.R., *Overview of common causes of chronic cough: ACCP evidence-based clinical practice guidelines*. Chest, 2006; 129(1 Suppl): 59S-62S.
30. Miller, M.R., et al., *General considerations for lung function testing*. Eur Respir J, 2005;26(1):153-61.
31. Miller, M.R., et al., *Standardisation of spirometry*. Eur Respir J, 2005;26(2):319-38.
32. Wagner, J., et al., *Standardisation of the measurement of lung volumes*. Eur Respir J, 2005;26(3):511-22.
33. Macintyre, N., et al., *Standardisation of the single-breath determination of carbon monoxide uptake in the lung*. Eur Respir J, 2005(4):720-35.
34. Calverley, P.M. and Koulouris, N.G., *Flow limitation and dynamic hyperinflation: key concepts in modern respiratory physiology*. Eur Respir J, 2005;25(1):186-99.
35. Pellegrino, R., et al., *Interpretative strategies for lung function tests*. Eur Respir J, 2005;26(5):948-68.
36. Thorevska, N.Y. and Manthous, C.A., *Determinants of dynamic hyperinflation in a bench model*. Respir Care, 2004;49(11):1326-34.
37. *ATS/ACCP Statement of cardiopulmonary exercise testing*. Am J Respir Crit Care Med, 2003;167(2):211-77.

Textbook Readings:

1. Squire, *Fundamentals of Radiology*.
2. Collins and Stern, *Chest Radiology: The Essentials*.
3. Murray and Nadel, *Textbook of Respiratory Medicine*, applicable chapters.
4. Fraser and Pare, *Diagnosis of Diseases of the Chest*, applicable chapters.
5. Prakash, U., *Bronchoscopy*, Chapters 1 thru 8, 27.
6. Zavala D.C., *Flexible Fiberoptic Bronchoscopy*.
7. Ruppel, G., *Manual of Pulmonary Function Testing*. Chapters 1 and 2.
8. Levitzky, M., *Pulmonary Physiology*.
9. Kryger, Roth, and Dement, *Principles and Practices of Sleep Medicine*, applicable chapters.
10. American Academy of Sleep Medicine, *The International Classification of Sleep Disorders, 2nd Edition*.
11. American Academy of Sleep Medicine, *AASM Manual for the Scoring of Sleep and Associated Events: Rules, Terminology, and Technical Specifications*.

Competency Specific Expectations and Objectives for Evaluation:

Medical Knowledge

1. Demonstrates level appropriate skill in interpreting chest radiographs and computed tomography studies as well as other radiologic studies of the lungs.
2. Is able to identify the normal anatomy of the lungs and pleural space as well as the physiological functioning of the structures thereof.
3. Understands and can explain expiratory air flow limitation, dynamic hyperinflation, intrinsic PEEP, and dynamic airway compression.
4. Knows and applies the GOLD COPD criteria.
5. Knows and applies the NIH asthma diagnosis and treatment guidelines.
6. Understand the anatomy and physiology of sleep disorders such as obstructive sleep and applies appropriate, patient specific evaluation strategies to diagnose sleep disorders.
7. Applies knowledge appropriately and effectively using systematic Bayesian reasoning.

Patient Care

1. Takes a comprehensive yet focused pulmonary history including environmental/occupational exposures and tobacco use.
2. Management plan is problem-centered and includes patient education.
3. Applies NIH and GOLD/ATS guidelines routinely in management plans.
4. Extension of OLD evidence-based management plans into outpatient care.
5. Appropriately manages sleep disorders in the outpatient setting, with an understanding of the practical application of CMS criteria for treatment of OSA.

Practice-based learning and improvement

1. Becomes facile with using computer based radiography tools to access and interpret studies.
2. Seeks and gets feedback from the pulmonary function lab staff, the bronchoscopy suite staff, and Sleep Center personnel as well as others in a position to give meaningful feedback.
3. Incorporates feedback in an appropriate manner into daily practice.
4. Is familiar with seminal literature in the field of obstructive lung diseases and bases decision making on these sources.
5. Is able to cite current COPD literature and guidelines and to use them for appropriate patient care.
6. Understands and applies NIH Guidelines and GOLD Criteria sufficiently well to teach residents and students.
7. Prepares and presents journal club, case presentation, and combined Pulmonary/Pathology/Radiology conferences and other didactic sessions as requested.

Systems-based practice

1. Works hard to learn skills in the PFT lab and other procedural skills.
2. Demonstrates understanding and proper use of pulmonary rehabilitation, PFTs, oxygen therapy, and mechanical (invasive and non-invasive) ventilation in both the hospital and home settings for diverse causes of respiratory failure.
3. Is aware of system resources for smoking cessation and utilizes these resources appropriately.

4. Documents appropriately and legibly in the medical record in a timely fashion.
5. Begins to understand billing and coding and levels of service and documentation required for such.

Professionalism

1. Maintains a professional and collegial relationship with members of the radiology department and uses them as a resource.
2. Works well with the PFT lab staff, the bronchoscopy personnel, the Sleep Center staff, the section administrative staff, and other people within the section.
3. Is helpful to colleagues in all fields and at all levels of training.
4. Attends the required formal educational sessions.
5. Keeps the primary physicians and referring teams informed daily about patient care plans and recommendations.
6. Is appropriate in dress, demeanor, and attitudes towards patients, their families, colleagues, and co-workers.
7. Is helpful to the nursing and respiratory therapy staff and other personnel within the section and the hospital.
8. Maintains appropriate relationships with representatives of home health care companies involved in providing services to the patients of the section.

Interpersonal and Communication Skills

1. Obtains appropriate informed consent for bronchoscopy and other procedures.
2. Teaches effective use of inhalation therapies to patients and their families.
3. Works well with support staff including nurses and respiratory therapists as well as Sleep Center personnel.
4. Counsels about tobacco abuse and smoking cessation and weight loss as integral parts of management of OLD and OSA.
5. Able to counsel patients about airway hygiene and avoidance of environmental triggers of exacerbation.

**ROTATION PCS 1 & PCS 2: GENERAL CHEST RADIOGRAPHY,
PULMONARY FUNCTION PHYSIOLOGY/CARDIOPULMONARY EXERCISE
TESTING, OBSTRUCTIVE LUNG DISEASE, AND INTRODUCTION TO
SLEEP MEDICINE**

Competency-specific Goals

Medical Knowledge:

Continue to develop medical knowledge regarding the topics specific to the curriculum materials. Read, understand, and be able to discuss the pertinent literature regarding these topics (as specified in the required readings). Continue to develop as a medical educator of the residents, students, and patients as well as your colleagues.

Patient Care:

Continue to develop skills relating to the management of patients with disease states related to the topics in the curriculum. This includes the rationale for, application of, and interpretation of tests and procedures. Continue to develop skills as a patient advocate. Continuously provide high quality patient care with compassion and cultural understanding.

Practice Based Learning and Self-Improvement:

Continuously strive to learn and improve your practice of Pulmonary Medicine as related to the specific goals of the curriculum. Know your limitations and ask for help as needed. Use all available resources to further your practice. Ask for regular feedback regarding performance (strengths and weaknesses) and incorporate feedback into your daily practice.

System-Based Practice:

Continue to develop habits of practicing within a larger system. Expand from the team level to the program level, the hospital level, the community level, and the national level as regards your practice of Pulmonary Medicine. Use available resources from the hospital and community to advocate and care for your patients. Use available resources (print and electronic) to improve your practice and communications.

Professionalism:

Strive at all times to interact professionally your patients and their families, the medical staff in all areas and at all levels of training. Continuously demonstrate integrity, honest, reliability, and fairness.

Interpersonal Communication Skills:

Continue to improve communication skill as they pertain to the curriculum specifics. Use appropriate communication with patients and their families, incorporating cultural and educational parameters. Develop good habits of communicating with your colleagues on the medical staff to improve patient care and safety. Use appropriate methods (verbal, written, electronic) for communications.

I have reviewed and been given the above curriculum, understand its goals and will work to achieve its objectives:

Fellow's Signature

Date

**ROTATION PCS 1 & PCS2: GENERAL CHEST RADIOGRAPHY,
PULMONARY FUNCTION PHYSIOLOGY/CARDIOPULMONARY EXERCISE
TESTING, OBSTRUCTIVE LUNG DISEASE, AND INTRODUCTION TO
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Patient Care: Continue to develop skills relating to the management of patients with disease states related to the topics in the curriculum. This includes the rationale for application of, and interpretation of tests and procedures. Continue to develop skills as a patient advocate. Continuously provide high quality patient care with compassion and cultural understanding.

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Professionalism:

Strive at all times to interact professionally with your patients and their families, the medical staff in all areas and at all levels of training. Continuously demonstrate integrity, honest, reliability, and fairness.

Interpersonal Communication Skills:

Continue to improve communication skill as they pertain to the curriculum specifics. Use appropriate communication with patients and their families, incorporating cultural and educational parameters. Develop good habits of communicating with your colleagues on the medical staff to improve patient care and safety. Use appropriate methods (verbal, written, electronic) for communications.

I have reviewed and been given the above curriculum, understand its goals and will work to achieve its objectives:

Fellow's Signature

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FELLOWSHIP YEAR 1

ROTATION PCS 3 & PCS 4: PULMONARY AND THORACIC MALIGNANCIES

Although the broad topic of malignancy as it relates to pulmonary medicine is included during PCS 3 and PCS 4, mastery of this topic will develop longitudinally over the course of the fellowship and the fellows' abilities and knowledge will be expected to progress throughout the course of their training.

Thoracic Malignancies:

1. Primary lung cancer;
2. Genetic and molecular basis of lung cancer (including the "multiple hit" theory and familial tendencies toward developing malignancy, the role of promoter area mutations and mutations in tumor suppressor genes, the role of various cytokines in the development, growth, and inhibition of tumors, apoptosis and its role in tumor development);
3. Environmental carcinogens and their pathogenic mechanism;
4. Pathobiology (and different behavior) of the lung cancer types:
 - a. Squamous cell carcinoma;
 - b. Adenocarcinoma;
 - c. Bronchoalveolar carcinoma;
 - d. Large cell carcinoma;
 - e. Small cell carcinoma;
 - f. Carcinoid;
5. Paraneoplastic syndromes and their relationship to various tumors:
 - a. Hypercalcemia
 - b. SIADH
 - c. Hypertrophic osteoarthropathy
6. Diagnosis of small and non-small cell (CT/PET, bronchoscopy, CT guided needle biopsy, mediastinoscopy, surgical lung biopsy, histological appearance of various tumors, special marker staining);
7. Staging of small cell and non-small cell lung carcinomas including clinical and pathological (role of PET and other imaging, clinical versus pathologic staging);
8. Treatment strategies for non-small cell and small cell lung cancers (adjuvant and neo-adjuvant chemotherapy, surgical interventions, and the newest recommendations for treatment of both early and late stage non-small cell lung cancers, and limited vs. extensive stage small cell lung cancer);
9. Mediastinal tumors:
 - a. Superior: thymomas and thyroid tumors;
 - b. Anterior: thymomas, teratoma, lymphomas, germ cell tumors;
 - c. Middle: tumors of the vascular structures;
 - d. Posterior: tumors of the esophagus, spine and nervous system structures;
10. Lymphoma – Hodgkin's and non-Hodgkin's lymphoma of the thorax;
11. Mesothelioma and other tumors of the pleura, including the role of environmental exposures.
12. Carcinoma metastatic to the lung, mediastinum, and pleura;
13. Other intrathoracic neoplasms;
14. Tumors of the mouth, nasopharynx, oropharynx, and vocal cords.

Solitary and Multiple Pulmonary Nodules:

1. State the definition of a solitary pulmonary nodule and a pulmonary mass;
2. Name the three most common causes of a solitary pulmonary nodule;
3. Name considerations in the evaluation of a solitary pulmonary nodule;
4. Name causes of cavitary pulmonary nodules;
5. Name causes of multiple pulmonary nodules;
6. Know the indications for and the potential complications of percutaneous biopsy of a solitary pulmonary nodule;
7. Know the role of bronchoscopy in evaluating a solitary pulmonary nodule;
8. State the role of positron emission tomography (PET) in the evaluation of a solitary pulmonary nodule;
9. Know the current recommendations for the serial radiographic evaluation of pulmonary nodules.

Benign and Malignant Neoplasms of the Lung, Esophagus, and Pleural Space:

1. Name the four major histologic types of bronchogenic carcinoma, and state the difference between non-small cell and small cell lung cancer;
2. Name the type of non-small cell lung cancer that most commonly cavitates;
3. Name the types of bronchogenic carcinoma that are usually central and those that are usually peripheral;
4. Describe the TNM classification for staging non-small cell lung cancer, including the components of each state (I, II, III, IV and substages), and the definition of each component (T1-4, N0-3, MO-1);
5. State the staging of small cell lung cancer;
6. Name the most common extrathoracic sites for non-small cell lung cancer and small cell lung cancer to metastasize;
7. State which stages of non-small cell lung cancer are potentially resectable, be able to make patient-specific recommendations, and know the role of surgery in small cell lung cancer;
8. Include non-malignant causes of solitary and multiple pulmonary nodules in the differential diagnosis of such lesions (including infectious, granulomatous, vasculitic, and bronchogenic cysts);
9. Recognize abnormal contralateral mediastinal shift on a post-pneumonectomy chest radiograph, and state possible etiologies for the abnormal shift;
10. Name the most common location for adenoid cystic and carcinoid tumors to occur;
11. Suggest the possibility of radiation change as a cause of new apical opacification on the chest radiograph of a patient with evidence of mastectomy and/or axillary node dissection;
12. Describe the acute and chronic radiographic and CT appearance of radiation injury in the thorax (lung, pleura, pericardium, esophagus) and the temporal relationship to radiation therapy;
13. State the role of MR in lung cancer staging (e.g. chest wall invasion, superior sulcus or Pancoast tumor);
14. State the role of positron emission tomography (PET) in lung cancer staging;

15. Describe the TNM classification for staging esophageal carcinoma, including the components of each stage (I, II, III, IV) and the definition of each component (T, N, and M);
16. State the role of imaging in the staging of esophageal carcinoma;
17. State which stages of esophageal carcinoma are potentially resectable;
18. State the classification of lymphoma, the role of imaging in the staging of lymphoma, and the typical and atypical manifestations of thoracic lymphoma;
19. Define primary pulmonary lymphoma and pleural cavity lymphoma (including its viral correlates);
20. Be able to recognize features of pleural malignancy such as mesothelioma;
21. State the importance of pleural effusion in the staging of pulmonary or metastatic malignancy.
22. Know what structures may give rise to non-pulmonary malignancies within the thorax (thymus, thyroid, germ line tumors, nerve sheath tumors, etc.).

Pulmonary Function Testing as related to Pulmonary Malignancy:

1. Know the pulmonary function abnormalities that accompany lung cancer;
2. Understand the use of pulmonary function tests in determining operability/resectability prior to surgical treatment of lung cancer (e.g. split perfusion testing).

Required Reading:

Fellows are required to read, at a minimum, the seminal articles listed below and present at least one of them to the team each week. Additional information can be found in the textbooks listed below. Seminal articles on this topic can be found at:
<http://www.thoracic.org/fellows/syllabusintro.asp>

Articles:

1. Silvestri, G.A. et al., *Noninvasive staging of non-small cell lung cancer: ACCP evidence-based clinical practice guidelines (2nd Edition)*. Chest, 2007; 132(3 Suppl): 178S-201S.
2. Ko, J.P., et al., *CT depiction of regional nodal stations for lung cancer staging*. AJR Am J Roentgenol, 2000;174(3):775-82.
3. Detterbeck, F.C., et al., *Seeking a home for PET, part 2: Defining the appropriate place for positron emission tomography imaging in the staging of patients with suspected lung cancer*. Chest, 2004;125(6):2300-8.
4. Halpern, B.S., et al., *Presurgical staging of non-small cell lung cancer: positron emission tomography, integrated positron emission tomography/CT, and software image fusion*. Chest, 2005;128(4):2289-97.
5. Gupta, N.C., et al., *Clinical role of F-18 fluorodeoxyglucose positron emission tomography imaging in patients with lung cancer and suspected malignant pleural effusion*. Chest, 2002;122(6):1918-24.
6. Tournoy, K.G., et al., *Esophageal endoscopic ultrasound with fine-needle aspiration with an on-site cytopathologist: high accuracy for the diagnosis of mediastinal lymphadenopathy*. Chest, 2005;128(4):3004-9.
7. Herth, F.J. and Ernst, A., *Innovative bronchoscopic diagnostic techniques: endobronchial ultrasound and electromagnetic navigation*. Curr Opin Pulm Med, 2005;11(4):278-81.

8. Eberhardt, R., et al., *Electromagnetic navigation diagnostic bronchoscopy in peripheral lung lesions*. *Chest*, 2007;131(6):1800-5.
9. Micames, C.G., et al., *Endoscopic ultrasound guided fine needle aspiration for non small cell lung cancer staging: a systematic review and meta analysis*. *Chest*, 2007;131(2):539-48.
10. Schwartz, A.M. and Henson, D.E., *Diagnostic surgical pathology in lung cancer: ACCP evidence-based clinical practice guidelines (2nd edition)*. *Chest*, 2007; 132(3 Suppl): 78S-93S.
11. Detterbeck, F.C., et al., *Invasive mediastinal staging of lung cancer: ACCP evidence-based clinical practice guidelines (2nd edition)*. *Chest*, 2007; 132(3 Suppl): 202S-220S.
12. Fritscher-Ravens, A., et al., *Mediastinal lymph node involvement in potentially resectable lung cancer: comparison of CT, positron emission tomography, and endoscopic ultrasonography with and without fine needle aspiration*. *Chest*, 2003; 123(2): 442-51.
13. Rivera, M.P. and Mehta, A.C., *Initial diagnosis of lung cancer: ACCP evidence-based clinical practice guidelines (2nd edition)*. *Chest*, 2007; 132(3 Suppl): 131S-148S.
14. Ost, D., Fein, M.M., and Feinsilver, S.H., *Clinical practice. The solitary pulmonary nodule*. *N Engl J Med*, 2003; 348(25): 2535-42.
15. Bach, P.B., et al., *Screening for lung cancer: ACCP evidence-based clinical practice guidelines (2nd edition)*. *Chest*, 2007; 132(3 Suppl): 69S-77S.
16. Swensen, S.J., et al., *CT screening for lung cancer: five-year prospective experience*. *Radiology*, 2005; 235(1): 259-65.
17. Granville, C.A. and Dennis, P.A., *An overview of lung cancer genomics and proteomics*. *Am J Respir Cell Mol Biol*, 2005; 32(3): 169-76.
18. Potti, A., et al., *A genomic strategy to refine prognosis in early-stage non-small-cell lung cancer*. *N Engl J Med*, 2006; 355(6): 570-80.
19. Schwartz, A.G., *Genetic predisposition to lung cancer*. *Chest*, 2004; 125(5 Suppl): 86S-9S.
20. Zhong, L., et al., *Efficient identification and use of tumor-associated antibodies as markers on non-small cell lung cancer*. *Chest*, 2004; 125(5 Suppl): 105S-6S.
21. Arenberg, D., *Bronchioloalveolar lung cancer: ACCP evidence –based clinical practice guidelines (2nd edition)*. *Chest*, 2007; 132(3 Suppl): 306S-13S.
22. Arriagada, R., et al., *Cisplatin-based adjuvant chemotherapy in patients with completely resected non-small-cell lung cancer*. *N Engl J Med*, 2004;350(4): 351-60.
23. Jett, J.R., et al., *Treatment on non-small cell lung cancer, stage IIIB: ACCP evidence-based clinical practice guidelines (2nd edition)*. *Chest*, 2007; 132(3 Suppl): 266S-276S.
24. Robinson, L.A., et al., *Treatment on non-small cell lung cancer – stage IIIA: ACCP evidence-based clinical practice guidelines (2nd edition)*. *Chest*, 2007; 132(3 Suppl): 243S-265S.
25. Scott, W.J., et al., *Treatment of non-small cell lung cancer stage I and stage II: ACCP evidence-based clinical practice guidelines (2nd edition)*. *Chest*, 2007; 132(3 Suppl): 234S-242S.
26. Socinski, M.A., et al., *Treatment of non-small cell lung cancer, stage IV: ACCP evidence-based guidelines (2nd edition)*. *Chest*, 2007; 132(3 Suppl): 277S-89S.

27. Silvestri, G. A. and Rivera, M.P., *Targeted therapy for the treatment of advanced non-small cell lung cancer: a review of the epidermal growth factor receptor antagonists*. Chest, 2005; 128(6): 3975-84.
28. Simon, G.R. and Turrisi, A., *Management of small-cell lung cancer: ACCP evidence-based clinical practice guidelines (2nd edition)*. Chest, 2007; 132(3 Suppl): 324S-39S.
29. Colice, G.L., et al., *Physiologic evaluation of the patient with lung cancer being considered for resectional surgery: ACCP evidence-based clinical practice guidelines (2nd edition)*. Chest, 2007; 132(3 Suppl): 161S-77S.
30. Duwe, B.V., Sterman, D.H., and Musani, A.I., *Tumors of the mediastinum*. Chest, 2005; 128(4): 2893-909.
31. Marchiori, E. et al., *Laryngotracheobronchial papillomatosis: findings on computed tomography of the chest*. J Bras Pneumol, 2008; 34(12): 1084-9.
32. Jeung, MY et al. *Imaging of Cystic Masses of the Mediastinum*. RadioGraphics, 2002; 22: S79 - S93.
33. Gaerte SC, et al., *Fat-containing Lesions of the Chest*. RadioGraphics, 2002; 22: S61 - S78.
34. Ganjoo, K et al., *Results of modern therapy for patients with mediastinal nonseminomatous germ cell tumors*. Cancer, 2000; 88(5),1051-6.
35. Moore AJ, Parker RJ, and Wiggins J, *Malignant mesothelioma*. Orphanet J Rare Dis, 2008; 3:34.
36. Ceresoli GL, Gridelli C, and Santora A., *Multidisciplinary treatment of malignant pleural mesothelioma*. Oncologist, 2007;12(7):850-63.
37. Manegold C, *Malignant pleural mesothelioma: ESMO clinical recommendations for diagnosis, treatment, and follow-up*. Ann Oncol, 2007;18Suppl2:ii34-35.
38. Ismail-Khan R, et al., *Malignant pleural mesothelioma: a comprehensive review*. Cancer Control, 2006;13(4):255-63.

Textbook Readings:

1. Murray and Nadel, *Textbook of Respiratory Medicine*, applicable chapters.
2. Fraser and Pare, *Diagnosis of Diseases of the Chest*, applicable chapters.

Competency Specific Expectations and Objectives for Evaluation:

Medical Knowledge

1. Knows and can discuss lung cancer screening recommendations with support from recent literature.
2. Knows the appropriate evaluation schema for solitary pulmonary nodules and other lung masses.
3. Knows the appropriate use of bronchoscopy, needle biopsies and surgical approaches for diagnosis malignancy.
4. Knows non-invasive and invasive strategies for staging of malignancy.
5. Knows the evaluation strategies for mediastinal masses as well as the causes of these masses.
6. Knows and can discuss the definitive and palliative therapies for lung cancer (including surgery, external beam radiation therapy, combination chemotherapy, adjuvant and neo-adjuvant chemotherapy, and brachytherapy and other airway procedures).
7. Knows the salient features of the biology and pathology of non-small cell, small cell, typical and atypical carcinoids, and other lung malignancies.
8. Knows and can discuss paraneoplastic syndromes.
9. Applies knowledge appropriately, effectively, and in a cost sensitive way using systematic Bayesian reasoning.

Patient Care

1. Takes a directed/focused pulmonary history that addresses pulmonary malignancy risk factors and symptoms including a thorough history of environmental and occupational exposures and smoking history.
2. Accurately determines the clinical stage for patients with lung masses.
3. Understands functional capacity and how it plays a role in recommendations for therapy.
4. Makes timely referral to Medical Oncology and Thoracic Surgery as appropriate and maintains contact with consultants to facilitate patient care.
5. Daily progress notes address pathology results with updates of therapy recommendations as appropriate.

Practice-based learning and improvement

1. Knows and applies the current staging schema for both small and non-small cell lung cancers.
2. Uses current medical literature to inform recommendations regarding evaluation strategies, staging, and treatment recommendations for patients with various pulmonary malignancies.
3. Prepares and presents combined Pulmonary/Pathology/Radiology conference when assigned, arranging for all appropriate presenters.
4. Attends monthly pulmonary oncology conference and the monthly pulmonary pathology review conference.
5. Taught medical students and residents as appropriate regarding pulmonary malignancies.
6. Seeks and incorporates performance feedback from oncology nurses, case managers, and other appropriate personnel with experience in the care of patients with pulmonary malignancy.

Systems-based practice

1. Understands and applies the team-based approach to the diagnosis and treatment of malignancy.
2. Knows the current staging for both small cell and non-small cell lung cancer.
3. Utilizes resources within the oncology section and the hospital to facilitate and improve the care of patients with pulmonary malignancy.
4. Is aware of resources within the hospital system and region for services not provided within the hospital (e.g. interventional pulmonary services and advanced radiation therapy services).
5. Learned about and applied principles of palliative care and end of life discussions, using hospital and system resources as a source.
6. Makes appropriate referrals for palliative care and hospice.

Professionalism

1. Treats patients with malignancy with respect, compassion, and empathy and spends time with them and their families in an attempt to inform, educate, and allay concerns regarding the diagnosis and treatment.
2. Maintains appropriate relationships with referring physicians and subspecialists to ensure a multi-disciplinary approach to the diagnosis and treatment of lung cancer.
3. Attends and participates in hospital wide pulmonary oncology conferences as appropriate.

Interpersonal and Communication Skills

1. Is able to and does inform the patient and their family of the diagnosis of malignancy and participates meaningfully in discussions regarding the impact of such a diagnosis in patient specific terms.
2. Keeps patients and their families up-to-date with developments.
3. Maintains communications with the primary physician, referring team, and consultants as appropriate.
4. Discusses palliative care and end of life issues, in the proper context, with all patients with lung cancer.
5. Works and communicates effectively and collegially with nursing and respiratory therapy staff.

ROTATION PCS 3 & PCS 4: PULMONARY AND THORACIC MALIGNANCIES

Competency-specific Goals

Medical Knowledge:

Continue to develop medical knowledge regarding the topics specific to the curriculum materials. Read, understand, and be able to discuss the pertinent literature regarding these topics (as specified in the required readings). Continue to develop as a medical educator of the residents, students, and patients as well as your colleagues.

Patient Care:

Continue to develop skills relating to the management of patients with disease states related to the topics in the curriculum. This includes the rationale for, application of, and interpretation of tests and procedures. Continue to develop skills as a patient advocate. Continuously provide high quality patient care with compassion and cultural understanding.

Practice Based Learning and Self-Improvement:

Continuously strive to learn and improve your practice of Pulmonary Medicine as related to the specific goals of the curriculum. Know your limitations and ask for help as needed. Use all available resources to further your practice. Ask for regular feedback regarding performance (strengths and weaknesses) and incorporate feedback into your daily practice.

System-Based Practice:

Continue to develop habits of practicing within a larger system. Expand from the team level to the program level, the hospital level, the community level, and the national level as regards your practice of Pulmonary Medicine. Use available resources from the hospital and community to advocate and care for your patients. Use available resources (print and electronic) to improve your practice and communications.

Professionalism:

Strive at all times to interact professionally with your patients and their families, the medical staff in all areas and at all levels of training. Continuously demonstrate integrity, honest, reliability, and fairness.

Interpersonal Communication Skills:

Continue to improve communication skill as they pertain to the curriculum specifics. Use appropriate communication with patients and their families, incorporating cultural and educational parameters. Develop good habits of communicating with your colleagues on the medical staff to improve patient care and safety. Use appropriate methods (verbal, written, electronic) for communications.

I have reviewed and been given the above curriculum, understand its goals and will work to achieve its objectives:

Fellow's Signature

Date

ROTATION PCS 3 & PCS 4: PULMONARY AND THORACIC MALIGNANCIES

Competency-specific Goals

Medical Knowledge:

Continue to develop medical knowledge regarding the topics specific to the curriculum materials. Read, understand, and be able to discuss the pertinent literature regarding these topics (as specified in the required readings). Continue to develop as a medical educator of the residents, students, and patients as well as your colleagues.

Patient Care:

Continue to develop skills relating to the management of patients with disease states related to the topics in the curriculum. This includes the rationale for, application of, and interpretation of tests and procedures. Continue to develop skills as a patient advocate. Continuously provide high quality patient care with compassion and cultural understanding.

Practice Based Learning and Self-Improvement:

Continuously strive to learn and improve your practice of Pulmonary Medicine as related to the specific goals of the curriculum. Know your limitations and ask for help as needed. Use all available resources to further your practice. Ask for regular feedback regarding performance (strengths and weaknesses) and incorporate feedback into your daily practice.

System-Based Practice:

Continue to develop habits of practicing within a larger system. Expand from the team level to the program level, the hospital level, the community level, and the national level as regards your practice of Pulmonary Medicine. Use available resources from the hospital and community to advocate and care for your patients. Use available resources (print and electronic) to improve your practice and communications.

Professionalism:

Strive at all times to interact professionally with your patients and their families, the medical staff in all areas and at all levels of training. Continuously demonstrate integrity, honest, reliability, and fairness.

Interpersonal Communication Skills:

Continue to improve communication skill as they pertain to the curriculum specifics. Use appropriate communication with patients and their families, incorporating cultural and educational parameters. Develop good habits of communicating with your colleagues on the medical staff to improve patient care and safety. Use appropriate methods (verbal, written, electronic) for communications.

I have reviewed and been given the above curriculum, understand its goals and will work to achieve its objectives:

Fellow's Signature

Date

FELLOWSHIP YEAR 1

ROTATION PCS 5 & PCS 6: PULMONARY INFECTIONS

Although the broad topic of infectious diseases as they relate to pulmonary medicine are included in PCS 5 and PCS 6, the learning of this topic area will occur throughout the fellowship and the fellows' mastery of the topic will be expected to progress through the course of their training.

Medical Knowledge

1. Community acquired pneumonia (CAP):
 - a. Know the definition and common organisms involved (including MRSA and *Legionella pneumophila*);
 - b. Know the indications for inpatient vs. outpatient treatment of CAP;
 - c. Know the currently recommended antibiotic regimens for CAP;
 - d. Know the mechanisms of action of antimicrobials used to treat CAP.
2. Health care associated pneumonia (HCAP) and ventilator associated pneumonia (VAP):
 - a. Know the risk factors for HCAP and VAP and be able to identify patients at risk for these infections;
 - b. Know the specific mechanisms involved in innate and acquired immunity.
 - c. Know the most common microbial agents involved in each (and how they change depending on duration of hospitalization);
 - d. State the most appropriate diagnostic methods (and their limitations);
 - e. State the most current antimicrobial regimen for each;
 - f. Know the mechanisms of action of antimicrobials used to treat HCAP;
 - g. Know appropriate prophylactic measures to prevent VAP;
3. Pneumonia in the immunocompromised host:
 - a. Know the risk factors for immunosuppression (HIV, chronic steroid use, neutropenia, underlying malignancy, chemotherapy, etc.) and be able to identify the microbial spectrum implicated in each immunocompromised state;
 - b. Know the cellular and mediator based mechanisms by which each immunodeficient state increases susceptibility to infection.
 - c. Be able to develop a broad differential diagnosis of potential infectious sources in each group;
 - d. State the most appropriate diagnostic methods;
 - e. State the most current antimicrobial regimens for each;
 - f. Know the adjunct therapies involved in treating such patients (GCSF, GMCSF)
 - g. Recognize the risk of worsening infection/inflammation attendant to reconstitution of the immune system;
4. Fungal pneumonias, including PCP
 - a. Recognize groups at risk for fungal pneumonia and be able to explain the mechanisms involved;
 - b. Know the differences in diagnostic strategy for PCP between HIV infected and non-HIV infected patients;
 - c. Know the current antimicrobial regimen most appropriate for each agent;
 - d. Understand the differences between colonization and invasive infections;

- e. State the types of infection with *Aspergillus fumigatus* and understand the importance and treatment of each;
- f. Know the geographic distribution of each of the mycoses;
5. Mycobacterial disease (MTB and non-MTB)
 - a. Know the risk factors for acquiring MTB;
 - b. State the current interpretation of tests for determining past exposure to MTB (PPD and interferon release assay) and know the indications for each;
 - c. Know the current treatment strategies for latent, active, and multi-drug resistant TB as well as the risks and monitoring involved in these;
 - d. Know the microbiologic basis for development of (multi) drug resistance.
 - e. Know the current epidemiology of MTB and it's relationship to HIV;
 - f. State the non-tuberculous *Mycobacteria* and their diagnosis and treatment;
6. Atypical bacteria – *Mycoplasma*, *Legionella*, *Chlamydia*, *Actinomyces*, *Nocardia*;
7. Agents of bioterrorism – plague, anthrax, tularemia, brucellosis, Q-fever;
8. Viral pneumonias – HSV, CMV, Influenza, RSV, Hantavirus, Ebola;
9. Differential diagnosis and approach to diffuse vs. focal pneumonia in patients with:
 - a. Solid organ transplants;
 - b. Stem cell/bone marrow transplants;
 - c. Connective tissue diseases;
 - d. HIV/AIDS.

Radiographic Manifestations of Pulmonary Infection

1. Name the radiographic manifestations of primary pulmonary tuberculosis;
2. Name the three most common segmental sites of involvement for reactivation tuberculosis in the lung;
3. Define Ranke-complex and Ghon lesion; recognize both on a radiograph and CT;
4. Name and describe the four types of pulmonary *Aspergillus* disease;
5. Identify an intracavitary fungus ball on chest radiograph and chest CT;
6. State the radiographic appearances of Cytomegalovirus pneumonia;
7. Name the major categories of disease causing chest radiograph or chest CT abnormalities in the immunocompromised patient;
8. Other than bacterial infection, name two important infections and two important neoplasms to consider in patients with AIDS and chest radiography or chest CT abnormalities;
9. Describe the chest radiograph and chest CT appearance of *Pneumocystis* pneumonia;
10. Name four etiologies of hilar and mediastinal adenopathy in patients with AIDS;
11. State the radiographic appearances of *Mycoplasma* pneumonia;
12. Describe the radiographic and CT appearance of a miliary pattern, and provide a differential diagnosis;
13. Name the diagnostic considerations in a patient who presents with recurrent or persistent pneumonia;
14. Name the endemic mycoses, the geographic regions where they are found and their radiographic manifestations;
15. State the most common pulmonary infections seen after solid-organ transplantation;
17. Describe the radiographic and CT findings of post-transplant lymphoproliferative disorders.

Pulmonary Function Testing

Review and master pulmonary function testing as it relates to infectious lung disease.

Required Reading:

Fellows are required to read, at a minimum, the seminal articles listed below and present at least one of them to the team each week. Additional systematic “area of emphasis reading” can be found in the textbooks listed below and seminal articles can be found for these areas at: <http://www.thoracic.org/fellows/syllabusintro.asp>

Articles:

1. Mandell, L.A., et al., *Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults*. Clin Infect Dis, 2007; 44 Suppl 2: S27-72.
2. Niederman MS, Mandell LA, Anzueto A, et al. Guidelines for the management of adults with community-acquired pneumonia: diagnosis, assessment of severity, antimicrobial therapy, and prevention. Am J Respir Crit Care Med, 2001;163(7):1730-54.
3. Fine MJ, Auble TE, Yealy DM et al. A prediction rule to identify low-risk patients with community-acquired pneumonia. N Engl J Med, 1997;336(4):243-50.
4. Arnold, F.W. et al., *Hospitalization for community-acquired pneumonia: the pneumonia severity index vs. clinical judgment*. Chest, 2003; 124(1): 121-4.
5. Mittl RL, Schwab RJ, Duchin JS et al. Radiographic resolution of community-acquired pneumonia. Am J Resp Crit Care 1994;149:630-5.
6. *Hospital-acquired pneumonia in adults: diagnosis, assessment of severity, initial antimicrobial therapy, and preventive strategies. A consensus statement, American Thoracic Society*, November 1995. Am J Respir Crit Care Med. 1996 May;153(5):1711-25.
7. *Guidelines for the management of adults with hospital-acquired ventilator-associated, and healthcare-associated pneumonia*. Am J Resp Crit Care Med, 2005; 171(4): 388-416.
8. Grossman, R.F. and Fein, A., *Evidence-based assessment of diagnostic tests for ventilator-associated pneumonia: Executive summary*. Chest, 2000; 117(4 Suppl 2): 177S-181S.
9. Rello, J., et al., *Epidemiology and outcomes of ventilator-associated pneumonia in a large US database*. Chest, 2002; 122(6): 2115-21.
10. Shorr, A.F., and Kollef, M.H., *Ventilator-associated pneumonia: insights from recent clinical trials*. Chest, 2005; 128(5 Suppl 2): 583S-591S.
11. Rano, A., et al., *Pulmonary infections in non-HIV immunocompromised patients*. Curr Opin Pulm Med, 2005; 11(3): 213-7..
12. Beck JM, Rosen MJ, Peavy HH. Pulmonary complications of HIV infection. Report of the Fourth NHLBI Workshop. Am J Respir Crit Care Med. 2001 Dec 1;164(11):2120-6.
13. Huang, L., et al., *An official ATS workshop summary: recent advances and future directions in Pneumocystis pneumonia (PCP)*. Proc Am Thorac Soc, 2006; 3(8): 655-64.