I have nothing to disclose that would create a conflict of interest.
Objectives

- Understand some basic concepts of occupational medicine
- Increase knowledge of occupational contributions to lung disease
- Understand the relevance of occupational medicine as it relates to lung disease
WHY is knowing your patient’s occupational history important?
WHY?

1. Occupational injuries and illnesses are common!

- Nearly 3.0 million nonfatal workplace injuries and illnesses reported by private industry employers in 2014 occurred at a rate of 3.2 cases per 100 equivalent full-time workers, 13 deaths per day

- Non-occupational medicine providers may be the first medical providers to come into contact with individuals who are experiencing occupational injuries and illnesses.

https://www.osha.gov/oshstats/commonstats.html
WHY?

2. The medical therapies that you prescribe to your patients can directly impact the ability of your patient to be able to safely perform the essential functions of his/her job and thereby greatly impact his/her livelihood.

Having knowledge of your patient’s occupational history can allow for shared decision making with regards to medical therapies prescribed as well as guide discussions on preventing problems at work.
**HOW** to take an occupational history (for the non-occupational medicine provider)

**DO’s:**
1. Ask about current and past jobs
   a. Get the details; understand the potential exposures
2. Ask about length of time spent at each job
3. Does the patient have to wear protective equipment at work? If so, what?
4. Has the patient ever had to have medical tests done because of his or her work?
5. Does the patient have any concerns about his/her current treatment plan with respect to his/her ability to do his/her job?
6. Does the patient have any concerns with regards to health effects believed to be caused by his or her job?
HOW to take an occupational history

DON’Ts

1. Don’t be satisfied with the patient telling you simply a job title when you ask; this tells you nothing specific about potential hazardous work exposures!

2. Don’t skip this part because you don’t have time!!!
What defines “occupational”?

The injury or illness must be “work-related”

- Any injury or illness caused by, or substantially contributed to, by exposure to factors associated with employment

This is not always obvious!

- Beware the subtleties of causation! This is what we do best.
Occupational disease looks like non-occupational disease.

- The first step in the process for an occupational physician is to ascertain if there is disease.

- MAKE A DIAGNOSIS!
Concept of “Causation”

Is there an identifiable factor (eg, accident or exposure to a hazard) that results in a medically identifiable condition?
Concept of “Causation”

- Work related versus work aggravated (asthma)
Concept of “Causation”

Often asked to provide an opinion about the likelihood that a particular illness or injury caused an impairment

**Impairment:** “a loss, loss of use, or derangement of any body part, organ system or organ function”

**Disability:** alteration of an individual’s capacity to meet personal, social or occupational demands because of an impairment. (Guides, WHO, Social security Admin, State Workers Comp Law)
Occupational Lung Disease Overview

- Rhinitis and laryngitis
- Tracheitis, bronchitis and bronchiolitis
- Asthma
- Interstitial lung disease
- Lung cancer
- Inhalation fever
Airway Anatomy
Airway Anatomy
Airway Anatomy
Structure of an Alveolus

- Oxygen rich blood
- Oxygen poor blood
- Capillary
- Alveolar macrophage
- Type I cell
- Type II cell
- Fluid with surfactant
- Respiratory membrane

$\text{O}_2$, $\text{CO}_2$
Anatomy of the Lung Interstitium
The Lungs and Respiratory Diseases

- **Rhinitis and laryngitis**: Large particles are deposited in the nose, pharynx, and larynx. More soluble gases (e.g., sulfur dioxide) are absorbed by upper respiratory tract mucous membranes, causing edema and mucus hypersecretion.

- **Tracheitis, bronchitis, and bronchiolitis**: Large particles (more than 10 μm in diameter) are deposited and then cleared by cilia. Small particles and fine fibers are deposited in bronchioles and bifurcations of alveolar ducts. Less soluble gases penetrate to deeper, small airways.

- **Asthma and chronic obstructive pulmonary disease**: Allergens and irritants are deposited in large airways by turbulent flow, causing chronic inflammatory changes.

- **Cancer**: Carcinogens (asbestos and polycyclic aromatic hydrocarbons) come into contact with bronchial epithelial cells, causing mutations in proto-oncogenes and tumor-suppressor genes. More than one such contact results in malignant transformation.

- **Interstitial disease**: Small particles (less than 10 μm in diameter) and fibers are deposited in terminal bronchioles, alveolar ducts, and alveoli. Penetration to the interstitium results in fibrosis and the formation of granulomas.
Asthma
Airway Disease

**Definition:** Lung disease characterized by increased “reactivity” of the airways to a wide range of stimuli (sometimes called “hyper-reactivity”)

**Symptoms:** Episodic breathlessness, cough, wheezing, and production of secretions

**Pathology:** Airways inflammation, intermittent narrowing of the airways and excessive production of secretions (reversible *obstruction*)
Asthma facts:
Asthma is an *episodic* disease with *exacerbations* followed by symptom-free periods

Lung function is abnormal (*obstruction*) during asthma episodes and normal during periods between asthma episodes

**HYGIENE HYPOTHESIS:** Growing up on a farm reduces risk of asthma, but... exposure to agricultural hazards increases risk of asthma
Asthma

- 5-10% population has asthma
- 2-30% adult onset are of occupational origin
- Asthma is the most frequent occupational lung illness (50-60%)
Making the Diagnosis

- Pre and post spirometry
- Serial peak flows with diary
- Specific challenge tests
FIGURE 4. Normal spirometric flow diagram. (A) Flow-volume curve. (B) Volume-time curve. The smooth lines, expiratory time of greater than six seconds, and quick peak of the peak expiratory flow rate indicate a good spirometric effort.
PFT FLOW VOLUME LOOPS

RESTRICTIVE PATTERN

NORMAL PATTERN

OBSTRUCTIVE PATTERN
Lung volumes and capacities
DIAGNOSIS OF OCCUPATIONAL ASTHMA
WITH SERIAL PEAK FLOW MEASUREMENTS
Peak Flow Meter

- **Low cost, easy to use and effective** way to help diagnose and monitor worker airway disease

- However, effort dependent, so may not perform test properly OR may use it for “secondary gain”.

- Measurements: arising, pre shift, mid shift, end shift and bedtime

- **LOOK FOR TRENDS**
42-Year-Old Man with Asthma and Work-Related Symptoms. The patient used a portable peak expiratory flowmeter and a daily calendar. The early-morning peak flows showed the diurnal morning dip usually seen with asthma. The peak flow values were consistently lower when the patient was at work than when he was at home, a finding that confirmed that the asthma was related to work.
Occupational Asthma

- Asthma caused by dusts, vapors, mists and fume in the workplace, even though symptoms may appear at a later time.

- High molecular weight antigens (95% of cases) vs. low molecular weight antigens.
Specific Causes of Work-Related Asthma

- Diisocyanates
- Stainless steel welding fumes
- Formaldehyde
- Paint
- Pesticides
- Lates
- Chlorine
- Wood dust
- > 250 reported cases
Occupational Asthma

- PROGNOSIS

- Some patients continue to have asthma for years after the discontinuation of exposure

- Prolonging exposure can worsen bronchial hyperreactivity, symptoms, lung function, and prognosis.

- Occupational asthma therapy emphasizes early diagnosis and removal of the substance responsible for the exposure
Occupational Asthma: Prognosis

- 79 patients with well documented occ asthma over 6 years
  - 90% some symptom improvement
  - 72% needed chronic medication
  - 40% had continued limitation of activity
  - 33% were unemployed
  - 10% required hospitalization

Venable K, Respir Med 1989, 83:437
Occupational Asthma

- **TREATMENT**
  - Control exposure maximally. Even small exposures can exacerbate disease.

  - Airflow obstruction is treated with inhaled beta-agonists, inhaled corticosteroids, and other drugs as needed to prevent chronic symptoms.
Reactive Airways Dysfunction Syndrome (RADS)

- A distinct subset of “irritant induced asthma”

- Irritant induced asthma is thought to represent 5% of all cases of occupational asthma

- Described after single inhalational exposure to a high level of a toxic substance.
Interstitial Disease

- Parenchymal disease
- Describes many, many diseases
Anatomy of the Lung Interstitium

- Network of connective tissue that includes alveolar walls, interlobular septa and peribronchovascular interstitium
Anatomy of the Lung Interstitium

Disorders involve THICKENING of the interstitium
Interstitial Lung Disease of Occupational Origin

- Disease of the supporting framework of the lung
Pneumoconiosis

- Silicosis
- Asbestosis
- Coal Workers Pneumoconiosis
- Berylliosis
- Inorganic Dusts
1930’s: Hawks Nest Tunnel

The story of one of this country’s worst industrial disasters.

- Large scale occupational silicosis

- The stage: 1930’s Depression days with men desperate for work
Acute Silicosis

Hundreds of migrant workers came to dig a 3.8 mile tunnel through the mountain through 99% pure silica.

Over 700 men died of acute silicosis.
Acute Silicosis

Silica is a naturally occurring mineral that is mainly composed of silicon dioxide (SiO$_2$). It exists in a crystalline and amorphous state. Quartz, cristobalite, and tridymite are the 3 most common forms of crystalline silica, which causes silicosis.
Acute Silicosis

Is depicted as widespread nodules measuring 2-5 mm in diameter, with a predominance in the middle and upper lung zones.
Silicosis

Progressive massive fibrosis.

Shows large, conglomerate nodules in both the middle and upper lung zones.

Peripheral hyperlucency represents emphysematous lung tissue secondary to central migration of the large nodules.

Bilateral upper lobe volume loss is also noted.
Silicosis

Latency >10 years

Cough, sob, failure

Restrictive PFTs in advanced

Epi evidence as a carcinogen
Asbestosis

- Asbestos refers to a group of six types of naturally occurring minerals. Asbestos minerals are made up of fine, durable fibers and are resistant to heat, fire and many chemicals.
Asbestos

http://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5363851

http://tedkinsman.photoshelter.com/image/I0000Q.iFPuK9i8A
Asbestos-THEN

Kent Filters Best
gives you less tar and nicotine

WHY THEY RETAIN HEAT


LIQUID ASBESTOS in handy pressurized cans, for spraying on heating pipes, water pipes, above furnaces and around located registers.

Weather Will NEVER Wear Them Out

Asbestos-Shingles Are Perrenial

JASPER/MANSFIELD

Johns Manville

THEEN

Asbestos-
Asbestos in Industry

- fire blanket
- Asbestos in floor tiles
Abestos Related Lung Disease

- Non-Malignant:
  - Asbestosis: scarring and fibrosis (mid and lower lung fields)
  - Pleural disease: effusion, plaques and calcification

- Malignant:
  - Brochogenic cancers
  - Mesothelioms
  - GI malignancy
  - Latency 15-30 years
  - No “safe” level
  - Synergy with Tobacco
Asbestos - NOW

Banned under TSCA (toxic substances control act)

Banned “new” uses
Working and Living with Agriculture
Respiratory Hazards - living and working in an agricultural state.

- **DUSTS and AEROSOLS**
  - Organic debris of plant, animal, fungal, and bacterial origin (very common in agriculture)
  - *Allergens* – biological agents that induce an allergic response
  - *Endotoxins* – also called “lipopolysaccharides,” are large molecules that form part of the cell wall of gram-negative bacteria

Pesticides and other chemical agents
  - Organophosphates, carbamates, paraquat, fumigants
  - Solvents, fuels, disinfectants, fertilizers

Inorganic dusts
  - Silica (uncommon)
Pesticide Exposure
Manure Pit: underground storage for livestock waste.
Fumes are toxic
Respiratory Hazards - living and working in an agricultural state.

- **Gasses**
  - Ammonia (anhydrous ammonia fertilizer and animal waste storage)
  - Hydrogen sulfide (animal waste storage)
  - Oxides of nitrogen (fresh silage)
Respiratory Hazards - living and working in an agricultural state.

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Inorganic dusts
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Control Exposure and Prevent Disease

- The hierarchy of workplace controls:
  - **Engineer** the exposure out of the work place
    - Substitute/remove
    - Separate the process from the worker
  - **Administrative**
    - Job rotations, shift changes
  - **Personal Protective equipment**
    - Respirators, gloves, trench coats, goggles
Review

- Fundamentals for evaluating an occupational exposure
- Basic pulmonary anatomy and pulmonary testing
- Example of airway disease, asthma
- Example of interstitial disease, silicosis, and asbestos
- Touched on agricultural relevance
- Exposure and prevention hierarchy.

- Thank You
  Claudia Corwin MD MPH
  claudia-corwin@uiowa.edu
“Here was a subject tainted with Socialism or with feminine sentimentality for the poor.”

-Alice Hamilton