**Occupational and Environmental Medicine: Past, Present, Future**

MIT EHS Lunch and Learn
August 2012

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**Outline**

- What is Occupational and Environmental Medicine?
- Past: History of Occupational and Environmental Medicine [OEM]
- Present: Current practice of OEM at MIT
- Future: Trends
  - in workers and in work
  - in occupational injury and illness
  - in public health and emergency response

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**How can work and health affect each other?**

**Work => Health**
- Asbestos and lung cancer; health care and needle sticks; animal research and allergies; manual labor and back pain

**Health => Work**
- Epilepsy and airplane pilot; monocular forklift driver; sleep apnea and truck driving

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**OEM Definition**

Occupational and environmental medicine is the medical specialty devoted to prevention and management of occupational and environmental injury, illness, and disability; and promotion of health and productivity of workers, their families, and communities

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**Occupational Medicine: preventing adverse impacts of work and health**

**Work => Health**
- Eliminate exposure, put in place industrial hygiene, personal protection, administrative controls, treat worker

**Health => Work**
- Evaluate and optimize care for health issues, recommend reasonable accommodations of work, determine fitness for duty

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**OEM: Past**

"No wonder your arm aches. Shackles should be placed at eye level. Men it's an ergonomic nightmare down here."
Occupational Medicine: In the beginning... a labor law!

The history of occupational medicine can be traced into antiquity 400 BC. Reports of increased rates of illnesses and mortality among miners date back to Greek and Roman times.

Hazards of Miners: 16th century

*De Re Metallica*: “the dust has corrosive qualities, it eats away the lungs and implants consumption in the body... Women are found who have married seven husbands, all of whom have this terrible consumption has carried off to a premature death.”

Occupational Medicine: First Textbook

Dr. Bernardini Ramazzini publishes first edition of Diseases of Workers

Occupational Medicine: The Modern Era

Dr. Alice Hamilton 1869-1970
- 1919 First woman prof. at HMS, new Dept. of Industrial Medicine
- 1925 Industrial Poisons in the United States; 1934 Industrial Toxicology (reissued in 1949 with Dr. Hardy); 1943 Exploring the Dangerous Trades

Occupational Medicine: The Modern Era

Dr. Harriet Hardy 1905-1993
- 1940s investigated Salem Sarcoid - beryllium
- 1947 MGH Clinic and MIT Environmental Medical Service
- 1954 One of first to link asbestos and lung cancer
- Research on mercury, benzene, radiation poisoning, and lead
Occupational Medicine: The Modern Era – Organized Specialty

1948
The American Board of Preventive Medicine and Public Health, Inc., created

1955
Certification in Occupational Medicine authorized

1992
Environmental added to Occupational Medicine

ACOEM


In 1970, Congress passed the Occupational Safety and Health Act (OSH Act), created the:

- Occupational Safety and Health Administration (OSHA) – regulations and inspections
- National Institute for Occupational Safety and Health (NIOSH) – research and standards
- Occupational Safety and Health Review Commission (OSHRC) – adjudicate fines

Injuries and Illnesses in Private Industry

NIOSH Worker Health Chartbook 2004

Top 10 most cited OSHA violations: 2011
- Fall protection
- Scaffolding
- Hazard communication
- Respiratory protection
- Lock-out/tag-out
- Electrical-wiring methods
- Powered industrial trucks
- Ladders
- Electrical-General Requirements
- Machine guarding

NIOSH Most Important Occupational Related Illnesses

1. Occupational lung diseases
2. Musculoskeletal injuries/disorders
3. Occupational cancers
4. Severe occupational trauma injuries
5. Cardiovascular diseases
6. Disorders of reproduction
7. Neurotoxic disorders
8. Noise-induced hearing loss
9. Dermatologic conditions
10. Psychologic disorders
Illnesses in Private Industry

How accurate are the statistics on Occupational Injury and Illness?
- No comprehensive national surveillance system
- Non-reported employment or regulatory exclusion
- Bureau of Labor Statistics annual survey, Workers Comp, and physician reporting data bases not integrated
- Legal and scientific challenges in establishing causation
- Number of new injuries and illnesses underestimated by several fold

Occupational and Environmental Medicine at MIT

MIT: Environments and Occupations
- 11 million square feet of labs
- 1+ billion dollars in research annually
- 24/7/365; 30,000 people worldwide
- Power plant; police force; ambulance service; research reactor; lasers; radiation emitters; medical department; law, investment, real estate businesses; many thousands of research animals; residential housing 8,000….etc.

OEM at MIT
- MIT first university to have medical specialist in OM: Dr. Harriet Hardy in 1940’s
- Developed over 50 years to Environmental Medical Service (EMS) as part of MIT Medical: ~45 allied health professionals:
  - Industrial hygiene, Radiation Protection, Biosafety
  - Medical Director: MD specialist in OEM
- Reorganized 2001:
  - Environmental, Health, and Safety (EHS) – focus on environments and safety
  - Employee Health and Occupational Medicine (EHOM) – focus on clinical services, based in Medical Department

Staff of OEM at MIT Medical [E23]
- David V. Diamond, MD: Associate Medical Director, Board Certified in OEM, 22 years at MIT, 31 years in OEM
- Jacqueline Sherry, RNP: Clinical Coordinator of OM and Infection Control at MIT, 14 years at MIT, 32 years in OEM (private industry)
- Medical specialities at MIT: orthopedics, dermatology, allergy, neurology, pulmonary, infectious diseases – on-site [part time]
- OEM supported by allied health professionals at EHS: IH, RPO, BSO, Safety
Clinical OEM services at MIT

1] Pre-placement exams
- There are no routine medical exams for all new MIT employees
- There are evaluations for specified work:
  - Medical Department: infection control [Tb and vaccines], blood borne pathogen
  - Tower climbers, confined space workers, HAZMAT, truck drivers, pilots: federal regulations
  - Kwajelain deployment: general health status review
  - Animal care workers: Tb screening, Tetanus boosters, and allergies
  - Laser users: baseline eye exams
  - Blood borne pathogen exposure: Hepatitis B vaccination

2] Regulatory exams
- Truck drivers [DOT] – every two years
- NASA and private pilot exams [FAA] – every one or two years
- Respirator users [OSHA] – medical clearance for respirator fit testing
- SCUBA divers [PADI] – pre-training
- Reactor operators [NRC] – every two years to maintain license
- Confined space workers
- Animal care, primates [AALAC]

3] Periodic surveillance exams
- Prior asbestos exposure: lung evaluation
- Beryllium workers: lung evaluation
- Noise exposed: hearing tests
- Animal care workers: Tb, allergy, ergonomics, Td
- HIV and TB researchers: biologic testing offered
- Biologic monitoring is insensitive and often too little/too late – not the focus of OEM

4] Evaluation of actual workplace injuries and illness: by appointment or walk-in
- Physical hazards: trauma, noise, repetitive strain [ergonomics, computers], bites, needles
- Biologic hazards: blood borne pathogens [HIV, Hep B], Tb, Simian B virus, other infectious agents [recombinant, pathogenic], allergens [rodents]
- Radiation: UV, laser, radioisotopes, nuclear reactor, microwave, electromagnetic
- Chemical: acids [HF], alkali, contact sensitizers [epoxy], toxins [mercury]

4] Consults about potential workplace concerns, exposures, or illnesses
- Odors: working with EHS to determine if odor is a health risk, ergonomics
- "Sick building": indoor air quality, meeting with occupants and assessing symptoms to help identify potential sources
- Lab environment risks for pregnancy
- Infectious agents: addressing worker’s concerns about biologic research with pathogens such as HIV, Tb, Vaccinia
5] OEM and campus emergency response

- AED deployment: Heart Safe Campus, student run ambulance service
- Bioterror and pandemics: planning for campus wide response
- Lab accidents: large spills or gas releases
- First aid training and supplies
- Planning for small and large events with EHS, Campus Police, MIT Administration, etc.: Emergency Operations Center [EOC]: example the fire at One Broadway

Accidents do happen: Injuries and Illness at work

When disaster strikes, the element of surprise...

MIT Medical OEM: case examples

- **Chemist** gets a few drops of HF containing fluid on hand, washes on site and applies HF gel antidote, comes to Urgent Care [E23 first floor] for exam and follow up

  - **Lab worker** has sore thumb from using mechanical pipette, evaluated by appointment, tendonitis diagnosed, medical advice given but also IH referral to get automated pipette as alternative

- **Grad student** breaks beaker, cuts hand, bleeding, comes for wound check, suturing, tetanus booster

- **Animal handler** develops chronic runny nose and cough, comes for appointment, animal allergy suspect, sent to allergy specialist for testing, rodent allergy confirmed, work modifications recommended and medications prescribed, follow up exams with OEM and pulmonary specialist

MIT Medical OEM: case examples

- **Support staff**: gets HA every time she sits in “new” office, retrofitted space, no operable windows. Have IH site visit, check air quality and quantity, look for VOC, CO2, recommend HVAC adjustment

- **Water supply ruptures**: floods basement labs, lots of chemicals stored, emergency response workers get wet, several days to remove water, dampness and stale air; when can re-occupy, any toxic exposures?

The OEM Team: OEM MD and NP are part of a team that includes:

**Industry**
- Safety Professional
- Industrial Hygienist
- Worker Representative
- Management
- Health Physicist
- Ergonomist
- Environmental Engineer
- Biosafety

**Medicine**
- Nurse
- Nurse Practitioner
- Physician Assistant
- PCP Physician
- Physical Therapist
- Occupational Therapist
- Epidemiologist
- Med/Surg Specialists
- Hospital
OEM Trends
- Aging workforce
- Change in work: new technology, new hazards
- Changing laws and regulations
- Terrorism and emergency response
- Workplace violence
- Lack of OEM specialist training
- Wellness and cost control with preventative health services

Future OEM: Changes in workers
- Workforce is more diverse in age, gender, race, and nationality
- Most new jobs in businesses with less than 500 workers
- Large numbers of immigrant workers, many part-time, contracted, and/or undocumented and not within regulated environments
- International workforce location

Future OEM: Changes in Work
- Nature of work
  - Increasing proportion of service, health care, computer jobs
  - Decreasing proportion of manufacturing, agriculture, fishing
- Organization of work
  - Transient employment (temporary, contracted workers)
  - E-commerce
  - Homework and the 24 x 7 workweek
  - Globalization

Future OEM: New work = new illness?
- Traditional hazards exist, but increasingly in small difficult to monitor settings or overseas
- Contemporary occupational hazards are insidious, long latencies, environmentally ubiquitous and unlikely to result in pathognomic occupational illnesses:
  - Ergonomic
  - Stress
  - Sedentary work life
  - Low-level chronic exposures to environmentally pervasive agents (phalates, nanoparticles)
  - Biotechnology and engineered infectious agents

Future OEM: Beyond work-related illness and injury → community wellness
- Terrorism: response and business recovery, false alarm or real
- Large scale accidents and environmental emergencies: industrial chemicals, water mains, fire
- Health and Safety of emergency responders
- Environmental issues
- Natural disasters: earthquakes, floods, ice storms
- Workplace violence: VT shooter example
- Managing the cost of all health care
  - Wellness and health care maintenance to reduce costs
  - Work site health care: primary care and prevention
  - Benefit design to encourage wellness and disease management
Future OEM: Health and Productivity Initiatives

- Collaborations with payers, employers, and labor to prevent and manage disability
- Health Risk Assessments
- Disease management
- On-site screenings
- Health insurance design
- ROI: proven but difficult to budget!

Summary: Occupational and Environmental Medicine

- Long history of recognizing and eliminating workplace hazards
- Collaborative and multidisciplinary effort
- Goal is worker and environmental safety through risk avoidance and prevention of injury and illness
- Added benefit: improved productivity, and reduced costs of: injury, illness, OSHA fines, and business interruptions

Thank you for your attention – and your help in providing OEM at MIT!

Questions?
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Occupational Lung Diseases

- Asbestosis
  - Diffuse, extensive scarring of lung
  - Progressive SOB
  - Disease can progress after cessation of exposure
  - Latency 10-25 years
  - Smoking may increase risk
  - 10-20% insulation workers may die of this

Appendix
Occupational Lung Diseases

Byssinosis
- Inhalation of cotton, flax, hemp
- Acute or chronic disease
- Chest tightness, cough, small airways obstruction

Occupational Lung Diseases

Silicosis
- Crystalline silica dust
- Mines, foundries, abrasive blasting, stone, clay, and glass manufacturing
- Gauley Bridge – 1936; 1500 died; America’s worst industrial disaster; no safety precautions
- Cough, SOB, nodules

Occupational Lung Diseases

Coal Workers’ Pneumoconiosis
- Black lung disease
- Industrial bronchitis
- Coal exposure
- Fibrosis with emphysema
- 4000 deaths per year

Occupational Asthma
- Grain dusts, metals, isocyanates, enzymes, fungi, soldering fluxes, epoxy resins, and trimellitic anhydride
- Organic and inorganic agents
- Vanadium – up airway irrit, green tongue
- Prevalence: 10-100% in certain occupations
- Irritants vs. sensitzers
- HMWP vs. LMWP

Musculoskeletal injuries
- Low back injuries – 20% of WC expenditures
- Pain – not compensable in Florida
- Repetitive motion disorders: CTS(?), tendonitis, bursitis, tenosynovitis, tendonosis
- Vibration-associated injuries – 7 million whole body (disc disease)/1.2 million segmental (Raynaud’s)

DWC - 25
- Objective findings
- Restrictions
- Preexisting conditions and apportionment
- Exacerbation vs. Aggravation
- 4 boxes
### Occupational Cancers

- Lung – arsenic, asbestos, chloroethers, chromates, ionizing radiation, nickel, PAHs
- Testicular cancer – 1775, chimney sweeps
- Leukemia – benzene, radiation
- Hemangiosarcoma – arsenic, vinyl chloride

### Occupational Cancers

- Nasal cancer – hardwood dusts, nickel, chromates, radium
- Mesothelioma – pleural and peritoneal – asbestos
- Bladder cancer – naphtylamines, benzidine, 4-aminobiphenyl
- Skin cancer – arsenic, UV radiation

### Occupational trauma

- Highway MVA: 34% traumatic deaths
- Falls: 12%
- Industrial vehicles or equipment: 11%
- Blows: 8%
- Electrocutions: 7%
- 10 million occupational injuries/year – 10,000 fatal, 3 million severe

### Cardiovascular diseases

- Metals, dusts, trace elements – restrictive lung disease and cor pulmonale
- CO (hypoxia), CS2 (atherogenesis), halogenated HCs (arrythmias), NTG/nitrates (rebound vasospasm)
- Noise - ? of increased BP, changes in cholesterol and hormones
- Of psychosocial stress (JAMA/CNN)

### Diseases of Reproduction

- >50 chemicals common in industry associated with adverse outcomes
- 1970: methyl-HG poisoning in Minamata; DCP (dibromochloropropane) – male sterility in U.S.
- Decreased fertility, spon ab, major and minor birth defects, childhood CA, perinatal death, LBW, fetal dvlpmt/behav
- Lab/chemical workers: Pb, EtO, anesthetic gases

### Neurotoxic Disorders

- Lead and palsy – Pliny, 1st Century
- Hg – tremor "mad as hatter", 1500s
- Subtle clinical presentation
- Peripheral neuropathy: arsenic, acrylamide, lead, carbon disulfide, n-hexane, methyl-n-butyl ketone, mercury
- Parkinsonism: Mn, CO, CS2, MPTP
Neurotoxic Disorders
- Kepone (chlordecone): opsoclonus, tremor, gait disturbance, personality changes
- Trichloroethylene - trigeminal neuralgia
- Carbon disulfide - psychosis
- Hydrocarbon solvents - acute intoxication

Neurotoxic disorders
- Solvents, pesticides – acute encephalopathy
- Lead, solvents (carbon disulfide) – mild or severe chronic toxic encephalopathy
- Mercury – constricted visual fields
- Organotin Cds – paraplegia
- Methanol – impaired visual acuity

Noise-Induced Hearing Loss
- Preventable, Irreversible, Progressive
- Sensorineural – inner ear damage (cochlea)
- Conductive – may be treatable
- Begins at 4000 HZ
- Adjust for age
- Affects 3 million workers

Dermatologic Conditions
- 20-25% result in lost time
- Skin injuries – 82% lacs, 14% chem burn
- Contact dermatitis (90%)
- Infections (5%)
- 50% CD improves w/periodic recur
- 25% CD persistent, progressive
- Red rash when drink: TCE

Psychologic Disorders
- Mass psychogenic illness/idiopathic environmental illness
- HA, dizziness, nausea after exposure to strong odor
- Work overload, lack of control over job
- Non-supportive work environment, ltd job opportunities, role ambiguity or conflict, rotating shift, machine-paced

OEM Workforce
- Total Occupational Health and Safety Professionals
  - 75,000 – 125,000
- AMA estimates 10,000 physicians practice some OM
- 3,332 Board-certified occupational medicine physicians since 1955
- Only 1,500 - 1,800 are actually in practice today
- About 100 new diplomates per year
- ACOEM
  - 5100 members
  - Mean age 55
  - 93% > 40