

OCCUPATIONAL DISEASE

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EOH 466A

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Scope of the problem

- Arch Int Med 157:1557 (1997)
 - USA
 - 6500 Deaths by Injury
 - 13,200,000 nonfatal injuries
 - 60,300 Disease deaths
 - 862,200 illnesses
 - Cost: \$171 Billion.

Scope of the Problem

- 2005 Bureau of Labor Statistics Data
 - 4.2 million injuries/illnesses
 - Agriculture: 6.2 injuries / 100 workers
 - Construction: 6.3 injuries / 100 workers
 - Mining: 3.6 injuries / 100 workers
 - Manufacturing: 6.3 injuries / 100 workers

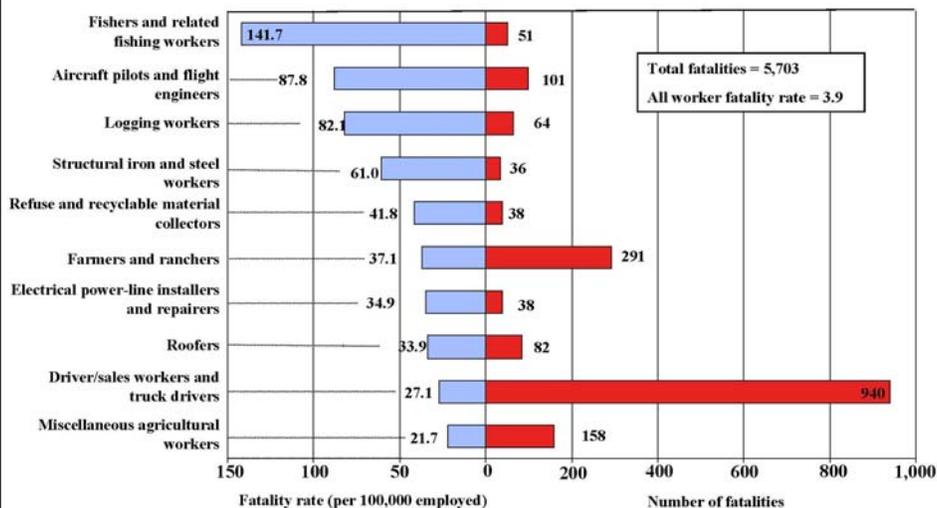
Scope of the Problem

- 2005 Bureau of Labor Statistics Data
 - 2.2 million lost workday or restricted activity cases
 - 4.0 million injuries
 - 242,500 illnesses

Scope of the Problem

- Fatalities 2006: 5703
 - 42 % Transportation incidents
 - 14 % falls
 - 13 % homicide
 - 17 % Contact with objects or equipment
 - 9 % Exposure to harmful substances or environments
 - Map of fatalities, 2007: <http://edlabor.house.gov/issues/workerdeaths.shtml>

Selected occupations with high fatality rates, 2006



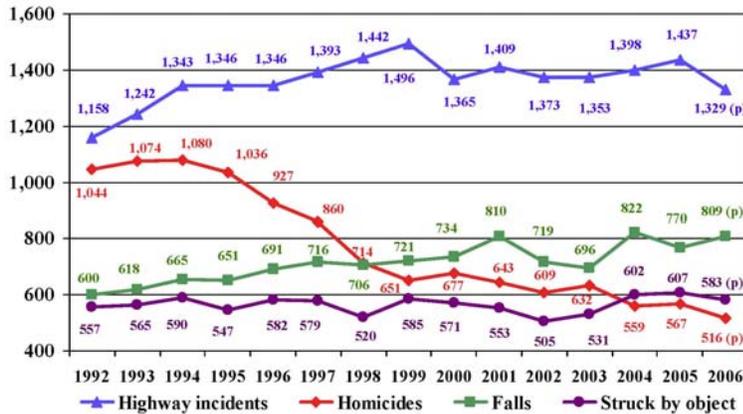
Fatal work injury rates were highest for fishers, aircraft pilots and flight engineers, and logging workers in 2006.

SOURCE: U.S. Bureau of Labor Statistics, U.S. Department of Labor, 2007

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Four most frequent work-related fatal events, 1992–2006

Number of fatalities



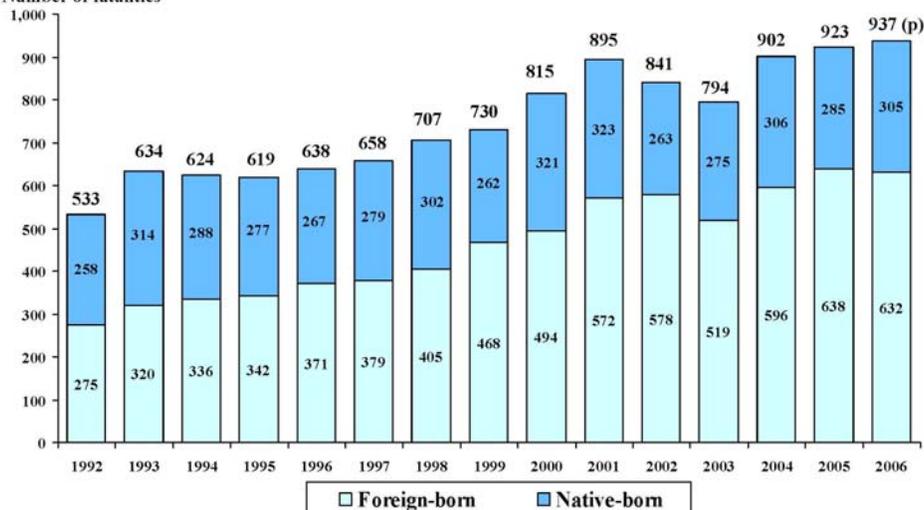
Workplace homicides have declined over 50 percent since 1994, while fatal falls have trended higher. Struck by object fatalities overtook homicides as the third most frequent fatal event in 2004.

p = Preliminary
 NOTE: Data from 2001 exclude fatalities resulting from the September 11 terrorist attacks.
 SOURCE: U.S. Bureau of Labor Statistics, U.S. Department of Labor, 2007

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Number of fatal work injuries involving Hispanic or Latino workers, 1992–2006

Number of fatalities



Fatal work injuries involving Hispanic or Latino workers increased to a series high in 2006, though the fatality rate for this group of workers was lower. More than two-thirds of fatally-injured Hispanic or Latino workers in 2006 were born outside of the United States.

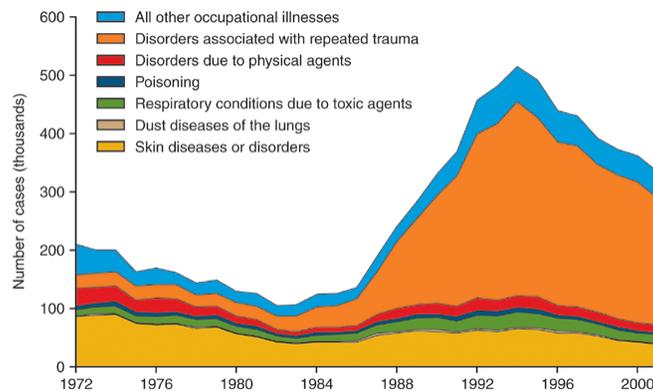
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 SOURCE: U.S. Bureau of Labor Statistics, U.S. Department of Labor, 2007.

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Recognition of occupational illness

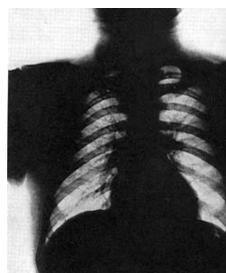
- Most chronic illnesses go unrecognized: reporting, latency, similarity to non-occupational disease, education and training of physicians.

NIOSH [Worker Health Chartbook](#) (Nonfatal Illnesses)

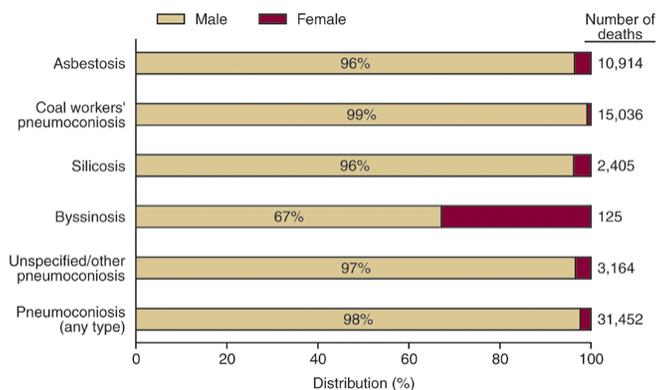


Occupational Lung Disease

- Diagnosis based on chronic or acute symptoms, often after patient experiences health problems.
- Chest X-rays: used in diagnosis. Pre-employment screening X-rays can be used to provide a baseline.



Occupational Lung Disease



Pulmonary Function Tests

- Pulmonary Function Tests: evaluate the ability of the lungs to take in air. Often used in conjunction with X-rays to evaluate pulmonary health. Commonly used in occupational settings.
- FVC (Forced Vital Capacity) and FEV₁ (Forced Expiratory Volume in one second) are used to diagnose lung disease.

Pulmonary Defenses

- Structure
- Upper airways
- Mucociliary escalator
- Macrophages

Pulmonary Responses

- Acute irritant responses: airways, nasal passages, bronchi, sometimes alveoli
 - Symptoms: headache, sneezing, runny nose, coughing, laryngitis, SOB, asthma. Delayed edema and pneumonitis may result.
 - HCl, HF, Ammonia, chlorine, sulfuric acid, ozone, phosgene.

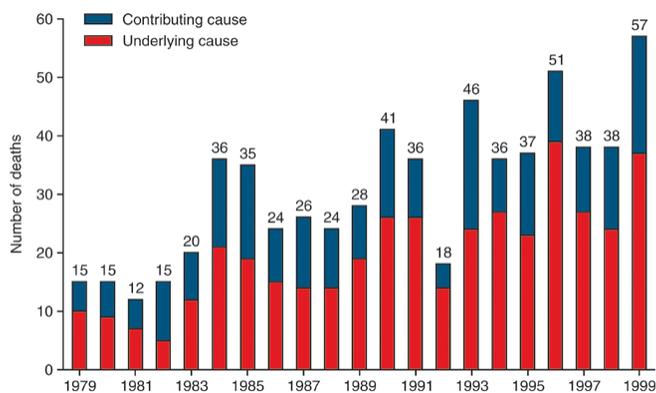
Pulmonary Responses

- Occupational asthma: associated with work. Self-selection may occur.
 - diisocyanates, alkyl amines. The hospital industry has a high incidence of occupational asthma (14.4 % among nonsmokers)

Pulmonary Responses

- Hypersensitivity pneumonitis
 - SOB, coughing, fever and chills.
 - **Bagossis** sugar cane
 - **Farmers lung** moldy hay
 - **Sequiosis** redwood dust.
 - Many other examples of allergic reaction to fungal, bacterial, animal or plant material have been reported.
 - NIOSH survey: 51 deaths in 1996.

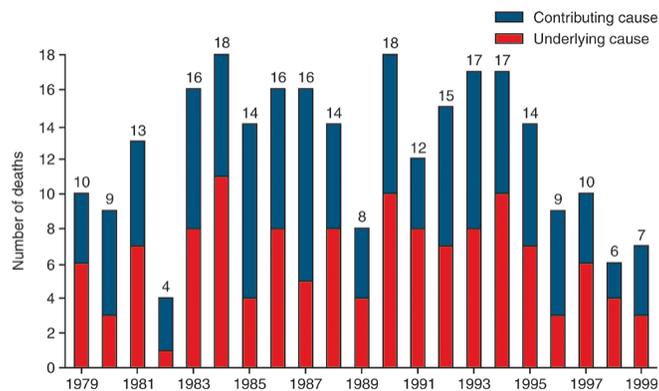
NIOSH [Worker Health Chartbook](#) (Hypersensitivity Pneumonitis)



Pulmonary Responses

- Cotton dust/byssinosis
 - exact nature of the link is not well understood, but is related to plant material. More direct association with carding and baling operations (early in process) NIOSH survey: < 20 deaths annually in 1996.

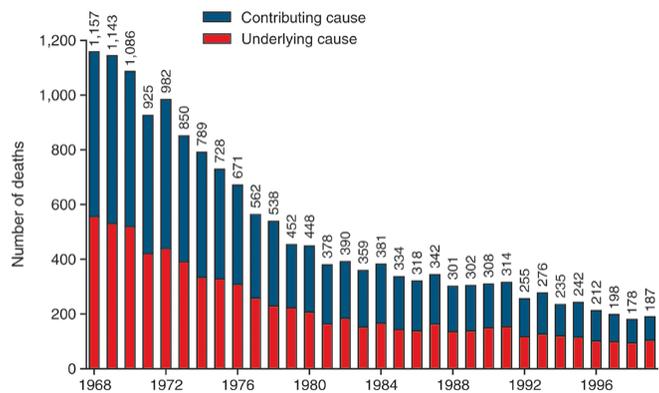
NIOSH [Worker Health Chartbook](#) (Cotton Dust)



Pulmonary Responses

- Pneumoconiosis
 - pulmonary fibrosis caused by exposure to mineral dusts.
 - Particles must reach deep into the lungs, be 10 microns or smaller in size.
 - Silicosis
 - crystalline silica (cristobalite, tridymite, quartz); acute or chronic.
 - NIOSH Survey: <250 deaths in 1996. (8 % of pneumoconiosis deaths.)
 - Overexposures commonly reported in OSHA surveys.

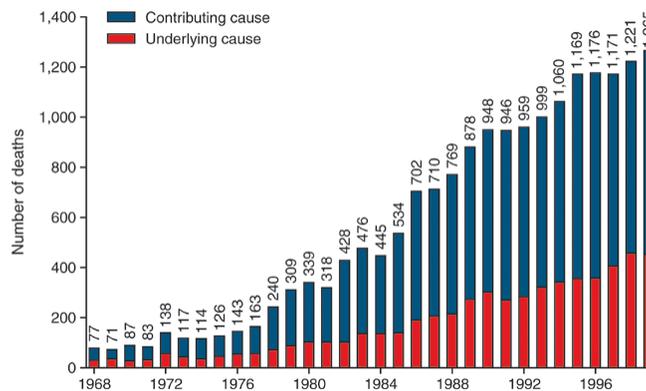
NIOSH Worker Health Chartbook (Silicosis)



Pulmonary Responses

- Asbestosis
 - results from heavy exposure to dust. Lighter exposures cause mesothelioma and lung cancer.
 - NIOSH survey: asbestosis 28 % of deaths 1987 - 1999.
 - < 100 in 1968 but > 1200 in 1999.

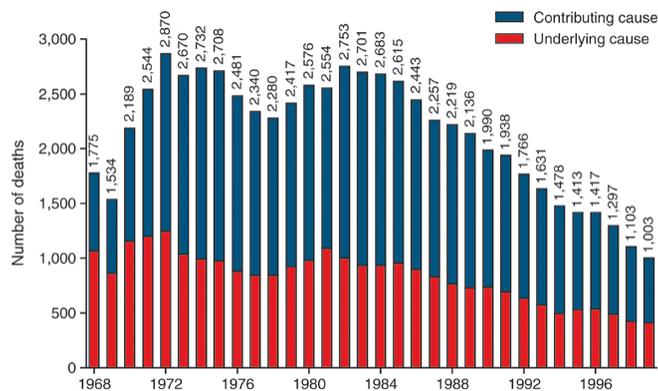
NIOSH [Worker Health Chartbook](#) (Asbestosis)



Pulmonary Responses

- Coal workers pneumoconiosis
 - progressive massive fibrosis. MSHA defines degree and nature of disease that can be compensated.
 - NIOSH survey: 50 % of deaths.
 - Declining > 2500 in 1982 but < 1500 in 1996. Federal 'black lung' beneficiaries 400 000 in 1987 but 250 000 in 1996
 - Recent report: Incidence rate is increasing in Appalachia

NIOSH [Worker Health Chartbook](#) (Coal Workers Pneumoconiosis)



Neurologic and Behavioral Disorders

- Neurologic Disorders: Peripheral Nervous System, Central Nervous System, Combined Effect (both systems)
 - Peripheral Damage
 - Affects peripheral nerves. Segmental demyelination, axonal degeneration
 - Symptoms: numbness and tingling in hands and feet; motor weakness in hands and/or feet; ataxic (uncoordinated) walk. Muscle weakness and atrophy may occur.
 - Toxins: lead, alkyl mercury, hexane, MBK. acrylamide

Neurologic and Behavioral Disorders

- Central Nervous System Damage
 - Affects central nervous system, thus behavioral and motor effects may occur.
 - Symptoms: altered personality, moodiness, incoordination, impaired reaction time, memory disturbance.
 - Toxins: Carbon disulfide, inorganic mercury, carbon monoxide, organic solvents.

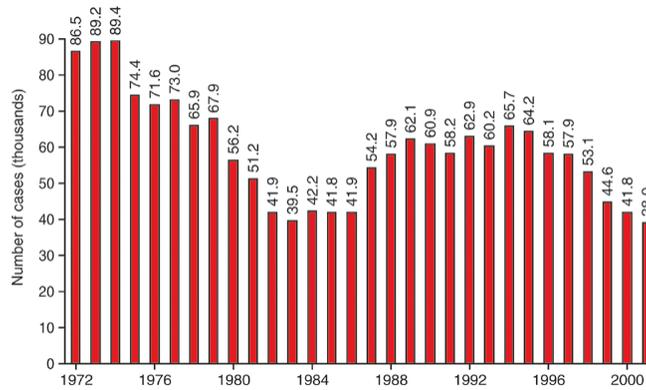
Neurologic and Behavioral Disorders

- Mass Psychogenic Illness
 - Occurs in conditions with low or minimal chemical exposures
 - High stress jobs, little personal (individual control), repetitive tasks.
 - Some triggering stressor, for example unusual odors, disaster situations, etc.
- Other cause must be ruled out; make sure that a chemical / biological cause is not present.

Skin Disease (dermatitis)

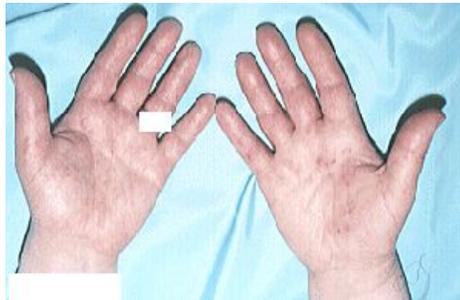
- Dermal contact, protective clothing. Not always needed to elicit response
- Classes of dermal reactions
 - **Contact dermatitis**
 - Areas where direct contact occurs
 - Erythema (reddening) edema (swelling) blisters, scaling, itching and pain may occur
 - **Irritant reactions**
 - Chemicals penetrate to lower tissues.
 - No immunologic reaction
 - Wider spread than contact dermatitis

Skin Disease



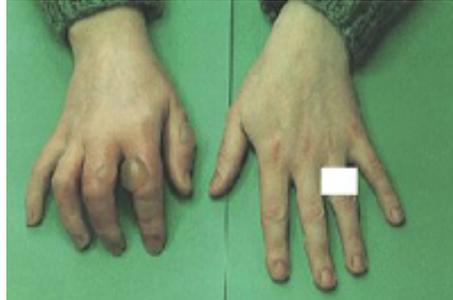
Skin Disease

- Contact Dermatitis



Skin Disease

- Irritant reactions



Skin Disease (Dermatitis)

– Allergic contact reactions

- Immunologic component.
- Sensitization must occur first
- Delayed reaction (12 - 48 hours)
- May be associated with pulmonary sensitization

– Photosensitization

- Abnormal reaction to UV light, sometimes visible light
- Example is coal tar pitch volatiles.

Skin Disease (Dermatitis)

- Allergic dermatitis to nickel



Skin Disease (Dermatitis)

– **Urticarial Response**

- Wheals and flares on skin.
- Immediate hypersensitivity response (Histamine release)

– **Acne**

- Simple acne caused by contact with greases, oils, creosote or coal tar pitch.
- *Chloracne* (severe skin reaction) caused by chlorinated aromatic hydrocarbons such as dioxins, furans, possibly PCBs

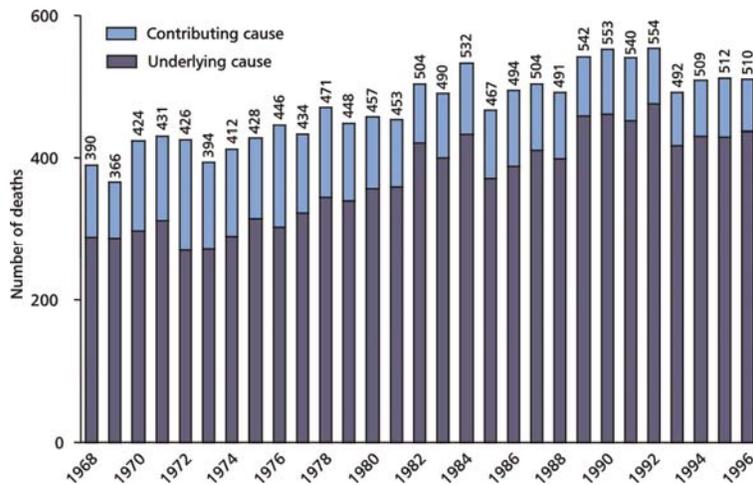
Cancer

- Any organ can be affected
- May have chemical causes
- Environment and diet may make an impact
- Can be large in some worker populations
- US Estimate: 20 – 40 thousand per year in US, but most not recorded.

Cancer

- Pulmonary system (estimated 15 - 20 % occupational)
 - Chromates
 - Asbestos (mesothelioma, bronchial)
 - Arsenic trioxide
 - Wood dust (nasal)
 - Bis(chloromethyl)ether
 - Formaldehyde
 - ?Silica

Cancer NIOSH Worker Health Chartbook



Cancer

- Blood and bone marrow
 - Benzene
 - Ionizing radiation
 - ?EtO
 - ?Chlordane and dieldrin
 - ?Butadiene

Cancer

- Bladder (estimated 10 % occupational)
 - Benzidine and related dyes
 - Beta-naphtylamine
 - Metalworking fluids
 - Arsenic

Cancer

- Skin
 - PNAHs
- Liver
 - VCM (angiosarcoma)
 - PCBs
 - Ionizing radiation

Classification of Carcinogens

- Variety of schemes ranging from yes or no (NIOSH < OSHA)

Classification of Carcinogens

- To gradations based on degree of confidence:
 - ACGIH:
 - A1: Confirmed Human carcinogen: (strong evidence in people)
 - A2: Suspected human carcinogen: (some evidence plus animal data)
 - A3: Confirmed Animal Carcinogen: unknown relevance to humans (strong animal data, no good human data)
 - A4: Not Classifiable as a Human Carcinogen: lack of human data, limited animal data
 - A5: Not suspected as a human carcinogen: Good epidemiological data or animal data that includes toxicokinetics.