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**Fourth**

**Occupational Health  
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L1**

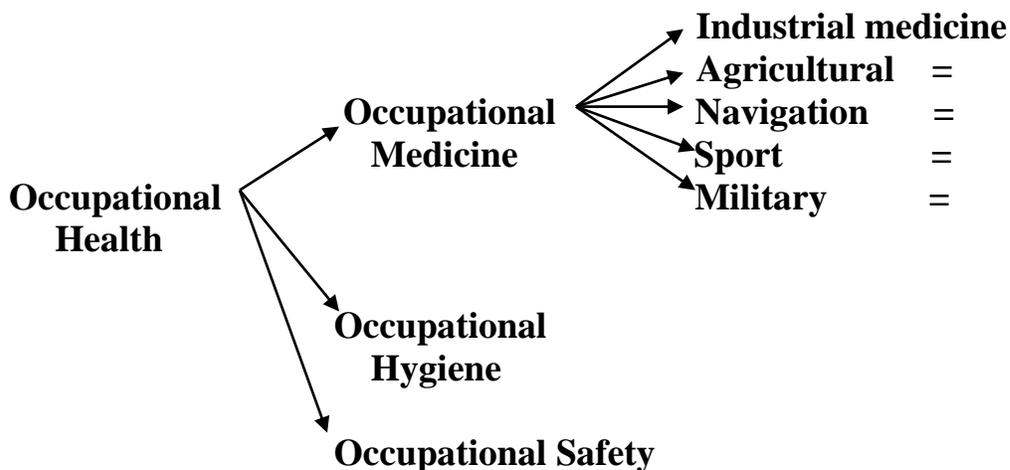
## **Occupational Health**

The workers are the main support of economic and social progress, so their health is an essential factor in development and represents an important human goal.

### **Definition: ( ILO and WHO definition )**

Occupational health is the promotion & maintenance of the highest degree of physical, mental, & social well being of the workers in all occupations.

“ protection of workers’ health at their workplace”



**Occupational Medicine:** refers to preventive & curative medical services to the working population which include the following: **Industrial medicine, Agricultural medicine, Navigation medicine, Sport medicine, Military medicine.**

**Occupational hygiene:** refers to activities concern with the control of working conditions i.e. activities concern with control of the environment.

**The effect of work on the health of man:**

As manufacturing techniques improved, machines became speedier and more dangerous. Toxic hazards were also increased because of the prolonged exposure to a wider range of new chemicals which were introduced without considering their possible effect on workers.

1. work can cause occupational diseases e.g. Asbestosis.
2. work can contribute to or exacerbate non – occupational diseases. e.g. MI & Asthma.
3. work may affect the workers ability to work efficiently & safely e.g. noisy atmosphere accidents
4. work may positively affect the health of workers.

**Occupational health services:**

**Defined by ILO as:**

Services mainly concerned with preventive function and responsible for advising the employer and the workers on the requirements for establishing and maintaining a safe and healthy working environment which will facilitate optimal physical and mental health in relation to work and the adaptation of work to the capabilities of workers in the light of their state of physical and mental health.

They include the entire form of health care delivery to the working population.

**The aims:**

1. Safe placement of workers according to their physical, mental, & emotional capacities.
2. Protection of people at work from hazards which may affect their health and safety.
3. Assistance in measures related to personal health maintenance.

4. provision of adequate medical care for workers and their families at the workplace and nearby facilities & rehabilitation of the occupationally ill & injured.
5. protection of the local environment.

### **Function of the occupational health services:**

#### **1. preliminary orientation to the enterprise:**

- analysis of the type of protection to indicate the type of hazard
- Review of previous problems and action taken to solve them
- Review of the characteristics of workforce( no. age, sex, ethnic group,...)will help to identify the vulnerable group
- Examination of the data on occupational diseases, accident and sickness absences.
- Data on working methods and the chemical substances handled at work, recent exposure measurements, no. of workers exposed. This will help to identify the priority problems.
- Any change in the equipment or in materials should be examined.

#### **2. Surveillance of the working environment.**

*Surveillance: continous systemic collection, analysis, and interpretation of health data that are important in planning, implementation and evaluation of health programme.*

This includes monitoring hazard exposure & comparing it with **Maximum Allowable Concentration** ( maximum level of exposure below which no adverse health effect to most of workers ); and health outcome.

**3. Informing** the employer, enterprise management and the workers about the occupational health hazards.

#### **4- Assessment of Health Risks.**

To compare workers exposure with the threshold limit value (TLV)

Steps for risk assessment:

- Identify the hazards
- Identify all affected by the hazard and how
- Evaluate the risk
- Identify and prioritize the required actions
- Periodic review, and if necessary re-assessment

## 5. Surveillance of worker's health.

The purpose of the examination:

- a. To assess fitness of workers to carry out certain jobs
- b. To assess any health impairment which may be related to exposure to harmful agent.

Health surveillance may be:

**Passive**            the worker seek care for occupational or non occupational diseases.

**Active**            includes:

### a. Pre – employment medical examination.

It is the process of assessing the health & abilities of future employees before they are appointed.

The **purpose** of pre – employment examination:

- 1.To ensure that the person examined does not have any medical condition that may be aggravated by the job.
- 2.To ensure that the person examined does not have any medical conditions that may affect the health & safety of others.
- 3.It serve as a baseline for future evaluations that are part of a medical surveillance programmed.

The contents of premedical examination depends on the type of job for which the worker is being considered.

### b. Periodic medical examinations.

#### **Objectives:**

1. Identify as early as possible any adverse health effect caused by work practices or exposure to potential hazard.
- 2.Detect as early as possible the onset of an occupational diseases.
3. Verifying whether the health of an especially vulnerable or chronically ill worker is being adversely affected by the work or work environment
- 4.To monitor personal exposure to hazards with the help of biological monitoring.
- 5.To evaluate the effectiveness of preventive & control measures.
- 6.Identify possible health effect of changes in the working practices or substances used.

**c. Treatment services.**

Providing efficient & quick treatment of injuries, acute poisoning, & minor conditions.

**6. First aid services & emergency care.**

\*Training of workers on first aid.

\*Arrangement with ambulance services, fire services, local hospitals,  
.....

**7. General preventive & curative health services.**

-occupational health services provide primary health care services to workers & their families.

-screening for early evidence of non – occupational diseases.

**8. Rehabilitation.**

To ensure early return of workers to their work & limit disability.

**9. Protection of vulnerable groups.**

e.g. children, the aged, the disabled, those with chronic diseases,.....

**10. Adaptation of work to the workers.**

Recommendation of modification of the job, the equipment or the working environment that allow the workers to perform work effectively and safely.

**11. Information, education, & training.**

-Increase workers awareness of occupational hazards to which they are exposed.

-proper use of personal protective equipment.

-promotion healthful behavior in the work place.

**12. Epidemiological study & keeping medical records.**

**13. Research.**

**14. Internal and external collaboration with other health care services**

**L2**

## **Occupational diseases:**

Occupation & health interact with one another. In **occupational diseases** there is a direct cause and effect relationship between hazard and diseases, for example silica dust and silicosis, lead fumes and lead poisoning. In **work related diseases**, in contrast, the work environment and the nature of the job contribute significantly, but as only one of the factors, in the causation of a disease of multifactorial a etiology, for example ischemic heart disease and musculoskeletal disorders. The insults from hazardous agents, whether direct or indirect, affect particular organs and systems of the body. Occupational diseases are usually classified according to:

### **I-According to agents causing the disease.**

#### **1. Physical agents:**

Noise, vibration, pressure, thermal ( temperature ), radiation, electricity, illumination.

#### **2. Chemical agents:**

#### **3. Biological agents:**

Viruses, bacterial, parasites, insects,.....etc.

#### **4.Psychosocial environment:**

This concerned with psychological climate in the work place & include two important topics:

- work – organization.
- Job satisfaction.

#### **5.Mechanical hazards:**

This leads to accidents.

### **II-According to target organ system:**

#### **1. Occupational lung disorders.**

#### **2. Occupational skin diseases.**

**3. Occupational diseases may affecting other organs like:** central nervous system, liver, haemopoietic system, genitor – urinary system, and cardiovascular system.

#### **4. Occupational cancers.**

#### **5. Occupational injuries.**

**Extent of the problem:**

An estimated 10 million work related injuries & 430 000 new work related illnesses occur each year in the United States of America. Each day in the United States an average of 9000 workers sustain 6ydisabling injuries in the job, 16 workers die from a work place injuries, and 137 workers die from work related diseases. There were 5.8 million cases reported in the 1996, of which 439,003 were occupational illnesses. The total work related illnesses by category of illness for the period extending between 1992 – 1996 are shown in the fig.1.

In developing countries, occupational injury and illness rate are much higher than that in developed countries. However the numbers of occupational diseases and injuries reported in both developed and developing countries are much lower than the real number.

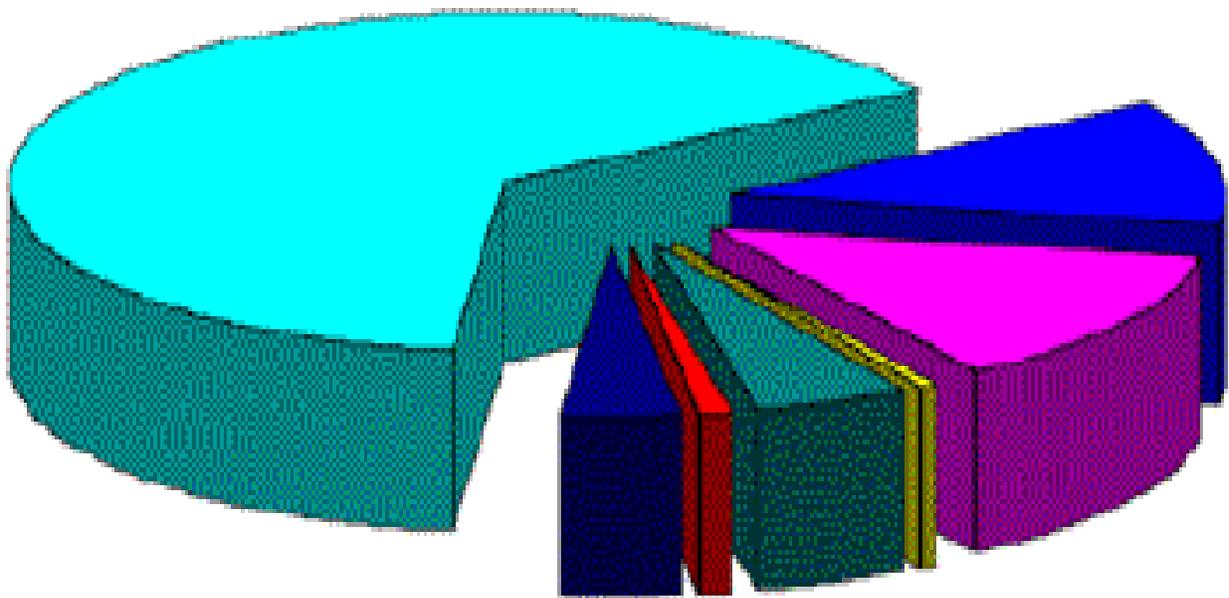
National records of morbidity concerning the health and safety of people at work are available in most countries, but are less reliable than mortality records, because denominators ( population at risk ) are inaccurate, or not available.

The difficulty in obtaining accurate estimates of frequency of work related diseases, is due to several factors ( shown in the fig. 2 ) which are as follows:

- 1.Many problems do not come to the attention of health professionals and employers and, therefore, are not included in the data collection systems.
- 2.Many occupational medical problems that do come to the attention of physicians and employers are not recognized as work related.
- 3.Some medical problems are recognized by health professionals or employers as work related, but not reported because the association with work is equivocal and because reporting requirements are not strict.

In spite of this under reporting there is evidence that the major groups of occupational diseases, like the pneumoconiosis and obstructive respiratory diseases are still very frequently reported.

**Figure (1) Total work – related illnesses by category of illness , 1992-96**

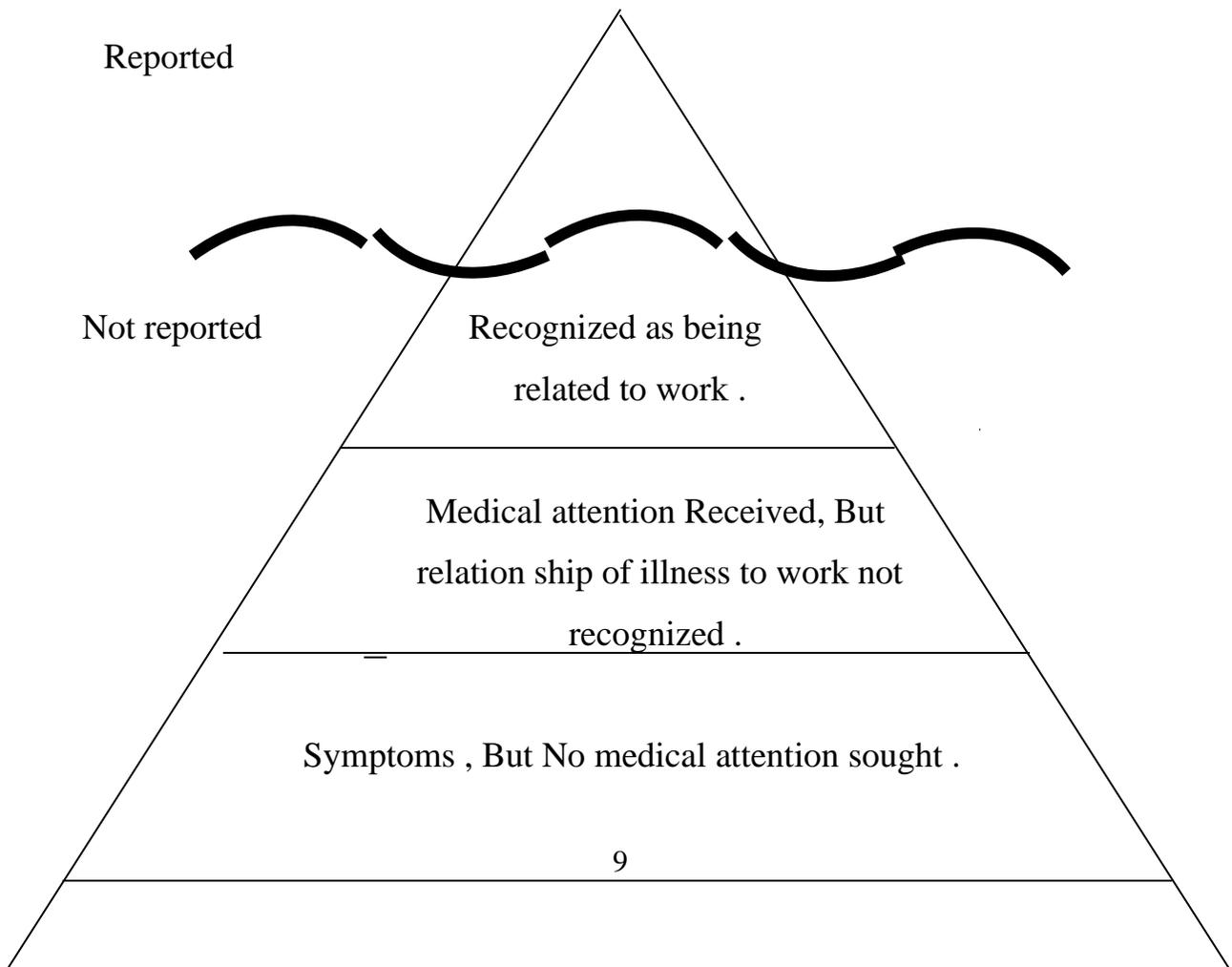


**Of the 5.8 Million Cases Reported in 1996, 439,003 Were Illnesses:**

■ 281,128 disorders associated with repeated trauma (29,937 cases of carpal tunnel syndrome)

- 53,018 all other occupational illnesses
- 58,099 skin diseases or disorders
- 3,473 dust diseases of the lungs
- 21,724 respiratory conditions due to toxic agents
- 4,785 poisonings
- 16,776 disorders due to physical agents

**Figure (2) “ The Ice- berg” of occupational diseases**



Affected But , No Symptoms .

### **Occupational health programme:**

Each country and each enterprise has to develop its own occupational health programme to deal with full relationship between work and the total health of man.

The WHO Expert Committee on Environmental and Health monitoring in Occupational Health stated that occupational health programmes should have the following aims:

#### **1.Control of hazards:**

To identify and bring under control at the workplace all chemical, physical, mechanical, biological, and psycho-social agents that are known to be or suspected of being hazardous.

#### **2.Match suitable workers and jobs:**

To ensure that the physical and mental demands imposed on people at work by their respective jobs are properly matched with their individual anatomical, physiological, and psychological capabilities, needs and limitations.

#### **3.Provide protection:**

To provide effective measures to protect those who are especially vulnerable to adverse working conditions and also to raise their level of resistance.

#### **4.Improve the work environment:**

To discover and improve work situations that may contribute to overall ill health of workers in order to ensure that the burden of general illness in different occupational groups is not increased over the community level.

#### **5.Implementation of health policies:**

To educate management and workers to fulfill their responsibilities relevant to health protection and promotion.

#### **6.Provision of occupational health:**

To carry out comprehensive in-plant health programmes dealing with man's total health, which will assist public health authorities to raise the level of community health.

The above goals are in line with the ' Health For All by the Year 2000 ' policy which has been adopted by all countries of the world.

#### **General principles for preventing and controlling occupational hazards:**

- 1. Educate the workers:** inform the workers of the hazards in the working environment and how they can protect themselves and other workers.
- 2. Replace hazardous chemical:** use the alternative safer compound as replacement for hazardous chemicals.
- 3. Modify the process:** engineering and other modifications can make a process safer, e.g. wet drilling to reduce dust in milling.
- 4. Eliminate toxic process at source:** remove the hazardous product to minimize the contamination of the environment, e.g. use exhaust fans to remove dust at the point of drilling.
- 5. Limit the number of workers exposed:** confine the hazardous process to a restricted area to which only essential workers have access and avoid unnecessary exposure.
- 6. protect workers:** workers should use protective gowns, gloves, goggles and other protective equipment as required.
- 7. Monitor the environment:** measure the environmental contamination, e.g. dust level.

- 8. Monitor exposure of workers:** measure the degree to which individual workers are exposed, e.g. using film ( radiologist ).
- 9. Monitor the health of workers:** workers in hazardous employment should be monitored to look for early signs of adverse effect, e.g. blood test in workers exposed to lead.
- 10. Establish emergency and first aid services:** workers and health staff should be trained to deal with emergencies.

## **Lead poisoning**

## **L3**

Lead is a soft, heavy, blue-gray metal. It occurs naturally in the Earth's crust but has been spread throughout the environment by various human activities. In the past, lead also was used in house paint and gasoline.

Lead poisoning is widespread throughout the world. Non-occupational lead poisoning occurs in adults and children, but adults are exposed to lead primarily in workplace.

Lead affects multiple body systems and can cause permanent damage.

Some Sources of lead:

- 1- Leaded gasoline
- 2- Lead- glazed cookware and dishes especially with acidic fluid
- 3- Ship building or repairing
- 4- Electrical insulation
- 5- Paint manufacturing
- 6- Battery industry
- 7- Plastic manufacturing
- 8- Printing industries
- 9- Manufacture of radiation shielding
- 10- Beauty products such as kohl eye make-up, certain hair dyes

**Routs of exposure, absorption and metabolism:**

- 1- Inhalation: mainly the inorganic lead is inhaled as fumes and soluble respirable dust.
- 2- Skin: mainly the organic lead can be absorbed through the intact skin.
- 3- Ingestion: usually the main route in environmental contamination but less in occupational or industrial contamination.

Adults absorb approximately 15% of an ingested dose through gastrointestinal tract in contrast to 50% GI absorption in children. Once absorbed, lead is found in all tissues, eventually >90% of the body burden is accumulated into the bone, where it remains for many years. Lead is excreted primarily through the urine (>90%), less amount is eliminated via feces, sweat, hair, and nails.

### **Symptoms of Lead Poisoning:**

Because lead interferes with the function of enzymes and essential cations particularly calcium, in cells throughout the body, lead poisoning is usually associated with multisystem signs and symptoms.

Clinically, the most significant are: neurologic, hematopoietic, GI, cardiovascular, renal, and reproductive system.

Early symptoms are often nonspecific involving the nervous system (fatigue, irritability, sleep disturbances, headache, difficulty in concentration, decreased libido), GI system (abdominal cramps, anorexia, nausea, constipation, diarrhea), musculoskeletal system (arthralgia, myalgia).

In severe and chronic lead poisoning, the symptoms are rather vague accompanied by headache, anemia, peripheral neuropathy, blue line in the gums and encephalopathy.

Lead anaemia is caused by:

- inhibition of haemosynthesis
- direct effect of lead on RBC by alternating the permeability of its membrane
- alternation of iron metabolism

### **Management:**

Start with general and lead-specific history, physical examination and lab tests. The single best diagnostic test for lead exposure is the blood lead level (BLL). It reflects both the current exogenous exposure to lead and

endogenous slow release of lead that may have accumulated in the bones over a period of years.

Erythrocyte protoporphyrin (EP) or zinc protoporphyrin (ZPP) is sometimes used as an indirect measure of lead exposure, an increase indicates that lead is affecting the haem synthesis pathway.

Primary management of lead poisoning is source identification and removal from exposure. Medical treatment depends on an individual basis. Chelating therapy is indicated in adults with high blood lead level  $> 100\mu\text{g/dl}$  who have significant symptoms.

### **Mercury**

Mercury (Hg) is a metal that occurs naturally in the environment and exists in different forms: 1-Metallic 2- Inorganic 3- Organic compounds.

The most common occupations involving mercury exposure are:

- 1- Metallic mercury: production of chlorine gas; manufacture of thermometers, manometers and barometers; jewelry; production of mercury battery cells; production of fluorescent tubes and mercury vapor lamps; preparation of dental amalgams.
- 2- Inorganic mercury: synthesis of mercury compounds; reagents in analytical chemistry. Numerous compounds have been used as germicides, insecticides, fungicides and topical antiseptics.
- 3- Organic mercury: laboratory reagents; preservatives and antifungal in paints or ink and adhesives; disinfectants and in laundry services.

The most common sources of exposure to mercury at home:

- 1- Some mercury compounds are still used as topical antiseptics and disinfectants in eye drops, eye ointments, nasal sprays and vaccines. Others were widely used at one time as laxatives, worming medications, teething powder and in herbal preparations.
- 2- The mercury in food is generally present in the form of methyl mercury. In severe environmental contamination. Ingestion of fish from polluted water may reach toxic levels. In Iraq in the 1970s, toxic levels

were reached after eating bread prepared from wheat treated with a methyl mercury- containing fungicide.

Other sources of exposure:

Inhalation of mercury vapor released from spills, incinerators and other facilities that burn mercury containing fuels.

**metabolism:**

<b>Route of absorption:</b>	<b>Organic</b>	<b>Inorganic</b>	<b>Metallic</b>
Gastrointestinal tract	very high	low(10%)	very low(0.1%)
Skin- mucosa	possible	possible	very low
Respiratory tract	easy	depend on compound	very high

Metallic and inorganic mercury are **eliminated** mainly through urine and feces, organic mercury is excreted predominately in the feces. Both inorganic and methyl mercury are excreted in breast milk.

Note: The urinary elimination of mercury persists for long period after cessation of occupational exposure because mercury accumulates in the kidneys and brain, then small amounts are constantly released.

Symptoms of acute poisoning:

Inhalation of metallic mercury causes cough, dysnea, chest pain, fever, chills, asthenia, myalgia, vomiting, diarrhea, and in sever cases, pneumonitis and pulmonary edema.

Chronic effects:

The most critical target organ is the central nervous system. The classical symptom is intentional tremor associated with personality changes, irritability, loss of memory and insomnia. The tremor usually begins in the eyelids, lips, and fingers increases with movement, is aggravated by stress and disappears during sleep. Sever cases may result in generalized tremor with violet spasms. Other neurological symptoms include:

Disturbance in hand writing, speech disorder, spastic gait, hyperactive tendon reflexes, parasthesia, alternation in taste and smell, hearing difficulty, touch and pain modalities in the fingers and toes, visual defect; and toxic organic psychosis may present as anxiety neurosis

The kidney is the second major target organ. Mercury causes kidney damage and nephrotic syndrome.

In case of inorganic compound, psychric symptoms tent to predominate over the neurological symptoms, whereas the reverse is true for organic compounds.

Other symptoms include gingivitis and excessive salivation; the teeth may become loose and drop out or become blackened and eroded. A mercury blue line may be seen in the gums. Skin lesions included irritant dermatitis and discrete ulcers.

Death occurs due to respiratory failure from lung fibrosis.

**Management:**

Urine is the most commonly used medium for monitoring occupational exposure to metallic and inorganic mercury. Blood levels are measured less frequently.

Treatment of mercury poisoning includes:

- 1- Immediate withdrawal from exposure.
- 2- Close pulmonary monitoring after acute inhalation of metallic mercury vapor.
- 3- Gastric lavage after ingestion of inorganic salts.
- 4- Symptomatic treatment includes chelating therapy for mobilization of mercury from the body.

# **Occupational Lung Diseases**

## **L4**

Occupational lung diseases are a group of illnesses that are caused by either repeated, extended exposure or a single, severe exposure to irritating or toxic substances that leads to acute or chronic respiratory disorder.

There are two broad categories of occupational lung diseases:

- 1- Diseases that are not occupation-specific, but are aggravated at work, such as occupational asthma; and
- 2- Diseases related to a specific occupation, such as asbestosis, coal worker's pneumoconiosis.

COPD (chronic obstructive pulmonary disease) and even lung cancer, though primarily caused by smoking, can also result from workplace exposures.

Certain occupations are associated with an increased risk of developing occupational lung diseases. They include:

- construction and industry workers who are exposed to asbestos,
- farmers who are exposed to a variety of dust and mineral particles,
- miners who are exposed to coal and minerals.
- Firefighters are also exposed to dust, combustion particles, gases, fumes, and other noxious materials while on the job.

## **Asbestosis**

Asbestosis is a progressive disease that results from breathing in microscopic fibers of asbestos. Asbestos belongs to naturally occurring fibrous, hydrated silicates that are present everywhere in the soil.

Throughout much of the twentieth century, many different construction and manufacturing applications involved the use of asbestos. In the U.S., asbestos use peaked in 1973 and but had declined by 99.8 percent in 2007.

Occupations associated with asbestos exposure:

- Asbestos miners
- Asbestos removal workers
- Asbestos paper makers and users
- Boilermakers
- Construction workers
- Electricians
- Glass workers
- Petroleum refinery workers
- Pipe fitters
- Plumbers
- Railroad workers
- Textile workers

Asbestos exposure mostly through inhalation route result in both non malignant and malignant asbestos- related respiratory diseases. The non- malignant manifestations include asbestosis, pleural plaques, benign pleural effusion, diffuse pleural thickening and rounded atelectasis. Malignancies include lung cancer and mesothelioma.

**The latency period** ( the time between fist exposure and clinical manifestation of disease) is long, 20- 30 years in asbestosis, 20-40 years in lung cancer, and 30-40 years in mesothelioma.

**Pathologically**, asbestosis causes bilateral interstitial fibrosis of lung parenchyma.

**Symptoms:** slowly progressive dyspnea on exertion, cough, chest pain, weight loss and haemoptysis.

**Diagnosis:**

- Clinical findings and history of exposure
- Chest x- ray and chest CT scan: interstitial fibrosis
- Pulmonary function tests : restrictive pattern
- Histological evaluation of lung tissue through biopsy

**Risks and complications:**

- 1- pulmonary hypertension and severe cardiovascular problems.
- 2- lung cancer . Tobacco smoke and asbestos enhance the carcinogenic effects of one another.

3- Additional lung problems that are associated with the pleura are possible. Thickening of the pleura may lead to pleural effusion and/or the development of pleural plaques. These calcified deposits are harmless, but pleural thickening can be a precursor to the development of mesothelioma.

**Treatment:**

No specific treatment. Corticosteroids and immunosuppressive agents tried without success. Thus treatment is supportive:

Oxygen therapy, intercurrent infections should be treated and treating any complication.

## Silicosis

Silicosis is one of the oldest occupational lung diseases in the world. It is caused by exposure to inhalation of airborne crystalline silica (crystalline silicon dioxide), a main form is quartz.

Silica (SiO<sub>2</sub>) is the name of a group of minerals that are found in mines, foundries, blasting operations, stone, clay, and glass manufacturing. Dust particles from silica can penetrate the respiratory system and reach alveoli. This causes fibrosis to develop in the lungs and impair the exchange of oxygen and carbon dioxide in the blood.

More than one million workers are exposed to silica each year. Though symptoms of silicosis rarely develop in less than five years, progression of the disease can lead to extreme shortness of breath, loss of appetite, chest pains, and respiratory failure, which can cause death. Silicosis also makes a person more susceptible to infectious diseases of the lungs, such as tuberculosis.

Occupation at risk include miners, sandblasters & manufactures of products such as glass and ceramics.

**Three types of clinical presentation:**

- Acute silicosis : Occurs within 2 years.
- Accelerated silicosis : Develops in 5-15 years.
- Chronic silicosis : Most common and develop in more than 20 years after exposure.

Acute and accelerated types are associated with high level of exposure.

**Diagnosis:**

Occupational history. Simple silicosis is usually asymptomatic, in advanced disease, cough and dyspnea.

Pulmonary function tests : often normal

Chest x- ray : silicotic nodules are located in upper lobe and hilar lymph nodes enlarged with pleural thickening.

**Complications:**

- Increase risk of tuberculosis
- Increase incidence of fungal infections
- Risk of lung cancer
- Increase incidence of collagen vascular disease.

**Treatment:**

Removal from further exposure, smoking cessation, supportive measures such as supplemental oxygen, treatment of heart failure, observation for early detection and treatment of tuberculosis, and bronchoalveolar lavage.

## **Coal workers' pneumoconiosis**

Also known as black lung disease. It is a fibrotic lung disease caused by inhalation of coal dust and other carbon materials. Coal worker's pneumoconiosis occurs in two forms: simple and complicated progressive massive fibrosis

The basic pathologic lesion is the coal macule with a zone of emphysema surrounds the macules.

Presentation is typically 20 years or more after onset of exposure. About 2.8 percent of coal miners have coal worker's pneumoconiosis.

**Diagnosis:**

Detailed occupational history

Physical examination is not helpful, pulmonary function tests are often normal.

Chest x-ray : round nodules located predominantly in the mid and upper lung zones, cavitations of larger masses may be seen due to necrosis.

**Complications:**

- Obstructive lung disease
- Tuberculosis and other infection
- Lung cancer
- 

No specific treatment

Prognosis is good

## **Byssinosis**

It is a spectrum of respiratory symptoms and functional impairment in workers exposed to dust from cotton. It has many features of asthma. A unique feature is “Monday feeling”: the affected workers have more problems on the first day of the week, and then improve after successive work days.

Mechanisms by which cotton fiber dusts cause byssinosis:

1. Non-immunologic release of histamine.
2. Antigen- antibody reaction.
3. Bacterial endotoxins.
4. Fungal enzymes.
5. Non-specific pharmacological mediator release.

**Latent period:** more than 10 years of exposure. This character distinguishes byssinosis from occupational asthma.

### **Diagnosis:**

- Appropriate exposure history
- Symptoms of chest tightness and dyspnea, signs of wheezing which is no regular.
- Pulmonary function tests before; during and after a work shift demonstrates airway obstruction.
- Chest x- ray: either normal or hyperinflation.

### **Treatment:**

- Avoidance of further exposure.
- Inhaled bronchodilators, steroids and sodium cromoglycate.

### **Prognosis:**

Uncertain. Airway obstruction may persist permanently.

## Occupational skin diseases

Work-related skin diseases account for approximately 50 percent of occupational illnesses. They are often underreported because their association with the workplace is not recognized.

Occupational skin diseases affect workers of all ages in a wide variety of work settings. Industries in which workers are at highest risk include manufacturing, food production, construction, machine tool operation, printing, metal plating, leather work, and engine service.

### Factors affecting occupational skin diseases:

1- **mechanical factors:** such as friction, pressure, and trauma. It causes cuts, abrasions, and infections. Repeated trauma causes callosities" thickening of the skin".

#### 2- physical factors:

- Heat causes heat rashes.
- Cold causes chilblains, and blue foot.
- Electricity causes burns.
- Sunlight causes sunburn and malignant changes.

#### 3- chemical factors:

- primary irritants: cause irritant dermatitis depending on concentration and duration of exposure. EX: alkalis and acids,
- Sensitizers: produce cell- mediated hypersensitivity and allergic contact dermatitis. EX: dyes and insecticides and oils.

#### 4- plants and their products:

as in farmers, gardeners, carpenters... who work with toxic woods and materials.

#### 5- biological agents:

- Dermatitis caused by mites: the lesion develops after a period of 12- 16 hours from exposure, and consists of papules, vesicles, pustules, and urticarial wheals of face, neck, arms and trunk.

- scabies: outbreaks are well known in camps. It is due to lack of hygiene rather than the occupation itself.
- Vitiligo: depegmentation of skin. The occupational vitiligo do not differ from true vitiligo but there is no evidence of autoimmune disorder as in true vitiligo.

### **General Principles of Diagnosis:**

It is advisable to screen all patients with skin disease for a work-related cause. If occupational skin disease is suspected, questions should be asked about the exact time relationship between the skin condition and the work exposure, including the effects of time off and return to work. An in-depth occupational history should cover the following points:

- General work conditions and specific activities in the patient's present job that involve skin contact with potential hazards.
- Physical, chemical, and biologic agents to which the patient is or may be exposed.
- Presence of skin diseases in fellow workers.
- Control measures to minimize or prevent exposure in the workplace, including personal and occupational hygiene (e.g., handwashing instructions and facilities, showers, laundry service) and the availability of gloves, aprons, shields, and enclosures.

The history of the illness and the occupational history may reveal a close association between the skin condition and a specific work exposure known to produce such skin effects. The appearance of the condition may also suggest the cause. For example, a glove-pattern distribution of vesicular lesions on the hands strongly indicates a contact dermatitis.

It is not unusual to discover an underlying skin disease that is exacerbated by work exposures.

**Contact dermatitis**, which includes irritant contact dermatitis and allergic contact dermatitis, accounts for 90 percent of skin disorders acquired in the workplace.

### **IRRITANT CONTACT DERMATITIS:**

**Clinical Features:** In irritant contact dermatitis, the rash appears in exposed or contact areas, in thin skin more often than thick skin (e.g., dorsum of the hands rather than the palms), and in the area around the belt or collar. The rash may be difficult to differentiate from the rash of allergic contact dermatitis.

Acute lesions are painful, weepy, and vesicular, whereas chronic lesions are dry, erythematous, cracked, and lichenified. The lesions assume a clearly demarcated pattern and are often asymmetric and unilateral. Hardening or adaptation of the skin may occur as a result of repeated contact with moderate irritants .

**Diagnosis:** The diagnosis is based on the presence of rash in exposed areas and clinical improvement of the rash on removal of the offending agent.

**Treatment:** For exposure to severe irritants, the extent of injury can be reduced by immediate, continuous, and prolonged water irrigation (up to three hours), with contaminated clothing removed while the affected area is under water. With large or full-thickness burns, hospitalization may be necessary

### **ALLERGIC CONTACT DERMATITIS**

**Clinical Features:** Rash appears in areas exposed to the sensitizing agent, usually with an asymmetric or unilateral distribution. Sensitizing agent on the hands or clothes is often

transferred to other body parts. The rash is characterized by erythema, vesicles, and severe edema. Pruritus is the overriding symptom.

In photoallergic dermatitis, sunlight and exposure to the offending substance usually affect the face and arms, but the sun-shaded area under the chin is generally spared. Although sunlight is essential for the initiation of photosensitization, the dermatitis may continue long after the photoallergy is eliminated (a condition known as a "persistent light eruption").

**Treatment and Prevention:** Allergic contact dermatitis improves with removal of the sensitizing agent. Desensitization to agents provides protection that is incomplete and lasts for no more than a few months; thus, desensitization must be repeated each year to maintain partial resistance.

### **OCCUPATIONAL SKIN NEOPLASMS**

Skin tumors can result from exposure to substances such as polycyclic hydrocarbons, inorganic metals, and arsenicals. These lesions can also develop because of trauma, burns, and exposure to ultraviolet light or ionizing radiation. Frequently, the skin tumors do not appear until two or three decades after the exposure.

#### **General control measures:**

1. As long as proper protective measures are in place, workers with irritant or even allergic contact dermatitis often can remain on the job. However, ordinary protective measures may be inadequate for some workers with allergic contact dermatitis. It may be necessary to recommend that these persons be given a different job or moved to another workstation.

2. Many dermatoses can be prevented by improved worker and workplace cleanliness. Workers should be counseled about personal hygiene.
3. The following should be recommended: provision of effective, nonirritating, non-allergenic skin cleansers; frequent clothing changes; daily showering; and rapid removal of oil- and chemical-soaked clothing.

### Selected Occupational Exposures and Protective Measures

Exposure	Protective measures
Dust, fiberglass, irritating solids (e.g., cement)	Clothing made of tightly woven material, pre-application of mild dusting powder, gloves, steel-tipped shoes
Liquids, vapors, fumes	Face shields, plastic or synthetic rubber gloves and aprons, adequate ventilation
Moderate alkalis, solvents	Synthetic rubber, or hypoallergenic gloves with replaceable soft cotton liners
Trauma	Leather gloves with smooth finish.
Sunlight, ultraviolet light	Sunscreen, protective clothing (hat, long-sleeved shirt or jacket)

### **Occupational cancer:**

Generally, cancers of occupational origin are not distinguishable by their clinical presentation from other cancers. Those agents that have been reported to have a high incidence of or mortality from cancer include:

- aromatic amines – high risk of cancer of the bladder ( aniline, & benzidine );
- Asbestos – significant increase in risk for cancer of lung, larynx, gastro – intestinal tract;
- Benzene – acute myelogenous leukemia;

- Beryllium – increased risk of lung cancer;
- Cadmium – increased risk of lung cancer;
- Chromium – increased risk of nasal and respiratory cancer;
- Nickel – increased risk of nasal cancer.

### **Occupational injuries:**

Occupational accidents are more serious and easier to report than other occupational disorders. There are 5 main factors that play a role in the high incidence of occupational accidents:

1. Inadequately controlled environmental factors;
2. Limited safety education;
3. Lack of protective equipment;
4. Higher susceptibility attributable to difficulties in adapting to mechanized work;
5. Low standards of general health.

## **Occupational Health Hazards of Health Care Workers L5**

### **Health care workers occupational hazards:**

1. Biological (Avian Influenza, SARS, TB, HIV, Hepatitis)
2. Chemical (drugs, disinfectants, pesticides)
3. Ergonomic (lifting, transfers)
4. Stress/Violence (staffing shortages, shift rotation)
5. Physical Hazards (radiation, heat, noise)

### **Categories of health care workers:**

1. Clinical: physicians, dentists, physical therapists.
2. Nursing
3. Clinical support: pharmacists, lab technicians, diagnostic imaging technicians, operating room technicians, security personnel
4. Facility support: engineering personnel, maintenance staff, housekeeping staff, food services staff, administrators.
5. Office based: clerical support personnel

**Biological hazards:** Blood borne pathogens: a broad range of blood-borne infections can be transmitted to health care workers via: Needle sticks, Splashes onto mucous membranes of mouth, eyes, and nose or even skin

**Human immunodeficiency virus:** the magnitude of risk from each exposure to HIV is approximately 0.3% per parenteral exposure.  
Transmission: parenterally, sexually, breast feeding, across placenta

**Hepatitis B virus, HBV:** Prior to the development of HBV vaccine, HBV represented one of the most significant work place risks for HCW.  
Transmission: HBV is transmitted parenterally, with percutaneous exposure

to infected blood the most important mode of occupational transmission. Mucus membrane exposure may also result in infection.

**Hepatitis C virus, HCV:** HCW are at risk for HCV infection as a result of parenteral or mucus membrane exposures to blood from patients infected with HCV. Transmission: same as HBV

**Risk of virus transmission :** Following percutaneous injury:

- HBV 6 – 30 out of 100 people
- HCV 3 – 10 out of 100 people
- HIV 1 out of 300 people

**Tuberculosis TB:** Transmission: by droplet nuclei produced during expiratory efforts (coughing, sneezing, talking...) of infected patients. Criteria for exposure: any close or even casual contact with an infected patient who is not appropriately isolated should be considered a potential exposure.

**Chemical hazards:**

- Anesthetic gases: health care personnel working in operating rooms, labor and delivery areas.
- Exposure may occur to nitrous oxide alone or in combination with halogenated agents (e.g. fluoroxene).
- Nitrous oxide levels could reach levels as high as 1000ppm in dental operations and 300ppm in hospital operating rooms. (normal <25ppm)
- Prevention of excessive nitrous oxide in operating rooms is achieved by protective devices.
- Risks of exposure: infertility, congenital anomalies.

**Hazardous drugs:** The principle hazardous drugs of concern in medical centers are antineoplastic agents. Exposure to antineoplastic drugs can occur in a wide range of occupations (pharmacists, oncology nurses, physicians, housekeeping)

**Exposure risks:**

- Spontaneous abortion
- Infertility
- Ectopic pregnancy
- Low birth weight & preterm delivery
- Congenital anomalies

**Formaldehyde (Formalin):** Exposure occurs among workers in anatomy, pathology, and histology labs. High exposure levels may cause tracheobronchitis, chemical pneumonitis and pulmonary edema.

**Ethylene Oxide:** Used as a cold sterilizing agent for medical supplies. Mainly personnel involved in surgical sterilization are exposed. Main route of exposure is inhalation. High levels of exposure can cause burns of skin and eyes, bronchitis, asthma, pulmonary edema

**Elemental Mercury:** Mainly in dentistry. Exposure route is inhalation. Risks of exposure: mostly neurological dysfunctions.

### **Physical hazards:**

**Musculoskeletal injury:** HCW have a high incidence of MSK injuries, especially in nursing staff. Risk factors: heavy patient weight, long horizontal distance between the lumbosacral spine and hands of the HCW.

**Noise:** Excessive noise exposure can be found in HCW working in central sterile supply area, operating rooms, food services area, maintenance, laundry. Noise (>90 dB, in 8 hours) may cause increased HR, BP, hearing loss, impair concentration.

**Heat:** Excessive heat exposure is most commonly found in kitchen facilities, boiler room, and laundry area. Health effects: dermatitis, syncope, heat cramps, heat exhaustion, and heat stroke. Prevented by insulation of heat source and proper ventilation.

**Lasers:** Found in operation room. Can cause severe burns

**Radiation:** HCW represent the largest group of individuals occupationally exposed to radiation. Exposure must be below 50 mSv/yr. Exposure may occur mostly with personals working at imaging centers and oncology. Protection is achieved by bodily protection with lead aprons.

**Violence:** HCW have a high risk of violence. Due to many reasons:

- Frustrated patients
- Aggressive patients
- Visiting family members
- Robbery due to presence of money and drugs.

**Shift work:** Effects of shift work: disruption of the normal circadian physiologic rhythms leading to an altered sleep-wake cycle, and also leads to social disruptions. Shift workers who do not adjust to shift work may develop a syndrome of chronic fatigue, sleep disturbance, depression, mood disturbance and personality changes.

**Latex allergy:** Contents of latex which is mainly used in making gloves: natural material extracted from rubber tree, it is a complex of protein, lipid, and phospholipids.

- Latex proteins cause type I hypersensitivity reaction
- Type I immediate hypersensitivity reactions to soluble latex proteins may range from localized urticaria, to systemic urticarial reactions, conjunctivitis, angioedema, bronchospasm.

## **Prevention:**

- 1- **Hand washing** prevents spread of infection from patient to HCW and from patient to patient
- 2- **Immunization:** recommended: Hepatitis B, MMR, influenza, varicella, tetanus
- 3- **Prevent Chemical Exposure:** •Substitute less hazardous chemicals, •Change to non-spill containers, •Keep containers closed, •Work under hoods, •Wear personal protective equipment, (gloves, masks, aprons)
- 4- **Prevent Physical Injuries:** •Muffle noisy machinery or wear ear plugs., Guards on machines, •Use “sharps” containers, •Dry wet surfaces
- 5- **Reduce Stress:** •Define aggravating factors, •Establish discussion/support groups, •Change work design, •Involve Employee Assistance personnel

- 6- **Elimination or substitution of sharp:** eliminate unnecessary injections, needleless IV systems.
- 7- **Administrative (policies and training programmes)**
- 8- **Work Practice Controls** (Universal Precautions, no recapping, provision & placement & removal of sharps containers)
- 9- **Personal Protective Equipment** (gloves, masks, gowns)
- 10- **Personal hygiene**