Al- Majmaah University

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Health care system and vocational safety

Level 1

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HEALTH CARE MANAGEMENT

Definitions of administration:
1- It is to do things through people. This needs science (facts, rules & laws) & skills (communication & decisions)
2- It is the art & science of utilizations resources (human & non-human) to perform a certain job.
3- It is the science & art of guidance, leadership & control of efforts of a group of individuals towards some common goals.

PUBLIC HEALTH ADMINISTRATION

Definition: It is the application of the science & art of administration in managing public health problems & facing the health demand & needs of community.

Tasks of Administrator:
- Directs the activities of other persons.
- Undertakes the responsibility for achieving certain objectives.

Basic skills of Administrator:
- Technical skill: working with things at lower level.
- Human skill (communication): working with people at every level.

Community: It is a group of individuals or families living together in a defined geographical area, usually a village, town, or city.

Community problems:
- Health problems.
- Health services problems.
- Health related problems.
Components of public health administration

- **Planning**: How to transfer polices, strategies & objectives into procedures easy to be achieved.
- **Organization**: It is the development of work structure in which the necessary tasks are carried out to reach the organization’s objectives.
- **Staffing**: Appointment of personnel.
- **Directing**: It is a process of supervision & instructions from the responsible personnel (leader).
- **Coordinating (controlling)**: It is the process through which there is insurance that plans are being followed.
- **Reporting**: It is important process for every plan to make a daily, weekly, monthly or yearly report from lower level to higher level to assess the progress.
- **Budgeting**: It is required for all components of public health administration
- **Evaluation**: To what extent the public health program meet the objectives
1- **Planning**

- **Definition:** It is the process of determining goals & how they are to be achieved.
- **What is strategic planning?** It is the formalized, long-range planning process used to define and achieve organizational goals (long-acting planning).
- **What is the operational (program) planning?** done at lower levels, focus on present operations.

**Planning process**

**Situation analysis:** Analysis of present (current) situation showing the past trend & forecast (predict) for the future policy (socio-economic, demographic, epidemiological, resources & services).

- **Define the problem:** It is a difficulty or obstacle not easy to change seen to exist between a present situation & a desired future objectives.

- **Problem analysis:**
  - **Identification the nature of the problem:** Medical, social, economic, medico-socio-economic
  - **Extent of the problem:** From population census, morbidity, mortality data & existing program.
  - **Pattern of spread of the problem:** progression, unchanged. In case of infectious disease (pandemic, epidemic, endemic, sporadic & outbreak)
  - **Hazards & sequels of the problem:** Immediate or late hazards.

**Setting objectives:**
**Goal:** is a broad term referred to a desirable future status. It needs not to be immediately attainable, not restricted by time or existing resources.

**Decision-making**
- **Definition:** It is the function carried out by the head of the organization. It requires the selection of alternatives that best meet the needs of the community.
- **Process of decision-making:**
  1. Identify the problem then the objective.
  2. Determine the alternative course of action.
  3. Predict the outcome of each alternative.
  4. Select the alternative that best meet the need.

**ORGANIZATION**

- **Definition:** It is the development of a work structure (framework) in which the necessary tasks are carried out to reach the organizational objectives.
  Or: It is setting up a formal structure of activities.
  Or: It is the division of work to make that structure efficient.
  Or: It is grouping the efforts (job description).
- **Grouping of efforts based on:**
  1. Kind of services.
  2. Types of clients.
  3. Organizational chart which includes:
     - Skeleton (to show major units)
     - Personnel (names of persons occupying the different major units)
     - Functional chart (functions, duties & activities of every one or group).
- **Steps of organization**
1- Detailing all activities (work) that must be done to attain the organizational goals.
2- Dividing the workload into activities can be performed by a person or a group.
3- Setting up a mechanism to coordinate the workload.
4- Monitoring the effectiveness of the organizational work.
5- Communications: exchange of understanding between a sender and a receiver.

**The communication process:**

- **Sender**: to transmit or translate information to receiver through a communication media (words, actions & pictures).
- **Receiver**: has to accept that information and then interpret it.
- **Methods**: oral or written communication.

**Principles of organization**

**I- Structural organization**: It is the ways in which it divides its work into distinct tasks and then achieves coordination among them.

**II- Functional organization**: The activities each individual in the organization is responsible for & performs.

**III- Authority and Delegation**

3- **EVALUATION**
Definition: It is the process of determining the amount of success in achieving predetermined objectives.

Evaluation should be based on:
Information gained from monitoring the implementation of policies, strategies and plans of action.

Categories of evaluation: There are five distinct categories of evaluation as follows:
1- Appropriateness: It relates to the extent to which programs are directed toward those problems which are believed to have the greatest importance.
2- Adequacy: It is concerned with the extent of a problem that a particular program intends to eliminate. Are these resources enough to carry out the activities?
3- Effectiveness: It concerns the extent to which pre-established program objectives are attained as a result of program activity (always be determined before efficiency).
4- Efficiency: It relates to the cost of resources of attaining objectives compared to the benefits obtained (optimal use of resources).
5- Side effects: They are effects of program operations other than attainment of objectives (all possible effects that could have occurred, positive and negative).

Levels of evaluation:
1) Evaluation of the program objectives: (design and structure)
   Are the objectives SMART(specific, measurable, acceptable, realistic, timeliness)
2) Evaluation the program operation:
   ▪ Resources: (human and nonhuman)
   ▪ Efforts: Measures the activity done by the program & its staff.
   ▪ Performance: We measure the quality of the effort.
3) Evaluation the program achievement:
• **Adequacy performance:** the percentage of objectives, which has been met by the implemented program.

• **Efficiency:** It is the ratio between improved or end result (outcome) per extended efforts (resources and activities performed)

  \[
  \text{Efficiency} = \frac{\text{Outputs}}{\text{Inputs}}
  \]

❖ **Methods of evaluation:**

1. By recipients.
2. By experts (outsiders).
4. By scientific measurements:
   • Defining aim of evaluation.
   • Describing the plan.
   • Setting the objectives.
   • Setting hypothesis.
   • Determined the criteria of success.
Hospital Administration

- Function of modern hospitals (WHO):
  - Restorative, preventive, educational and research centers.
  - It must be sensitive to the change in structure and function according to the community development.

- Effective hospital: which is able to achieve good results in terms of prevention, cure of disease and disability with no or minimum waste.

- Catchment area of the hospital:
  - Definition: It means all cases of diseases coming through attendance at a clinic rather than by field services in the community.
  - Factors affecting catchment area:
    1. The demography of the area.
    2. The attractiveness of the hospital to local population.
    3. The accessibility of the service.

- Hospital utilization:
  - Definition: It means the manner by which a certain community makes use of its available resources efficiently and effectively.
  - Factors affecting utilization:
    - The characteristics of the population.
    - Medical care applied to the people.
    - The interaction between the clients and the hospital.

- Indices used to measure hospital performance are:
  - Indices related to the population at risk:
    1. Hospital admission rate: It is the total number of hospital admission per 1000 of population per year.
    2. Bed occupancy ratio: It is average daily number of persons hospitalized per 1000 of the population.
3- **Bed population index**: It expresses the availability of hospital beds in terms of the number of beds per 1000 of population.

**Indices related to hospital:**

1- **Hospital beds**: the total number of beds available in the hospital.

2- **Admissions**: means the number of patients, accepted per year by a hospital, which received medical care in residence and expected to remain for one or more nights.

3- **Average length of stay**: the average period of stay in hospital (in days) per patient admitted per year.

4- **Bed occupancy rate**: it is obtained by dividing the daily average number of bed occupied per the percent of the hospital beds.

5- **Turnover interval**: the average period in days that a bed remains empty.

6- **Discharges and deaths**: the number of discharges (the patients who have left the hospital, those transferred to another health institution and those who have died).

**The most common indicators to measure performance of hospital are:**

1) Hospital admission rate

2) Average length of stay

3) **Bed occupancy rate**: \( \text{average daily admission} \times \text{average length of stay} \times 100 \quad \text{Annual available beds} \)

   - This index has a great value in measuring of the efficiency of hospital utilization.

4) **Bed turnover rate**:

   The number of patients discharged from a hospital during the study year

   \( \quad \text{The average number of a available beds} \)
Health System and Primary Health Care

Health system components:

1) Governmental Sector which include:
- MOH (ministry of health).
- Ministry of High Education
- University Hospitals
- General Organization of Teaching Hospitals
- Ministry of Interior.
- Ministry of Defense.

2) General sector:
- Health Insurance
- The Curative Organization

3) Private Sector:
- Private clinics uni/multiple or hospitals

Levels of service delivery:

Primary health care level:
1- Family and home.
2- Community health activities.

3- P.H.C. (Primary health care) facilities:
- Rural Health Units.
- Combined Rural Health (Rural Health Centers).
- Integrated Hospitals (Rural Hospitals).
- Urban Health centers.
- Health Office.

Secondary level: General hospital

3) Tertiary level: specialized hospitals & centers.
**Definition of Primary Health Care:**

1- PHC is the essential health care based on appropriate and acceptable methods and technology made universally accessible to individual and families in the community through their full participation and at a cost that the community and country can afford.

2- PHC is the first level of contact of individuals, the families and community with the health system bringing health care as close as possible to where people live and work.

**Concepts of the implications of health for all:**

1- Because of the principles of equity, there should be universal coverage with essential health services.

2- Health services should be effective, efficient and acceptable to local communities through the choice of appropriate methods.

3- Health care activities should include disease prevention, health promotion, curative and rehabilitative services.

4- Individual and community should participate in health services.

5- Protection of health needs cooperation of all developmental activities (health, social, economic, educational sectors).
**Elements of PHC: (eight)**

The deceleration of Alma-Ata stated that PHC includes at least:

1. Education of the community concerning prevailing health problems and the methods of preventing and controlling them.
2. Promotion of food supply and proper nutrition.
3. MCH care including family planning.
4. Adequate supply of safe water, and basic sanitation.
5. Immunization of children against the major infectious diseases.
7. Appropriate treatment of common diseases and injuries.
8. Provision of essential drugs.

**Principles of PHC:**

1. **Equitable Distribution:** to serve the whole population.
2. **Appropriate Technology:** to be effective and acceptable.
3. **Multisectorial Approach:** all health related sectors to be involved.
4. **Community Participation:** in implementation of health services.

**Strategies of P.H.C.:**

1. Expanding & extending the delivery of comprehensive health services with optimum quality and to be accessible to all people.
2. Strengthening the linkage between the three levels of health care.
3. Promote the provision of special health care for at risk and vulnerable groups.
4. Integration of promotive, preventive, curative and rehabilitative services.
5. Enhance intrasectoral and intersectoral coordination.
6. Enhance the relationship between health facilities and consumers.
7. Change the attitude and misunderstanding of the community towards PHC centers.
8. Continue orientation & in-services training of current health staff.
The functional infrastructure of P.H.C. (support system):

1- **Information systems:**
- Community assessments (statistical methods rates).
- Surveillance of health problems and needs.
- Monitoring programs.

2- **Management activities:** (planning, implementation, financing, evaluation).

3- **Manpower development:** (Training, supervision, education).

4- **Logistics:** including supplies – drugs – Transport and communication.

5- **Facilities:** including planning, designing, equipping and maintenance.

6- **Research:** on day – to – day problems of PHC.

Problems in the functioning of primary health care:

1- Poor working and living conditions.

2- Under-utilization of services.

3- Inadequate salaries and incentives.

4- Weak preventive orientation.

5- Weak health system management.

6- Weak intersectoral cooperation.

7- Problems with equipments and supplies.

8- Disease and waste.
Man power in PHC (Health team)

**Definition:** The team is a group of different personnel who work together in cooperation and harmony, to provide consumers with health services.

**Health team is made of:**

1- **Medical personnel:** physician, dentist.

2- **Paramedical personnel:** nurses, midwives, health visitors, technicians.

3- **Health related personnel:** social workers, sanitanarian, and food inspectors.

**Tasks of physicians:**

1- Leadership in health mater.

2- Health promotion within the community and monitoring the level of sanitation in the environment.

3- Education of the public and counseling about different health problems.

4- Specific intervention especially those requiring technical knowledge and skill.

5- Conduction of survey studies to assess different problems.

6- Helping in the process of quality assurance.

**Problem of human resource development:**

1- Inadequate number.

2- Inappropriate training.

3- Lack of health human resource planning.

4- Lack of community health workers.

5- Inadequate team work action and supervision.

6- Lack of continuing education.

7- Lack of job description.
**Definition:** The people have the right and duty to participate individually or collectively in the planning and implementation or evaluation of their health care”.

**Community participation has two different meaning:**

1- **Active involvement** in program planning, implementation or evaluation by people benefiting from the program.
2- **Acceptance** of the services, i.e. the degree to which parents bring their children for immunization when they are made available.

**Active community participation**

**Achieved through:**

1- **Making contact with the community**:
- It is important and essential to study what is going on in the community before carrying any contact.
- A person the community trust and familiar should take the initial contact.

2- **Informing the community** about the health service and conducting dialogue with the community.

3- **Health education**: This is the corner stone for the promotion of community involvement. All types of media should be utilized.

4- **Encouragement of the formation of Health committees**:
- Health activities supportive friends or committees could be organized.
- Small branch committees can also be formed in schools, social clubs, woman association or youth organization.
Advantage or benefits of active community participation:
1- Communication from respected local leaders, neighbors or family members is better understood and more influential than posters or radio messages.
2- Community residents are much more likely than outsider to know the most convenient times and locations for preventive or curative sessions.
3- Community people can provide an early warning system when rumors develop that threaten the program.

Examples of community participation:
1- Adopting a healthy life style by:
   - Improving the standard of personal hygiene.
   - Avoiding harmful practices and beliefs e.g. cigarette smoking.
   - Following health procedure in living condition.
   - Healthy housing. - Healthy methods of waste disposal.
   - Health food preparation. - Availability of clean water supply.

2- Actions intended to prevent specific diseases:
   E.g. Malaria and Bilharzias. The people can do a lot in control the spread of such a problem e.g. early case reporting, follow and participate in the preventive measures.

3- Diagnosis & treatment of simple ailment:
   - First aid actions can be taught to deal with simple ailments.

4- Appropriate utilization of health facilities:
   - The available facilities for vaccination of children thus reduce the incidence of killing diseases of childhood.
Referral system

Cases in need of specialized medical consultation and investigations, or / and hospitalization are referred by the physician to the proper place. Feed-back to the clinic is required, for follow up.

To improve utilization of PHC, it must be:

1- Acceptable.
2- Accessible.
3- Efficient.
4- Convenient (hours, steps, flow of work).

HEALTH OFFICE

**Place**: - Separate in urban areas. - Integrated in rural areas.

**Functions of H. office**:

1- Registration of births, deaths and infectious diseases.
2- Monitoring of environment e.g. Water supply, Insect & rodent control, Food sanitation.
3- Prevention and control of infectious diseases.
   - Cases → receive notification, supervises isolation carries out terminal disinfection.
   - Contacts → control measures for contacts & comm..

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• Immunization → of infants & children, international travelers and contacts.

4- Sick leaves for governmental employees.

**HEALTH INSURANCE**

**Definition:** It is application of the principles of insurance in the field of medical care.

**Benefits of health insurance:**

- Levels Improves utilization of medical care.
- Controls utilization of medical care.

**Requirements of effective health insurance service:**

- Efficient services → quality and size.
- Satisfactory financial resource.
- Organized referral system, with feed-back.
- Record-keeping system.
- The insured must be cooperative, avoid misuse of service.
OUTREACH PROGRAM

**Definition:** It is a form of rural health services that goes to people within their community.

**Outreach health services:**

1. Equipped mobile units for isolated areas & small community.

2. Home visits by public H. nurse or social worker for.
   - Health education.
   - Social study.
   - Assessment of general health status.
   - Family planning service.

3. Immunization campaigns: to →
   - Immunize drop-out cases.
   - Get better coverage
**OCCUPATIONAL HEALTH**

**Definition:** The branch of community medicine which deals with the study of different hazardous conditions affecting the health of workers in their working fields and measures to protect them.

- **Objectives of occupational health:**
  1. Health promotion and maintenance of the highest degree of physical, mental and social well-being of workers.
  2. The adaptation of worker to his job.
  3. Prevention and control of occupational health hazards caused by working conditions as well as non-occupational hazards.

- **Occupational risk:** individuals performing a particular work activity are at risk of certain occupational hazards.

- **At risk groups:**
  Medical professions, farmers, workers in industry

**Medical profession:**
Medical personnel may be exposed to varied health hazards, according to field and circumstances of work. They may be classified into:

1. **Physical hazards:** due to exposure to radiation.
2. **Chemical hazards:** handling chemicals used in disinfection and sterilization.
3. **Biological hazards**: personnel may be exposed to infection specially those working in control of infectious diseases and laboratories, through:
   - inhalation of infection on contact with respiratory infection
   - handling infective or contaminated material, especially blood

4. **Associated, not true occupational risk factors**:
   - Worry, stress, fatigue, and tension of work

**Working in contact with infection**:
- This is the most important factor in occupational infections.
- The worker may come in contact with disease persons, animals or handle infected or contaminated materials.
- In other words, these infections occur in physicians, nurses and personnel of hospitals, in veterinary doctors; workers who breed animals ….etc.
- The important infections are the following: anthrax, T.B., infectious fevers, brucellosis.

So any worker in medical field should be subjected to **Examination**:

- **Pre-employment examination**.

**Objectives**:
1. Proper workers in suitable job.
2. To have a base line medical record of the health state of worker before employed to be able to detect the effects of work on his health state.
3. Follow up of health state.
4. Health education and give advices.
Periodic examination:

Objectives:

1) Early detection of any disease.
2) Avoid further exposure to that health hazard and try to arrange for safety measures against them.

Health education

- **General education:** for personal hygiene, sound health habits and following principles of healthful living.
- **Special education and training:** for industrial safety and knowledge of the early manifestation of occupational hazards.

Methods of health education:

1- **Personal approach:**

- Face to face and Personal approach.
- Talks, lectures and seminars for group discussion.

2- **Mass communication:** radio, T.V. press, films, booklets and boosters.
Farmers and agricultural workers:
Those work in the farm exposed to:

1. work injuries
2. occupational diseases:
   a) physical exposure:
      • Prolonged exposure to heat.
      • Ultraviolet rays of the sun.
   b) Chemical exposure:
      • Application of insecticide
      • Empty container may used for filling water or other purposes.
   c) Biological exposure:
      • Infection : through
         1) Inhalation: as T.B
         2) Contact : wound infection (tetanus, sepsis), brucellosis, parasitic
erdiseases.
         3) Allergy : inhalation of biological allergen in air, as pollens, animal
              hair and others

Workers in industry:
Industrial hazards are divided into: accidents or work injuries and occupational
diseases.

Accidents: e.g. falls, blows, electric shock and burns.

❖ Factors leading to work injuries:

1- Environmental factors:
   • Ventilation: discomfort and impaired alertness.
   • Improper lighting.
   • Defective construction and maintenance of the building.
2- **Working conditions:**
- Crowding and defective house-keeping.
- Excessive noise.
- Negligence of machinery maintenance.
- Lack of safety measures for fire and electricity.

3- **Personal factors:**
- **Age**: Increase at the two extremes of age.
- **Lack of experience**.
- **Stress** and fatigue.
- **Diseases**:
  - **Poor health** and physical fitness.
  - **Unsuitable clothes** and shoes.

**Occupational Diseases**

- **Definition**: An occupational disease arises during the course of employment.
- **Classification of occupational diseases**: They are classified according to the **causative agent** into:
  
  I- Diseases arising from exposure to **physical agents** as heat, noise, pressure, radiation, vibration or electricity.
  
  II- Diseases resulting from exposure to **chemical substances** which may be in the form of gases, liquids, dusts, fumes or smoke or heavy metals.
  
  III- Diseases arising from exposure to **biological agents** e.g. anthrax, brucellosis.
Diseases due to Physical Hazards

**Definition:** Diseases arising from exposure of workers to physical agents such as Temperature (heat or cold), noise, pressure, radiation, vibration or electricity.

### HEAT DISORDERS

**Exposure:**
1. Certain industries as iron and steel industry, in front of ovens and workers.
2. Working outdoor in hot countries.

**Hazards:** Workers in hot industries can develop the following diseases:
- Heat exhaustion.
- Heat cramps.
- Heat pyrexia (heat or sunstroke).

1. **Heat Exhaustion (heat syncope):** this is the most common heat disorder:

#### Clinical picture:
- The skin is warm.
- The pulse is rapid.
- Rectal temperature is raised.
- The B.P. is low.

#### Treatment:
1. Removal of the worker from the hot environment to a cool one.
2. Lowering the head.
3. In severe cases I.V. fluids are given.
II- **Heat Cramps** This is the second common heat disorder.

- **Clinical picture:**
  - Cramps are painful, of short duration and accompanied with excessive sweating.
  - Rapid pulse and normal rectal temperature.

- **Treatment:**
  1- Intravenous sodium chloride injection (pain responds only to sodium chloride).
  2- Analgesics are useless.

III- **Heat Pyrexia (heat stroke) (Sun stroke)**

- **Clinical picture:**
  - The worker feels severe headache, irritability, dizziness, loss of consciousness and death.
  - The skin is dry and hot and the rectal temperature is above 40°C.

- **Treatment:** It is an emergency.
  1- The affected person should be removed immediately from the hot environment and put cold water and ice.
  2- The skin is rubbed with ice till the rectal temperature reaches 38°C, then transfers to a cool room and observe the temperature.
  3- Continue this treatment until the temperature stabilized.

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**Exposure to Cold**

- Is a rare occurrence causing local chilling and predisposes to respiratory infections e.g. in cold storage rooms.
- Workers can be protected by suitable clothes.
Exposure to High Pressure

**Etiology:** rapid decompression causes N₂ bubbles to be released and these may lodge in the arterioles of different parts of the body producing embolic phenomena.

**Exposure:** The syndrome occurs in:
- **Caisson workers:** the pressure is about 2 atmospheres.
- **Sea-divers:** 5 atmospheres.
- **Aviators:** when they go up rapidly (air embolism of aviators).

**Prevention of Decompression illness:**

1. Gradual decompression of diverse.
2. Gradual ascent of aero planes.
3. Use of pressurized aero planes.

**Treatment:** Recompression in special chambers until symptoms disappear then gradual decompression.
Exposure to Radiations

1- **Ultraviolet rays:**

- **Exposure:**
  - Industrial exposure: in welding and facing unprotected lamps or furnaces.
  - In physiotherapy: both cases and personnel can be affected.

- **Hazards of Exposure:**
  1- **Eyes:** Actinic keratitis (burns of cornea) producing agonizing pain and severe photophobia about 12 hours after exposure.
  2- **Skin:** erythema (like sunburn) & pigmentation, desquamation and blister formation, diminished secretion of sweat.

2- **Infra-red rays:**

- **Exposure:** occurs in workers facing heat and glare of furnaces for many years e.g. in steel and glass industries.

3- **Ionizing Radiations:**

- **Exposure:** Industrial workers may be exposed to x-ray, gamma rays, alpha and beta particles and neutrons in some industries & mining of radioactive ores.

- **Hazards:** vary in nature and severity according to:
  - Type of radiation.
  - Power of penetration.
  - Duration and frequency of exposure.
1- **Acute effects (immediate):**

- Injury to the skin.
- Biological injury of the tissue cells with selective action on the actively subdividing cells e.g. the germinal epithelium, haematopoietic system and foetus. The gene structure of the daughter cells is injured due to injury of chromosomes.
- Radiation sickness.

2- **Chronic (delayed) effects:** Late somatic manifestations of different parts of the body e.g.: skin, lungs, intestines, including leukemia, neoplasms and congenital malformations of the fetus.

- **Clinically 4 forms:**
  - Genetic mutations.
  - Cancer and or leukemia.
  - Shortening of life-span.
  - Abnormal growth and development.

**Exposure to Vibration**

**Exposure and Hazards:**
- Workers using vibrating tools are exposed to continuous vibrations.
- They are liable to the following:
  - Osteoarthritis of joints due to small fractures in the bone ends.
  - Aseptic necrosis of bones, specially the small bones of hand.
  - **Reynaud’s phenomenon:** which is characterized by pallor followed by cyanosis and then redness in the terminal phalanges? This results from spasm of peripheral arteries. In advanced cases obstructive lesions of the vessels occur leading to gangrene.
II - Diseases due to Chemical Hazards

- On exposure to industrial chemicals, entry into the body may occur through one of the following ways:
  1. The respiratory tract.
  2. The digestive system.
  3. The skin.

- The absorption of chemicals through the respiratory tract depends on their solubility, rate of respiration and blood circulation.

- They can also reach the digestive tract by swallowing substances precipitated in the upper respiratory tract or through contamination of food, cigarettes or hands.

- The concentration of harmful chemicals in the working atmosphere and duration of exposure are the important determining factors in the causation of disease.
(1) **Occupational lung Diseases caused by Dust (Pneumoconiosis)**

- **Dust** is the solid particles of any matter that may be suspended in air.
- It constitutes an important problem in industry where complex materials are used and harmful dusts may be liberated on **crushing, girding, sawing, polishing** and other processes.
- Any lung disease which results from inhalation of dust is called **pneumoconiosis**.
- According to its effect **pneumoconiosis is classified into** the following types:

I- **Fibrotic pneumoconiosis (major pneumoconiosis):** Dust in this group causes massive fibrosis of the lung with impairment of pulmonary functions. It comprises 4 diseases:

  1- Silicosis.
  2- Asbestosis.
  3- Talcosis.
  4- Coal workers pneumoconiosis.

II- **Dust Reticulation pneumoconiosis (Minor pneumoconiosis):** Dust in this group produces **foreign body reaction** in the lung with minimal fibrosis and minor disturbance in pulmonary functions. They include:

  - Carbon dust → Anthracosis.
  - Silica dust → Silicatosis.
III- **Benign pneumoconiosis:** This group results from inhalation of dusts which cause no tissue reaction in the lung but they remain in the lung and cast a shadow in the x-ray picture although they cause no functional disability. They include:

a. Iron dust → Siderosis.
b. Barium dust → Baritosis.
c. Calcium dust → calicosis (in limestone, marble, cement).
d. Tin dust → stannosis.

IV- **Vegetable dust pneumoconiosis:** This is a heterogeneous group which results from inhalation of various vegetable dusts which induce lung lesions by various mechanisms:

E.g. 1- Allergy: type 1 and type 3.

2- Direct infection of the lung.

3- Mechanical irritation.

**Examples of this group:** cotton, Hay (farmer’s lung), and grain.

V- **Dust pneumonitis:** inhalation of certain dusts produces acute inflammation in the alveoli not followed by fibrosis e.g. manganese, platinum and beryllium.

VI- **Malignant pneumoconiosis:** this results from the inhalation of certain dusts which are carcinogenic as dusts of radio-active material, chromates, nickel and asbestos.
**SIICOSIS**

- **Definition**: It is a lung disease results from exposure to silica dust (silicon dioxide).
- **Occupation**: Occurs in artificial abrasives, sad stone and granite.
- **Diagnosis**:
  - History: of exposure
  - Symptoms and signs: Breathlessness, cough, finger clubbing is common.
  - Chest X ray: Discrete **rounded nodules** of intermediate densities in all the lung fields, size from **1-3 mm** in diameter when the disease progresses, opacities increase in size and number. It is large irregular opacities.
  - Lung functions test: non characteristic decrease total lung capacity, decrease vital capacity.
- **Complication**: T.B may develop as a complication of silicosis & lung failure may occur.

**ASBESTOSIS**

- **Definition**: It is a lung disease results due to exposure to inorganic dust asbestos
  - It may cause in addition to asbestosis Bronchial carcinoma, pleural plaques and pleural mesothelioma.
- **Diagnosis**:
  - **History**: of exposure
  - **Symptoms and signs**:
    - Dyspnea: first it is moderate and late it is severe,
    - Cough late on the disease,
    - Chest pain in severe cases, decrease chest expansion in lower chest.
    - Inspiratory crepitating and finger clubbing is frequent.
  - **Chest X ray**: the lesion is in the **lower part** of the lung (fine punctuate mottling, cystic or **honey comb appearance** (Cystic spaces less than 5mm).
    - Obliteration of the costophirinic angles and pleural wall thickening.
  - **Sputum analysis**: asbestos bodies are seen stain blue.
• **Lung functions test**: decreases in vital capacity and total lung capacity is common.

❖ **Complications**: Lung cancer.

### COAL WORKERS DISEASE (NODULES)

❖ **Definition**: It is lung disease due to exposure to inorganic dust (coal dust) occurs in miners and coal workers.

- According to the **dose and duration of exposure**, the case severity determined:

1. **Simple pneumoconiosis**: small nodules in upper chest zone around bronchioles in reticular form (pseudo asbestosis) but it occupies the upper zone. The nodules are black due to carbon.

2. **Progressive Massive Fibrosis (P.M.F)**: masses large in size, black in colour, concentrated in upper chest zone. The over lying pleura is involved and may become fibrotic. The lesion may be irregular in shape and may cavitate.

❖ **Diagnosis**:

• **History**: of exposure

• **Symptoms and signs**:

  - Less dyspnea in simple cases.
  
  - In severe PMF: cough of coal in Sputum, wheezing, trachea may be displaced.
  
  - Clubbing is more; also arthritis & pleural effusion are common.

• **Chest x ray**: hilar nodes show calcification with egg shell appearance.

❖ **Complications**: the most dangerous complications are emphysema and tuberculosis.
**Definition**: Pulmonary disorder characterized by wide spread partial obstruction of the air walls that varies in severity.

**Pathogenesis:**

1. **Reflex broncho-constriction**:
   - Cold air, inert dust, gases & fume reaction does not involve immune response.
   - It has history of asthma prior to occupation.

2. **Inflammatory broncho-constriction**:
   - Irritant gases vapors, damage to mucosa, leading to edema & necrosis.
   - Dyspnea, wheeze, cough at lower level of exposure.
   - Spontaneous resolution within several weeks.
   - If repeated exposure occur → pulmonary edema & death.

3. **Pharmacological broncho-constriction**:
   - Extra specific, dose response.
   - Level of exposure determine severity of the attack.
   - Chemical transmitters release or direct autonomic stimulation as pesticides inhibiting choline esterase or excessive parasympathetic stimulation.

4. **Allergic broncho-constriction**: most common.
   - IgE or IgG antibodies follow exposure to work place antigen (red cedar, isocyanate).

**Patterns of occupational asthma**:

1. **Early onset (immediate)**:
   - Within 10-20 mint of exposure end 2 Hours (type I reaction),
   - IgE coating mast cell react with antigen, release of histamine and newly formed mediators as leukotriene C4 and prostaglandin D2, result in broncho constriction and local inflammation.
2- **Late onset (Delayed or non immediate):**

- With 4-6 Hour end 24 Hours,
- Some attacks persist for days, recurrent nocturnal attacks of cough, dypnea, are the only manifestation.
- Circulating IgG antibodies in plasma bind to the antigen to form complexes (type III reaction) or IgE chemical mediators, or chemostatic factors released when mast cell degenerate and these attract oesinophils and eutrophils.
- Such cellular infiltration requires 4-6 Hours.

3- **Dual onset asthma:**

- Early and late onsets are combined. The initial attack resolves, followed by another several hours later.

❖ **Examples of occupational asthma:**

- **Byssinosis:** due to cotton dust.
- **Asthma due to grain dusts:** Grain dusts are a mixture of grain proteins & pollutant, fungi, insect, excreta of rodents & birds (immediate & late onset).
- **Wood dusts:** Red cedar plicate produce acid which is low molecular weight compound lead to dual onset.
- **Isocyanates asthma:** polyurethane in paint & varnish industries toluene disocyanate (T.D.I) fume, lead to dual onset,
- **Metal salts asthma:** As platinum in electronic, jewelry, fluorescent screens nickel, chromium, cobalt, vanadium, tungsten carbide.

❖ **Diagnosis:**

- **Symptoms and signs:** Pharyngitis, urticaria, asthma, dyspnea, wheezing and cough.
BYSSINOSIS

- **Definition:** A serious disease arises from exposure to cotton dust.
- **Occupation:** In weaving & spinning industry in ginning (separation of the lint from the seeds) & opening of bales and spreading the compressed lint.

- **Etiology:** Byssinosis is believed to be an allergic phenomenon as cotton dust contains an allergen producing bronchospasm.

- **Manifestation:** Cough, breathlessness (dyspnea), which happens in the first day of return to work and improve after this.

- **Grading of byssinosis:**
  - Grade 1/2: As there is occasional cough & dyspnea in first day of return to work.
  - Grade 1: Where cough & dyspnea occurs every first day of work.
  - Grade 2: As the manifestation occurs in first day and other days but without complication.
  - Grade 3: As grade 2 but there is complication as emphysema.

- **Diagnosis:**
  - By history,
  - Clinical examination,
  - Pulmonary function test using peak expiratory flow meter (small & portable apparatus):
    - Workers register reading before & after work shift in working days and in vocations.
    - The pattern of the disease show decreased flow in first day of return to work & improving in holidays and vocations away from the work.
    - Worker in grade 2 or 3 must avoid exposure.
INDUSTRIAL METALS

- Industrial poisoning may be caused by exposure to dusts, fumes or vapors of metals and their compounds, usually through inhalation and may be by contact and ingestion.
- Toxicity is influenced by their form (organic or inorganic), physical state (solid, liquid or gas), and portal of entry.

INDUSTRIAL GASES

- Toxic gases in industry are classified into 4 groups:
  1- **Simple Asphyxiants**: which interfere with the percentage of O₂ in the atmosphere e.g. CO₂, methane, N₂, H₂, Helium.
  2- **Chemical asphyxiants**: which interfere with the respiratory enzymes e.g. CO, H₂S and HCN.
  3- **Pulmonary irritants**: which produce irritation of the bronchial mucosa e.g. ammonia, SO₂, formaldehyde, NO₂ and chlorine.
  4- **Systemic poisons**: which do not produce effect locally in the lung but after absorption they may produce toxic effects in other organs in the body e.g. Arsine, stibine, phosphine, hydrogen selenide, nickel carbonyl and CS₂.
Carbon Monoxide (CO)

- **Definition**: Is a chemical asphyxiant.
- **Exposure**:
  e. Industrial gases, coal gas, blast furnace, producer gas.
  f. Exhaust gas.
  g. Incomplete burning of any carbonaceous material.

**Pathogenesis**: On exposure to CO, it unites with Hb forming carboxy Hb which is unable to transport O₂ from the lung to the tissues and thus the affected individual suffers from anoxia.

- **Clinical picture**: 3 types of CO intoxication:
  1. Acute asphyxiation.
  2. Acute asphyxiation with squeal.
  3. Chronic CO exposure.

  - The symptoms depend upon the amount of carboxy Hb present in blood:
    - Below 5% no symptoms.
    - Between 5 and 20%: headache, dyspnoea, noises in ear, cyanosis and low concentration.
    - Between 20 and 30% the patient can’t move, vision and hearing are impaired.
    - Between 30 and 50% marked dyspnoea, cheyne stokes respiration and coma occurs.

- **Diagnosis**:
  h. History of exposure.
  i. Clinical manifestations.
  j. The surest method is the demonstration of carboxy Hb in blood.
Prevention:

**Environmental measures**: enclosure, isolation, adequate ventilation, masks.

**Medical measures**: Preplacement and periodic medical examination.

Treatment:

k. Stoppage of exposure.

l. Artificial respiration if respiration has stopped.

m. O₂ inhalation and better give it under pressure (hyperbaric).

**Diseases due to Biological Hazards**

Industrial workers may be exposed to the risk of infection under the following conditions:

1.-**The living environment**: living under poor socioeconomic conditions especially housing and nourishment may increase the incidence of infection.

2.-**The work environment**: an in sanitary environment may increase the risk of infection.

3.-**The work conditions**: may cause hazards which predispose to infection such as silicosis and pulmonary T.B., exposure to excessive heat and pneumonia.

4.-**Working in contact with infection**:

- This is the most important factor in occupational infections.
- The worker may come in contact with disease persons, animals or handle infected or contaminated materials.
• In other words, these infections occur in physicians, nurses and personnel of hospitals, in veterinary doctors; workers who breed animals and slaughter houses.
• The important infections are the following: anthrax, T.B., infectious fevers, brucellosis, psittacosis, etc.

**Control measures for occupational safety**

**Objective:** elimination or reduction of exposure harmful agents in the work environment through:

❖ **Engineering measures (work environment):**

1. **Adequate design:** to reduce health hazards in already constructed unsafe work place, so care paid for:
   a- Safe placement of the plant.
   b- Safe machines & processes, their lay out.
   c- Adequate illumination and ventilation.

2. **Elimination of harmful agent at its source:** Discontinuation of the process, but it is difficult because of:
   • Economical consideration.
   • Necessity of presence of such process or agent..
   • Absence of other alteration.
   • Replacement of materials used substitution.
   • Modification and maintenance the process & equipment.
3. **Isolation:** The harmful agents can be isolated in order not to come into contact with worker, by many means:
   - Closed systems-for toxic chemicals,
   - Enclosure.
   - Separating walls (isolated areas and cabins.).
   - Distance, Hazardous operations at a distant location.
   - Minimize the time of exposure.

4. **Ventilation.**
   - Central or dilution ventilation.
   - Local exhaust ventilation.
   - Vacuum cleaning.

5. **Wet methods and fillet ring for dust control.**

6. **Good housekeeping storage.**

❖ **Personal control measures:**

1- **Limiting exposure to health hazards:** As decrease the time of exposure.

2- **Personal protective equipments** as: Respirators, gloves, boots, ear protectors, plugs, mufffs, protective glasses.
   - They must have the following criteria:
     * Fit to the worker concerned.
     * Well maintained and regularly cleaned.
3- **Personal hygiene:**

- Cleanliness of the person:
- Environmental monitoring
- Biological monitoring.
- Pre-placement medical exam.
- Periodic medical exam.