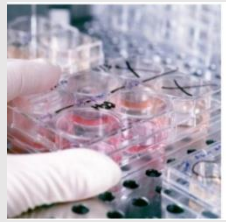
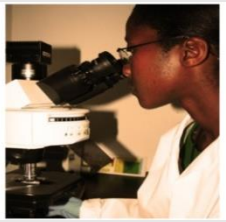
NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH

Division of the National Herlath Laboratory Service





The Role of Epidemiological Research in Preventing Occupational Diseases

Definition of Epidemiology

Study of the distribution and determinants of health related states and events in populations and the application of this study to control health problems

- Distribution of deaths, accidents, illnesses and their precursors.
- Searches for the determinants of health, injury and disease in the environment.

Basic Concepts in Occupational Epidemiology (OE)

- Occupational epidemiology is a discipline concerned with the effects of workplace exposures on the frequency and distribution of diseases and injuries in the population.
- It is an exposure orientated discipline that links epidemiology and occupational health- asks
    - Who is at risk
    - Where
    - When
    - How
- Use biostatistics to analyse the data collected- describes, summarises and interprets

- It is accepted that occupational disease is preventable if occupational exposure is controlled.
- The main purpose of OE is to serve a preventive purpose- all knowledge generated can and should be implementable.

Role of Epidemiology in Occupational Health and Safety

1. a. Field epidemiologic investigations of individual work places.

   b. Conduct large studies to assess the relationship between exposure and possible health outcomes.

2. Surveillance of occupational disease and injury.

3. Evaluation of an intervention

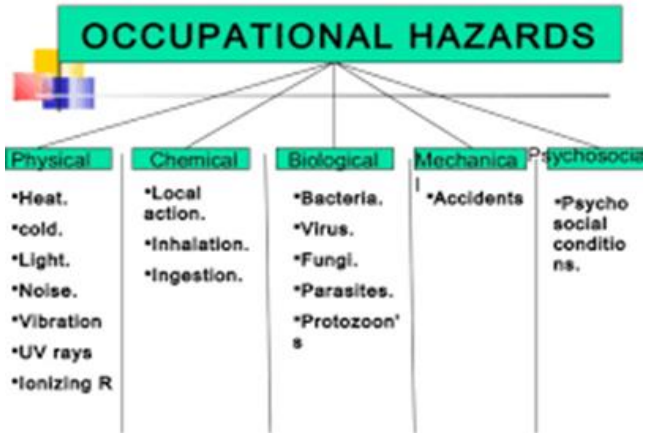
Field Epidemiological Investigation

1. Generation and testing of an hypothesis that a given exposure might be harmful and the quantification of an effect

- The identification of environmental or occupational hazards – usually requires evaluation of exposed persons and assessment of the risks of disease. (Combination of industrial hygiene and epidemiology is required)

- Urgent investigation required to recommend control and preventative measures.

→Aetiology of the problem (e.g. specific toxic agent)
→Source or mode of transmission
→Severity and extent of the problem
→Implement control measures immediately or after exhaustive epidemiological investigations



Impact of occupational field epidemiological investigations

- The impact of the investigations conducted because of requests from the representatives of workers or the industry itself:

  - In South Africa and internationally **lead exposure** studies – provided info on exposures, control measures and enforcement activities (development of regulations).
  - **Silica exposure** → in the USA several studies conducted in the roofing industry lead to redesigning the curriculum to train roofers to prevent occupational lung disease, development of regulations and recommendations to prevent exposure
  - Studies on **musculoskeletal disorders** –stimulated further research .
  - Powered latex gloves – risk factor for **latex allergy**→ played a role in replacing them with powder free gloves.

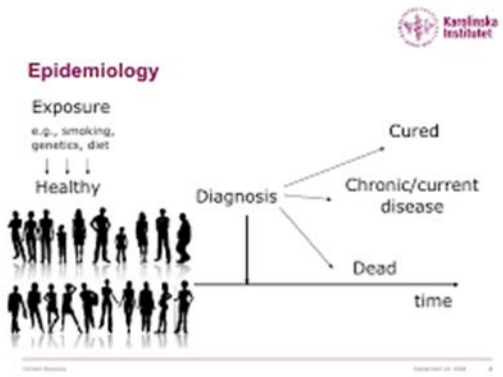
Large studies assess the relationship between exposure and possible health outcomes.

- Designed to detect if an increased risk truly exists, avoiding a false negative finding that may result from small sample sizes of a field studies or previously established exposure controls.

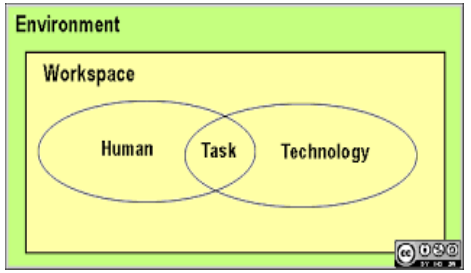
- To demonstrate an exposure–response relationship,
- This is critical to assessing causality and in establishing a level of exposure at which there is no effect, exposure must vary among cohort members.
- NIOSH has a critical role in the OSH Act- to conduct of epidemiologic studies of chronic and low-level exposure to chemicals in industry (i.e., industrywide studies).

Impact of large studies

- Industry wide studies especially in construction, agriculture, mining etc.
- Very limited in South Africa or other developing countries



The Workplace



Work environments, type of work, understanding of exposures and outcomes changes over time

- Workplace **hazards** are less obvious to identify and to measure.
- Occupational factors increase the risk of “common” diseases (**a-specific effects**)
- **Specific effects** are vague, psychological, subjective (distress, discomfort).
- **Genetics and behaviour** are becoming more and more relevant.
- **Working population** is changing in terms of age structure, sex composition, and ethnicity.

Methodology

- Is the same as in other branches of epidemiology.

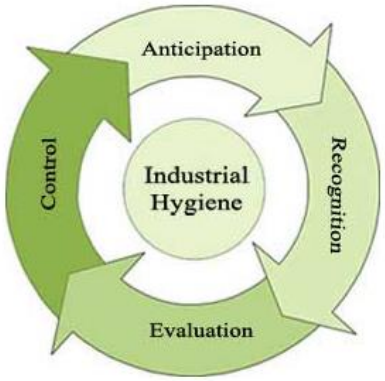
- Important difference or feature- deals with an adult population
  - – young to middle age, relatively health population
  - - has a lower morbidity and mortality than the general population.

- The work exposure experience constitutes the core of OE.

- General population more sensitive to health effects than workers- e.g. lead exposure in children vs adults

Measure of exposure and dose

- **Exposure should occur before disease** : level and duration
- Sufficient exposure – dose-effect relationship/ dose- response relationship
- Historical measurements



- **Health effects**
- Acute exposures- health effects
- Chronic exposure – cumulative in body or have a cumulative effect→ past exposure and duration of exposure more important than current exposure.

- Biomarkers/ biological monitoring- blood, urine, hair, nails
- Individual vs group measurements
- Qualitative statements from study participants

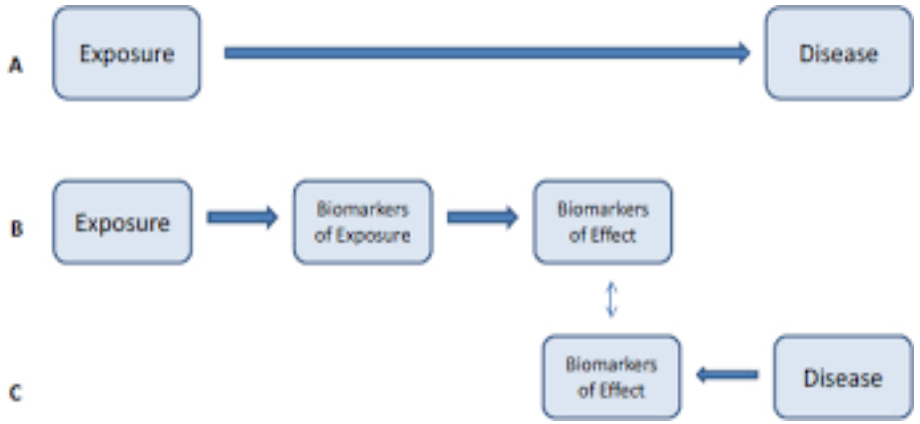
Study design

- **Driven by the research question**
- **Availability of information and population**
- **Type of disease**
- **Latency**
- **Type of studies: experimental and observational**
  - **Cohort**
  - **Case-control**
  - **Cross-sectional**
  - **Case studies**

Relation between exposure and disease

- Scientific methods to determine if there is statistical association between Level of exposure and disease frequency

- Simple way to relate exposure to disease is to compare incidence or prevalence of disease in exposed and not exposed group



Measure of occupational disease

- Incidence
- Prevalence
- Mortality studies
- Change over time
  - Shift
  - Work week

Measures of effect / statistics

- **Risk difference $\Delta I_{e+} - I_{e-}$ attributable risk**
- **Relative risk**

  How many times are more likely exposed people to get disease relative to unexposed > 1 <

- **Odds Ratio**

  Odds of disease in exposed in comparison to those with out exposure

  > 1 <

- **SMR > 100**

- **PMR > 100**

Types of Biases

- **Healthy worker effect HWE (Mortality studies)**
- **Healthy Survivor effect**
- **Selection bias**
- **Recall bias**
- **Measurement bias**
- **Can we control bias ?**

Epidemiology is Important to the practice of OM

- Evidence-based medical dispute resolution
  - workers' compensation, third-party litigation and insurance settlements
- Identifying occupational hazards
- Setting priorities in occupational health and safety practice,
- Supporting worker education
- Identifying possible aetiological mechanisms,
- Supporting prevention-related interventions,
- Establish a balance between between health risks and economic cost of prevention
- Designing periodic health surveillance protocols,

Occupational Health Surveillance in preventing disease

- The ongoing systematic collection, analysis, interpretation, and dissemination of data for the purpose of prevention.

- Essential to the planning, implementation and evaluation of occupational health programmes and control of work-related ill health and injuries and the protection and promotion of workers' health.

Health Surveillance

The criteria for carrying out occupational health surveillance are:

- There is an identifiable disease or condition associated with the work.
- There are valid techniques to detect the condition at an early stage.
- There is reasonable likelihood that the disease or condition will occur in the particular circumstances of the exposure.
- That health surveillance will be of benefit to individuals or groups of workers.

Goals of a Occupational Health Surveillance system

Provides data and analyses needed to understand the relationship between work and injuries and illness in order

→to improve worker safety and health

→Prevent work related injuries, illness and fatalities

→Pick up changes over time.

Information from surveillance systems will:

- Inform policy development
- Provide guidance for educational activities
- Help develop safer technology
- Enable research and prevention strategies

Characteristics of a good surveillance system

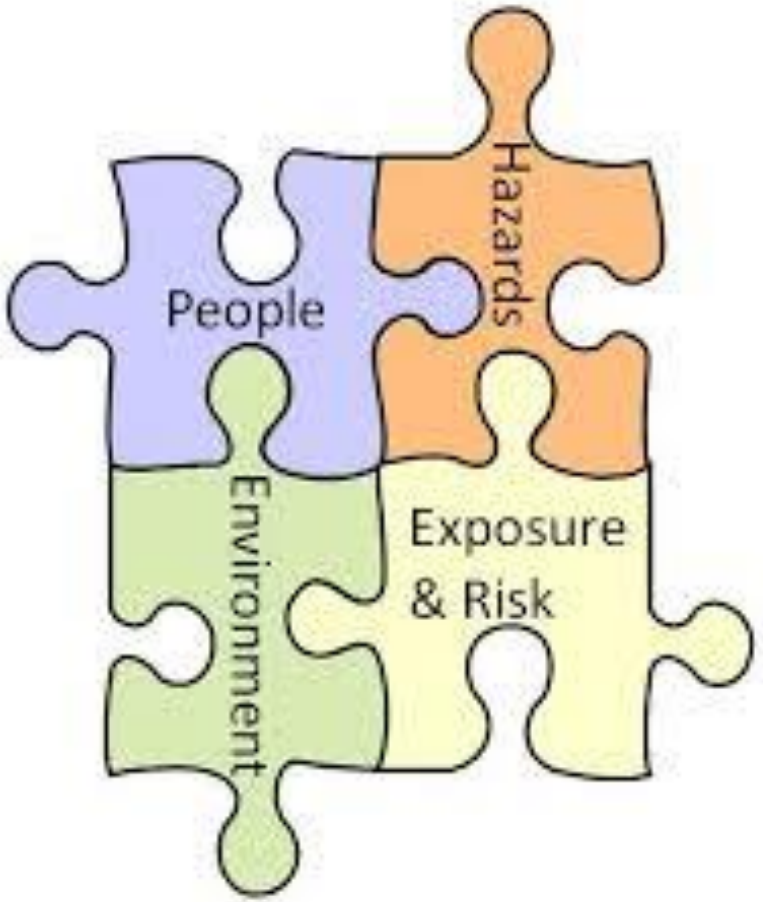
- Relies on **dedicated occupational injury and illness surveillance systems** as well as inclusion of occupational information into other **public health surveillance systems**;
- Maximizes the **use of new information technologies and changes in health care systems** to enhance the efficiency of data collection; provide the **flexibility** to change the data parameters collected and ensure consistency in data coding; and ensure **data quality and timeliness**;
- Ensures that an **individual workers' health data are kept confidential** while maximizing the utility of these **data for prevention**; and
- Must be **representative** of the target population.
- Is **periodically reviewed**, and, as appropriate, is modified.
- **Capable of rapid dissemination** - information is released when it is most needed, both routinely and in special situations
- **Closely allied to prevention and control efforts** - meaningful information is targeted to the right people and permits the right response

Types of Occupational Surveillance systems

- Hazard Surveillance
  - focus on hazards
  - assesses the distribution and trends

- Medical Surveillance
  - health of individual or groups of worke

Both complement each other



Hazard surveillance

- Clear exposure –health outcome relationship must be known
- Purpose: to reduce exposure in workplaces → decrease disease burdens

Types

- Incorporated in National systems
- Recording hazardous occurrences in specific occupational groups

Advantages

- Eliminates the need to wait for the disease to occur before taking steps for prevention
- Identifying single hazards is easier than the detection of disease

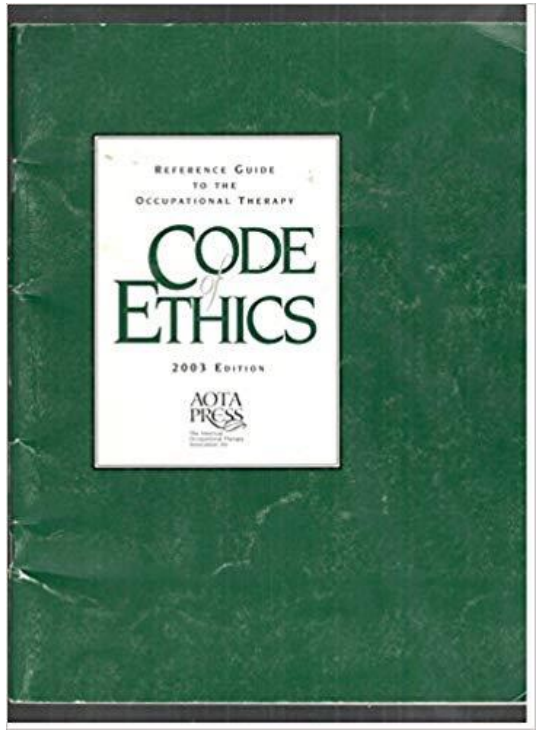
Medical/ Health surveillance

- Periodic clinical and/or physiological assessments of individual workers or groups of workers
- Detect health effects at early stage – for secondary prevention

- Legislation requiring health surveillance
- Can be active or passive
  - Active: Occupational physician actively select and invite workers to preventative medical examination to detect early symptoms of work related disease and /or non- occupational disease which can reduce work ability
  - Passive:In case of passive health surveillance, ill or affected workers are themselves coming to consult occupational physician. Passive surveillance usually detects only diseases with apparent symptoms

Ethical issues in epidemiology

- There must not be a delay in preventative measures
- Immediate transmission of information to workers and public
- Interventions must be evaluated
- OTHER



Summary

Without sound concepts of epidemiology proper assessment of occupational disease and exposure is flawed.

MAIN PURPOSES

- Prevention of disease outcomes
- Inform trends and emerging patterns of workplace hazards and illnesses

TO BE EFFECTIVE:

- Must be followed by preventive action
- Evaluation of the effectiveness of the intervention

ROLE OF THE NIOH

THANK YOU

- Nisha Naicker- NIOH
- Tel: +27(0)11 712 6436
- Fax: +27(0)11 712 6405
- nishan@nioh.ac.za
- www.nioh.ac.za

NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH
Division of the National Herealth Laboratory Service