

Occupational Toxicology: A Practical Approach

Applied Toxicology - NURS 678
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Learning Objectives

- To recognize occupational exposures to toxicants (Exposure History)
- To monitor exposures and their impacts on the environment
- To prevent exposures and their adverse health effects

What is Occupational Toxicology?

the discipline which:

Identifies chemical, physical or biological hazards, encountered in the work environment

Recognizes adverse health effects that arise out of workers' exposures to these toxicants

Establishes control measures to prevent or minimize exposures

Team effort / Different experts

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Exposure History

Importance & Implications

- Worker (limitation of temporary or permanent disability)
- Public health risk (co-workers, children at home, environment)
- Occupational illnesses are preventable

Exposure History

Background

- Occupational exposure can affect virtually all organ system and cause common illnesses
- Individuals have spectrum of exposures at work, home and in the community
- Toxicology knowledge and Epidemiological criteria are applied to determine probable causality between toxic exposure(s) and adverse health effect(s)

Exposure History

- History of the present illness
(onset, timing, risk factors.....)
- Exposure history
 1. Work history (present & past)
 2. Home setting & personal habits
 3. Community environment

Exposure History

Work history (present and past)

- Type of work (physical and psychological demands, working practices)
- Exposures (physical, chemical or biological)
- Control measures (protective equipment, monitoring...)
- Co-workers (similar illness, absent, turnover)

Exposure History

Work history (present and past)

Type of work

- a) Physical demand (metabolism and increase in inhalation and thus absorption)
- b) Shift (exposure duration & frequency)
- c) Working practices such as eating, drinking in the work place (other route of exposure)
- d) Workplace conditions (dust, mold...)

Exposure History

1. Work history (**present and past**)

- Type of work
 - Exposures
 - a) Physical (noise, cold, heat, radiation)
 - b) Biological (viruses, bacteria, fungus..)
 - c) Chemical (dust, vapors, fumes, ...)
- MSDS (Material Safety Data Sheet)
- Right to know

Exposure History

- **Work history (present and past)**
- Type of work
- Exposures
- Control measures
 - a) Personal Protective Equipment (PPE)
 - b) Monitoring the workplace, enclosed operations
(Safety Officer/Industrial Hygienist)
 - c) Medical Surveillance

Exposure History

- **Work history (present and past)**
- Type of work
- Exposures
- Control measures
- Co-workers
 - a) Similar symptoms, similar exposure
 - b) Turnover
 - c) Absenteeism (healthy worker effect)

Exposure History

Work history (present & past)

Home setting & personal habit

Community environment

Exposure History

- Home setting & personal habits
- Building (age, material, conditions)
- Furniture & Equipment
- Maintenance
- Activities (smoking, painting...)
- Occupants (children, pets...)
- Smoking, Alcohol, Drugs

Synergistic or additive effects of different exposures

Exposure History

Community environment

- Rural
- Urban, industrial

Air quality, water supply, waste disposal

Exposure History

The outcomes are:

- Identification of potential health hazard(s) in the work environment
- Indication for measuring the levels of biomarker(s), when they are available
- Triggering the process of risk assessment
- Providing evidence in establishing that the adverse health effect(s) are work-related

Recognizing Occupational Exposure to Toxicants

Criteria to establish work-relatedness of an illness

Timing & circumstances (*Exposure precedes outcomes*)

Biological plausibility (*known adverse health effects/toxicology*)

Strength of the association (*Similar cases in the same environment*)

Use epidemiological criteria

Useful resources

- Poison center 1-800-222-1222
- Literature (library, internet)
- Employer (supervisor)
- Co-worker
- Union or worker representative
- Government agencies (public health, research, regulatory)
- Consultant (occupational health specialist, industrial hygienist, safety officer, engineer)

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Monitoring Exposures

**Occupational Safety & Health Program
that is responsible for workplace:**

Risk assessment

Risk communication

Risk management

Efforts of a team, including:

Employers

Industrial hygienist and/or safety officer

Engineer

Occupational health specialist

Monitoring Exposures

Risk assessment

- Workplace site visit
- Observation of work practices
- Sampling for potential toxicants

Usually this is the role of the industrial hygienist/safety officer

In case of unknown hazard(s), NIOSH can be called for investigation

Monitoring Exposures

Risk Management

- Determination & Implementation of the appropriate control measures to reduce the risk
- Providing information & educating workers
- Establishing & Implementing policies In compliance with the standards & regulations
- Monitoring the effectiveness of the program and keeping records

Monitoring Exposures

Compliance with OSHA regulations

- OSHA is a regulatory agency that enforces the law (with a consultation arm)
- OSHA sets the PEL (Permissible Exposure Limit) (few PELs for a growing number of toxicants)
- OSHA uses the REL (Recommended Exposure Limits) established by NIOSH to set the PEL

Monitoring Exposures

PEL is for 8-hour workday over 40-hour workweek

Action level is the exposure level at which The employer shall institute a medical surveillance program for all employees who are or may be exposed

Ceiling level is the level at which an individual should not be exposed

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Prevention

- Implementing control measures
- Monitoring workers (screening)
- Limiting worker's disability

Prevention

Hierarchy of control measures

More desirable

Substitution !

Engineering controls !

Administrative controls !

Personal Protective Equipment !

(PPE)

Less desirable

Prevention

Monitoring Workers / Medical surveillance

- Known biomarkers
- Specific health outcome
- Medical removal protection

Limiting worker's disability

- Medical clearance
- Restricted duties

Summary

Occupational toxicology is a discipline that requires the effort of a team of experts

uses the fundamentals of Toxicology and epidemiology in establishing probable causal association between occupational exposure and adverse health effects

Identification and monitoring of potential hazardous exposure in the work environment are the key to preventing adverse health effects

Cases of Occupational Toxic Exposures

These cases will be discussed in
class at the end of the lecture

Case # 1

- Fifty-year-old forklift operator
- Severe headache
- Nausea

Case #2

- Twenty five-year-old car painter
- Fatigue, frequent headache
- Forgetfulness
- Relief during recent week-long vacation

- OSHA inspected the place, all exposure are below the permissible levels

Case # 3

- Thirty four-year-old painter
- Abdominal pain for 6 months
- Legs and back pain
- Extensive work-up negative

Case # 4

- Sixty-year-old man coughing blood
- He has been working as a maintenance mechanic in the school system

Case # 5

- Forty-year-old factory worker
- He cleans parts with cleaning solution
- Headache, fatigue at night
- Felt good when he was on vacation

Case # 6

- Thirty nine-year-old OR nurse
- Asthma exacerbated at work