University of Rochester
Summer Science Camp
1998

Environmental Health Unit
Presentation Notes

University of Rochester
Summer Science Camp

"ENVIRONMENTAL HEALTH AND YOU"

Introduction to Environmental Health and You
EHSC-UR Summer Camp July 1998
A. Armstrong, PhD

Background for the Case…Concepts

What is health?

What is disease?

What are the prime suspects?
a)
b) xenobiotics

How long can their effects remain undetected?

Who are the experts to assist in this type of case?

Background…History

How long have we known of these hazards? Who were the great detectives of the past?

How do we measure the effects of these hazards?

Where do these hazards fit into the general scheme of life concerns?

Role of work

Elements of work

Cost/Benefit

- **Benefit of metals (natural elements)/ chemicals to life…**
- **Costs…**
- **Host waste processing systems/ other host protective factors**
- **Society decides**
- **Risk analysis**

Where are the suspect substances encountered?

Sources

- **Metals**
  - **Lead, mercury**
- **Organic Chemicals**
  - **Solvents**
- **Radiation**
- **Physical Environment**
  - **noise**
  - **hot, cold, vibration**
  - **video display terminals**
  - **ergonomics**
- **Personal and General**
  - **tobacco**
  - **community/indoor air**
  - **water**
  - **hazardous waste**
  - **climate change**
  - **chlorofluorocarbons and ozone**

How are we protected?

Control and prevention

- **Child labor laws**
- **OSHA**
- **Workers' Compensation…**

Get Ready to complete your *Occupational Family Tree*!

Interview your parents, grandparents, siblings, friends, neighbors and others, and bring this back to camp on Friday.

Name: **Occupation:**

Job Rewards:

Job Risks:

Protective Steps Taken:

Name: **Occupation:**

Job Rewards:

Job Risks:

Protective Steps Taken:

Name: **Occupation:**

Job Rewards:

Job Risks:

Protective Steps Taken:

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AIR

What is air?

A. Air is a gas made up of nitrogen (78%), oxygen (21%), and other gases (1%).
B. In some ways, air is the most important substance for life. A person might live a month without food, a week without water, but no more than a few minutes without air.

What is polluted air?

A. Smoke, gases and dust in the air cause air pollution. Air pollution is harmful to your health, comfort and safety. There are five major sources of air pollution: motor vehicles, heating and power plants, factories, waste disposal, and miscellaneous causes.
B. We will do an experiment, which shows how polluted air can get trapped, and cause smog. Smog is a mixture of smoke, dust and water.

Name some workers who work in polluted air or in oxygen poor atmospheres and the protection they use.

A. Firemen must wear self-contained breathing apparatus.
B. Astronauts wear self-contained breathing apparatus.
C. Bridge workers wear air purifying and atmosphere supplying respirators.
D. Painters wear air-purifying respirators.

Chemical pollution can come in different forms.

A. Solids, such as dust, fumes and smoke.
B. Liquids such as mists and vapors.
C. Gases.

What are the defense mechanisms of the respiratory system?

A. Hairs in the nose
B. Coughing
C. Mucous
D. Cilia
E. Macrophage

WORK STATIONS

Respirator fit test

A. A test which uses saccharine solution to determine the proper fit of a respirator.

Respirators

A. A demonstration, by a fireman, of a self-contained breathing apparatus (SCBA).

B. A demonstration, by an industrial hygienist, of air purifying respirators using a half face, a full face and a powered air purifying respirator.

Spirometry

A. This is a lung function test which measures the maximum volume of air exhaled as rapidly, forcefully, and completely as possible from the point of maximal inhalation.

Peak Flow Meter

A. This test measures the Peak Expiratory Flow Rate (PEFR). PEFR is the fastest speed at which air is forced from the lungs after taking in a deep breath.

NOISE

GOAL: Science camp students will use interactive techniques to learn the effects of noise on the human body so they may understand how to prevent acute and long-term occupational and leisure-time exposures with resultant hearing loss.

OBJECTIVES:

1. Define noise
2. How does the human ear work? Model of ear
3. Exposures to noise-youth employment/adults
4. Occupations at risk
5. Leisure activities causing risk of hearing loss
6. Current events
7. Guarding our hearing-why/how
8. Interactive activity-otoscope-look in each others ears
9. Measured activity-audiogram

OVERVIEW

Introduction

Anatomy of the ear
How the ear works
Decibels/Hertz
Do any of the students have a hearing problem? Family members?

Occupational Applications

Youth employment-lawn care/jobs
Farm employment
Adult employment-Manufacturing
Transportation
Farming

Leisure-time applications-loud music
Ear phones
ATVs, motorcycles, skimobiles

Current Events-Last week-13 yo boy playing with firecrackers
Injured fingers of hand
Also deaf as a result of injury to ear drum from loud noise

Guarding hearing

Only get one set of ears-permanent hearing loss can not be treated medically
Use hearing protection
See different PPE and Demonstrate use
Ears are self-cleaning

Don’t scratch inside
Keep water out
Don’t put anything in sharper than your elbow
See a doctor for ear problems and for regular check-ups
Try to reduce the noise in your life

Measure activity
Otoscope- look in each other ears-external ear- compare to model
Audiogram-portable
Hear different decibel sounds
Try to get hearing test for each individual

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"Environmental Health and You"

Water Quality Unit:

W. Beckett M.D., M.P.H, Department of Environmental Medicine

Dale Kriewal, Water Quality Scientist, Monroe County Water Authority, Hemlock Plant

Learning Objectives:

At the end of the unit, fifth and sixth grade students will

1. Understand how water was made from condensation of hot gases during the cooling of the earth

2. Understand the human necessity of water for life and the role of water in body composition. Differences between salt and fresh water.

3. Understand the water cycle from oceans to precipitation to fresh water bodies to oceans.

4. Understand the major human uses of water:
    - Drinking
    - Energy Source
    - Irrigation / Food
    - Food source
    - Transportation and recreation

5. Understand geographical variations in water availability and its importance to human population patterns and culture. (In relation to latitude and in relation to deserts).

6. Understand the fitness of natural water for human consumption and the historical need to provide clean water as population centers grew. History of water quality programs in the Rochester area.

7. Understand how water quality is maintained by treatment facilities (and waste water treatment facility) with emphasis on basic principles of water quality:

a) maintaining cleanliness of precipitation water
b) removal of biological debris through sand filtering
c) removal of foreign matter through flocculation
d) role of coliforms in human ecology and disease
e) use of microbicides to reduce coliform count.

8. Understand the utility of prevention of dental carries by maintaining optimal fluoridation of community water supplies.

9) Understand how water quality has been maintained by reduction of source pollutants (industrial facilities on waterways) and introduction of waster water treatment programs.

10.) Understand how toxic substances can be concentrated in the fresh water of sea water food chain so that low water concentrations can become harmful to seafood eaters.

11.) Understand the responsibilities of citizens to maintain clean sources of water and how all citizens can contribute to the maintenance of a healthy water supply.

12). Communicate excitement of environmental health careers.

Occupational Ergonomics

OCCUPATIONAL ERGONOMICS

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ERGONOMICS

A body of knowledge about human abilities, human limitations and other human characteristics that are relevant to design.

Ergonomics design is the application of this knowledge to the design of tools, machines, systems, tasks, jobs, and environments for safe, comfortable and effective human use.

What's in a Name?

Ergonomics: ergo - work
nomus - study of

Other names: Human Factors
Human Engineering
Biomechanics
Work Physiology
Engineering Psychology
Engineering Anthropometry

A Multi-Disciplinary Science

- Physiology
- Engineering
- Psychology
- Anthropometry
- Biomechanics

Human Factors & Ergonomics Society

Technical Groups

Aerospace Systems • Aging • Cognitive Engineering & Decision Making • Communications • Computer Systems • Consumer Products • Education • Environmental Design • Forensics • Industrial Ergonomics • Individual Differences in Performance • Medical Systems & Rehabilitation • Organizational Design & Management • Safety • Surface Transportation • System Development • Test & Evaluation • Training • Visual Performance

History of Ergonomics

PHYSIOLOGICAL ROOT

Bernardo Ramazzini (1633-1714)
The founder of Occupational Medicine
The Diseases of Workers (1700)

Alice Hamilton
America's first Industrial Physician

Health of Munitions Workers Committee (1915)
Industrial Fatigue Research Board (1918)
Industrial Health Research Board (1928)

Harvard Fatigue Laboratory (1927-1946)

Occupational Ergonomics

History of Ergonomics

PSYCHOLOGICAL ROOT
Hawthorne Studies
(1924-27 National Research Council)
(1927-33 Harvard University)
Ross McFarland
(1901-76 Harvard School of Public Health)
World War II
Army gunnery studies (Tufts University)
Navy Systems Res. Lab. (Harvard, Johns Hopkins)
Air Corps Flight Program (Ohio State)

History of Ergonomics

ENGINEERING ROOT
Frederick W. Taylor (1856-1915) -time study
Frank & Lillian Gilbreath - motion studies
World War II - radar, computers, nuclear devices,high performance aircraft, etc.

History of Ergonomics

ANTROPOMETRIC ROOT
World War I - Army surveys for clothing sizes
US Dept. Agriculture & Commerce (1939)
Surveys women and children, and
Standards in clothing sizes
World War II - Military surveys for clothing and equipment

History of Ergonomics

BIRTH OF ERGONOMICS
First major application; World War II
Professional Societies
Ergonomics Society (1949)
Human Factors Society (1957)
International Ergonomics Association (1959)
Re-Birth - Three Mile Island
Media "Buzzword"

Word of Caution

"Everything is now ergonomically designed"

"Ergonomically designed equipment will cure all your problems."

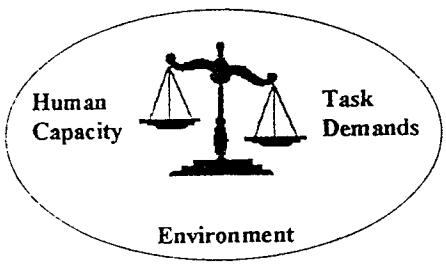
Fact:

Something is ergonomically designed when it is designed to fit the population who will be using it."

Bias:

Carefully consider claims of ergonomic design.

Balance of Capacity & Demands



Occupational Ergonomics

Balance of Capacity & Demands

When task demands are greater than human capacity then there will be an adverse consequence.

Including: performance deficits, fatigue, discomfort, and injury.

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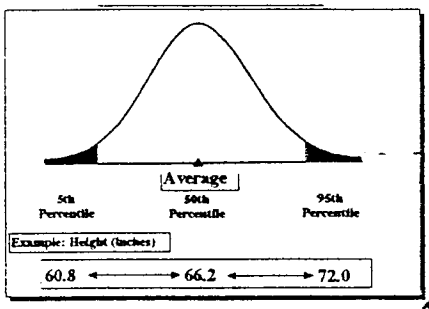
Normal Population Distribution



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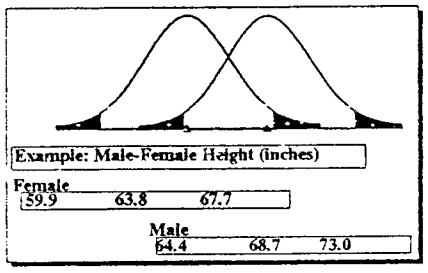
Bimodal Distribution



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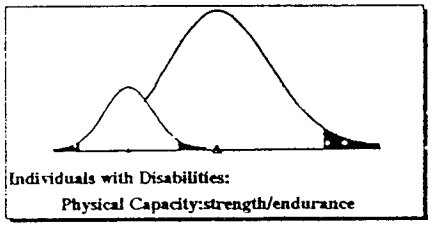
Bimodal Distribution



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Goal of Occupational Ergonomics

- To obtain a good match between the worker, work setting and work environment.
- To increase productivity.
- To decrease musculoskeletal and visual discomfort.
- To decrease injuries and illness.

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Scope of Occupational Ergonomics

- Low back pain and the design of manual handling tasks.
- Cumulative trauma disorders and the design of repetitive and sustained tasks.
- Human fatigue and job design.
- Anthropometry and workplace design.
- Human error and equipment and workplace design.
- Environmental stresses such as vibration, illumination and temperature.

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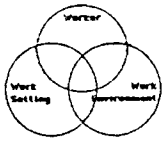
Occupational Ergonomics

Work Setting Interaction



- **Worker**: size, strength, range of motion, intellect, education, expectations, and other physical/mental capacities.
- **Work setting**: parts, tools, furniture, control/display panels and other physical objects.
- **Work environment**: climate, lighting, noise, vibration, and other atmospheric qualities.

Consequences of Poor Job Design

Discomfort, Fatigue, Eye Strain, Mental Strain, Aches & Pains

Absenteeism, Turnover, Complaints, Poor Performance

Health Effects:
Injuries
Illness
Work Restrictions
Disabilities

Operational Effects:
More Accidents
Production Problems
Lower Quality -
More Scrap
More Errors

Individual:
Economic Loss
Loss of Earning Power
Loss of Quality of Life

Organization:
Economic Loss
Loss of Expertise

Benefits

Effective use of ergonomics in the design of tools, equipment, and workplaces can:

- Reduce injuries, errors, defects and related costs
- Increase pool size of available workers
- Improve job retention of older workers
- Reduce work disability & speed return to work following injury or illness
- Reduce employee turnover and absenteeism
- Improve ease-of-use, morale and satisfaction
- Improve quality and productivity
- Stimulate innovation

Ergonomic "Red Flags"

- Complaints of: muscle/joint stiffness, aches and pains
  physical & mental exhaustion
  visual discomfort and vision problems
- Musculoskeletal injuries and illnesses
- Work disability
- Slow return to work following injuries
- High turnover rates in some jobs
- High absenteeism
- Increased error and defect rates
- Poor quality
- Productivity problems
- Difficulty using some machines & equipment
- Woman & older workers would have a difficult time
- "Home remedies" to improve comfort
- Bracing - wrists, elbows, back
- Low employee moral and job dissatisfaction

Ergonomic Design

The best time to incorporate ergonomics is in the initial design stage of a project.

Ergonomic interventions:

- Engineering
- Administrative

FATIGUE

Two basic types of Fatigue:

- Whole body physical fatigue
- Localized muscle fatigue

FATIGUE

The rate of fatigue is related to the intensity of the work being performed.

Work intensity is often measure in terms of a percentage of maximum capacity or strength.

Symptoms

The symptoms of fatigue include:

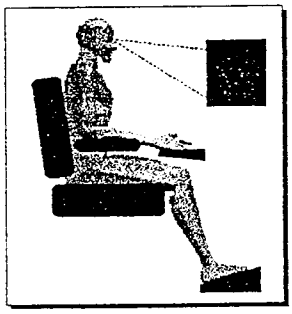
- exhaustion
- discomfort or sensation of fatigue
- increased perceived exertion
- decreased strength
- reduced neuromuscular control
- tremor
- altered electromyogram (EMG)

Determination of Suitable Position

Personal Landmarks		Computer Landmarks
Elbow height	-->	Keyboard height
Eye height	-->	Monitor height
Popliteal height	-->	Chair height
Elbow to knuckle	-->	Keyboard distance
Resting accommodation	-->	Viewing distance
Lower back	-->	Lumbar support
Arms	-->	Arm support

Sitting Posture

Sitting Posture w/ Equipment



Chair

Design Qualities

- seat height adjustment (pneumatic or similar),
- castors on a 5-point base,
- seat pan swivel,
- controls within easy reach from the sitting position,
- separate seat pan and back rest,
- fabric covered seat pan and back rest with breathable fabric,
- seat pan that is contoured and has a rounded "waterfall" front,
- chair sized (width, depth, length) to accommodate the individual using the chair.

Chair

More Design Qualities:

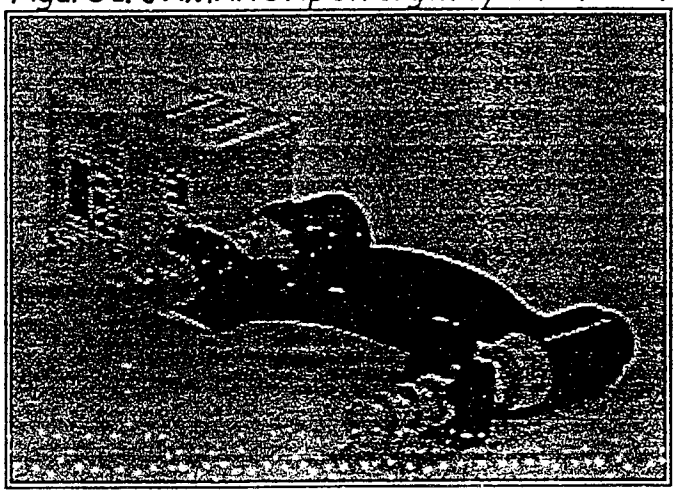
- back rest provides adjustable lumbar support (height, depth, tilt),
- seat pan tilt adjustment (forward/backward, tension control/locking),
- ability to add armrests,
- armrest adjustments (height, width, rotation),
- armrests that provide support/cradle the forearms

Test: STATIC GRIP STRENGTH

Purpose:
To test the isometric strength of the hands in a standing position.

Equipment:
JAMAR static strength, digital grip dynamometer. A picture of the dynamometer is shown in Figure 1.

Figure 1. JAMAR Grip strength dynamometer.



Procedure:
1. Stand with the feet approximately shoulder width apart.
2. Bend the elbow of the dominant hand to approximately 90 degrees. The palms are facing in.
3. Reset the pointer on the dynamometer to zero.
4. Squeeze the grip device, giving a 100 percent maximal effort.
5. Keep you head up, facing forward, do not move your arm."
6. Record the score on below.
7. Repeat the same test using the other hand.
8. Repeat this three times on each side.

	Trial 1	Trial 2	Trial 3
Right Hand			
Left Hand			

Test: BACKPACK CARRYING ABILITY

Purpose:

To determine the maximum acceptable weight of a school backpack.

Equipment:

A regular school backpack
Weights

Procedure:

1. Start with an empty backpack.

2. Pick up the back pack **off the floor**, place it over your shoulders and on your back and then carry it down the hall, through the door, up the stairs and back.

3. Adjust the weight in the back pack until you feel that it is the maximum amount that you can put on and carry comfortably, the maximum amount that you put on and carry without straining yourself, and the maximum amount that you can carry down the hall, through the door, up the stairs and back.

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Environmental Health and You

Your Name:_____

Please match the word with the proper definition.

a. Respirator	_____Weariness or exhaustion from hard work or stress
b. Cilia	_____Father of Occupational Medicine (1633-1714)
c. Lung Function	_____A chemical such as a drug or pesticide.
d. Ergonomics	_____Physical properties of substances: solid, liquid, gas.
e. Health	____To clean and remove unwanted particles.
f. Disease	____A quantity of water that is returned to the earth in the form of rain, sleet, hail or snow.
g. Ramazzini	_____The measured capacity of inspiration and expiration.
h. Xenobiotics	_____The process of changing water vapors to liquid.
i. Purification	_____Science that arranges people and things for the most safe and efficient work to be accomplished.
j. Precipitation	_____Protective device used to purify/supply clean air.
k. Condensation	_____The amount of work we are capable of performing in a specific amount of time.
l. Fatigue	_____The condition of being of sound mind, body, and spirit.
m. Workload	_____A condition of sickness or impaired bodily function.
n. Chemical form	_____A measure of sound.
o. Decible	_____Tiny ear hairs that help transport sound.

Certificate of Achievement

This certifies that **Special Agent**

_____

has successfully completed

Environmental Health and You

Summer Science Camp

University of Rochester

Environmental Health and Sciences Center & Finger Lakes Occupational Health Services

July 16-17, 1998

_____ _____

Signature *Date*

_____ _____

Signature *Date*

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Signature *Date*