

INTRODUCTION TO ERGONOMICS & EXPOSURE ASSESSMENT

Instructor: Nicholas Warren, The Exchange, 860-679-4023; warren@nso.uchc.edu
 PUBH 497
 BME 5339

Learning Objective	Competency	Core Area
1. Demonstrate a working knowledge of human anatomy and physiology relevant to the work process.	Describe genetic, physiologic and psychosocial factors affecting susceptibility to adverse environmental health hazards.	Public Health Biology
	Apply evidence-based principles and scientific knowledge base to critical evaluation and decision-making in public health	Occupational Health
2. Understand and apply an integrated knowledge of multi-level, ergonomic risk factors	Assess strengths and limitations of various research designs in interpreting results of public health studies	Behavioral Health
	Describe genetic, physiologic and psychosocial factors affecting susceptibility to adverse environmental health hazards.	Epidemiology Behavioral Health Occupational Health
	Apply evidence-based principles and scientific knowledge base to critical evaluation and decision-making in public health	
3. Be able to practically assess presence, intensity, and duration of all ergonomic risk factors, using multiple methods of varying detail	Apply evidence-based principles and scientific knowledge base to critical evaluation and decision-making in public health	Epidemiology Occupational Health Behavioral Health Biostatistics
4. Understand the social, political and regulatory environment of companies and workers affects levels of risk factors and their control	Describe the roles biostatistics and epidemiology play in informing scientific, ethical, economic and political discussion of health issues	Health Policy Epidemiology
	Identify vital statistics and other key data sources for describing socioeconomic conditions and health states of communities	
5. Propose practical intervention techniques to reduce presence of ergonomic risk factors in work situations.	Apply evidence-based principles and scientific knowledge base to critical evaluation and decision-making in public health	Health Policy Occupational Health

Summary

This problem-based course begins with a work-related overview of the design strengths and limitations of human anatomy and physiology (molecular, tissue and systems levels). Definition and measurement of “normal” and “non-normal” or pathological conditions are explored. Measurement of the response of these biological tissues and systems to work-related stressors is examined, to define the mechanism and presentation of cumulative trauma disorders. The course focuses on the translation of external exposure to internal response. It addresses physiological and anatomical damage due to both biomechanical and psychosocial stressors and explores the range of possible control strategies of interest to the engineer and public health practitioner. These range from job- and task-specific engineering changes to organization-level interventions. For each type of exposure, students are exposed to a range of measurement approaches, combined with an exploration of issues and trade-offs in exposure assessment.

Finally, the course explores the role of human cognition and perception in work performance and the contribution of work/worker mis-matches to the development of disease. Throughout the course, students will examine the political and social issues involved in identifying disease and risk factors and in altering work and organizations to control these risks.

Syllabus Fall 2009

PUBH 497
BME 5339

Text: Kroemer and Grandjean; Fitting the Task to the Human

Week:

Date

- | | |
|---|--------|
| 1. Introduction to Ergonomics & Exposure Assessment | 9/4/09 |
| a. Overview and extent of the field | |
| 1) Terminology | |
| 2) Measurement | |
| 3) Multi-factoral and multi-level nature of risk | |
| 4) Issues and controversies; measurement, epidemiological, “confounders”
(gender, age, class) and political/economic | |
| b. Ergonomics: | |
| 1) Themes of the course | |
| 2) Overview of ergonomics | |
| 3) Issues and Controversies | |
| c. Exposure Assessment: | |
| 1) Themes of the course | |
| 2) Issues and trade-offs | |
| d. Human & work design features | |
| e. Homework: | |
| Kroemer 1 & 2 Armstrong et al. | |
| Pathology readings: Putz-Anderson, (<i>reference</i>), <i>Cherniack Lederer</i> ,
<i>Cherniack/Warren</i> , | |
| Exercise: human/machine system | |
| Groundwork for project | |

2. Morphology & Physiology of Neuromuscular System; Normal Function and Disease (MSD) 9/11/09
 - a. Symptom Surveys
 - b. Muscle morphology and physiology
 - 1) Mechanism of contraction
 - 2) length/tension relationship
 - c. Tendon morphology
 - d. Ligaments
 - e. Nerve structure and physiology
 - 1) Nature of nerve impulse
 - f. Bone & cartilage
 - g. Pathology; non-normal function
 - h. Homework:
 - Kroemer & Grandjean, Chapters 1 & 2 & 3, 4, 5, 7
 - Warren: OSHA Standard Risk Factors chapter, section B
 - Epi readings on biomechanical risk factors, NIOSH yellow book
 - Epi and lab articles on biomechanical risk

3. Pathology: MSDs (continued), Extent and Costs 9/18/09
 - a. Finish pathology overview
 - b. Extent of MSD problem
 - c. Underreporting
 - d. Costs of MSDs
 - e. Homework: epidemiology articles
 - 1) Anton-MSDs in dental hygienists
 - 2) Anderson-MSD causes in computer users
 - 3) Gerr-summary of evidence for MSDs in computer users

4. Epidemiology Primer and examples 9/24/09
 - a. Epi background
 - b. CUSP example
 - c. Homework
 - 1) Punnett & Herbert Gender
 - 2) 1 page project proposal
 - 3) Review OSHA standard documents

5. Biomechanical Risk Factors 10/1/09
 - a. MSD and Low Back Pain/Injury
 - b. Issues and Controversies in exposure assessment:
 - 1) Exposure and outcome
 - 2) Measurement issues
 - 3) Terminology issues
 - 4) Work-relatedness
 - 5) Multifactorial causation
 - c. Concepts of dose, body burden, reparative capacity
 - d. Biomechanical Risk Factors
 - 1) Repetition
 - 2) Force
 - 3) Posture
 - 4) Mechanical Compression

- 5) Dynamic Factors
 - 6) Vibration
 - e. Modifiers
 - f. Anthropometry design considerations
 - g. Back anatomy and risk
 - h. Gender
 - 1) CUSP as example
 - i. Introduction to Task Assessment
 - 1) Job division, task characterization, work sampling
 - 2) Multiple levels
 - 3) Self-Report
 - 4) Checklists
 - 5) Quantitative methods
 - 6) Observational Techniques
 - j. Instrumented Techniques
 - 1) Homework:
 - observational
 - postural techniques
6. Qualitative & Qualitative Biomechanical Assessment 10/8/09
- a. Intro to Task Assessment: macro-scheduling
 - 1) Job division, task characterization, work sampling
 - 2) Multiple levels
 - b. Self-Report
 - c. Checklists
 - d. Observational Techniques
 - e. Postural Methods (cont)
 - 1) OWAS
 - 2) RULA
 - 3) Corlett
 - 4) Armstrong
 - 5) NIOSH Lifting Equation
 - f. Homework
 - 1) Barefoot ergonomic analysis
 - 2) NIOSH lifting equation
7. Quantitative Biomechanical Assessment (Cont) 10/15/09
- a. Computer-based videotape analysis
 - b. Estimating Back Exposures
 - 1) NIOSH Lifting Equation-go over homework
 - 2) Washington and OSHA tools
 - 3) Other computer tools
 - 4) Psychophysical tools—Snook tables
 - 5) Metabolic Modeling
 - 6) Heart Rate Monitoring
 - 7) Respiratory Gas Monitoring
 - c. Homework:
 - Drury (Chap 2), Chapter 6 Kodak (timed activity analysis), macroscheduling
 - Metabolic load readings, Garg, Metabolic Modeling

8. Metabolic Load; Cardio-respiratory physiology & energy consumption 10/22/09
- a. Lab work; measurement of energy consumption, rest times
 - b. Exercise: calculating metabolic load;
 - 1) Garg modeling methods
 - 2) Other tools:
 - a) RPE scales
 - b) Snook tables
 - c. Work scheduling
 - d. Homework:
 - Andersson instrumented techniques
 - Macroscheduling for project
 - e. Homework:
 - ANSI vibration standard
 - 2 epidemiological articles: Bovenzi; Chetter et al.
9. Vibration 10/29/09
- a. Review of Quiz
 - b. Vibration:
 - 1) Health Effects
 - 2) Measurement
 - 3) Abatement
 - c. Homework: Psychosocial and Organizational
 - 1) Kroemer chapters 12-16,
 - 2) Faucett and Rempel, Bongers
 - 3) Excerpts from Healthy Work
 - 4) Progress report for project
10. Quiz and Human Factors 11/5/09
11. Psychosocial Risk Factors; Job Stress 11/12/09
- a. Psychosocial Risk Factors, Human Factors,
 - 1) Human Factors, Cognitive Load, and Perception
 - 2) JCQ and Effort Reward Models
 - b. Homework
 - OSHA Standard Excerpts
 - Kodak books, Cox
 - Kroemer 177-190 (10); 219-239 (13, 14)
12. Stress Measurement: Physiological and Behavioral Assessment 11/12/09
- a. Measurement of Psychosocial Work Environment
 - b. Physiological and behavioral assessment
 - c. Symptoms as risk assessment
 - d. Measurement of Organizational Factors
 - e. Homework
 - Warren & Hodgson
 - Epi articles, built environment
 - NIOSH Work Organization book
13. Organizational Factors 11/19/09

- a. Culture
- b. Structure
- c. VHA case study
- d. Measurement of Organizational factors
 - 1) surveys
 - 2) administrative data
 - 3) observed characteristics
 - 4) Qualitative methods
- e. Homework
 - Environmental readings
 - Project final work

(Thanksgiving Vacation)

11/26/09

14. Environmental Ergonomics , social/economic costs of MSDs, and regulation/ergonomic programs

12/3/09

- a. Anne Bracker: Environmental Ergonomics:
 - 1) Illumination
 - 2) temperature
 - 3) humidity
 - 4) noise
 - 5) chemicals
- b. Tim Morse: ergonomic implications and regulation
 - 1) Soc/economic
 - 2) Regulation/
 - 3) Ergonomic Programs
 - 4) Interventions: Aspects of Participatory Ergonomics
 - a) Ergonomic Programs, Multi-factoral and multi-level interventions

15. Student Presentations

12/10/09