

EXPOSURE ASSESSMENT IN ERGONOMICS

Syllabus

The goal of the course is to develop a broad understanding of ergonomic risk factors, knowledge of the measurement modalities available for characterizing workplace risk, and an appreciation of the advantages and disadvantages of each modality. Students will be instructed in the use of laboratory techniques (EMG, videotaping and digitization, digital motion capture, force cells, accelerometry and exercise physiology). They will also be introduced to field methods used in ergonomic work-site assessment, ranging from simple check-lists (geared towards worker-based interventions), through detailed time/motion studies, self-report effort scales, epidemiological instruments, and psychosocial and organizational measurement tools. The grade will depend on completion of a laboratory-based, field or epidemiological project.

Week:

1. Introduction to Ergonomic Exposure Assessment
 - a. Uses of exposure assessment
 - b. Themes of the Course: Trade-Offs
 - 1) Level of detail vs. cost
 - 2) Level of detail vs. implications; measurement influence on findings
 - 3) Issues of Validity and Precision
 - a) Comparison of methods
 - b) "Objective" and "Subjective" measurement; relation of self-report to external observation and instrument measurements
 - 4) Decisions based on the intended uses of job analysis
 - c. Musculoskeletal Disorders; Extent of the Problem
 - d. Review of Disease/Tissue Pathology
 - e. Review of Risk Factors
 - 1) Biomechanical
 - 2) Psychosocial/Organizational
 - 3) Role of Work Organization in creation/reduction of risk

Work Environment Exposure Measurement

2. Qualitative Job Task Assessment: Biomechanical Risk Factors
 - a. Self-Report
 - b. Checklists
 - c. Observational Techniques
3. Qualitative Job Task Assessment: Biomechanical Risk Factors (cont.)
 - a. Observational Techniques (continued)
 - b. Video-Based Techniques
4. Metabolic Load; Exercise Physiology and Stress
 - a. Metabolic Modeling
 - b. Heart Rate Monitoring
 - c. Respiratory Gas Monitoring
5. Laboratory Techniques I; Repetition and Posture

- a. Digital Motion Capture: Using Image Capture (IC) to measure exposure in a task (hammering) and job (keyboarding)
 - 1) Repetition
 - 2) Posture
- 6. Qualitative Job Task Assessment: Human Factors, Psychosocial and Organizational Factors
 - a. Human Factors, Cognitive Load, and Perception
 - b. Measurement of Psychosocial Work Environment
 - c. Measurement of Organizational Factors
- 7. Quantitative Sensory Testing for Neurovascular Deficit
 - a. Exposure to Vibrating Tool Use: Duration of Temporary Threshold Shift
 - b. Concepts of dose, body burden, reparative capacity
- 8. Laboratory Techniques II: Force, Motion & Vibration
 - a. Dynamometry
 - b. Force Sensitive Resisters (FSR); Force Mapping
 - c. Dynamic Factors: Velocity and Acceleration
 - d. Accelerometry
 - e. Analogue and Digital Techniques and Conversion
- 9. Qualitative/Quantitative Job Assessment
 - a. Computer-based videotape analysis
 - b. Measurement of Duration, Intensity and Temporal Pattern
 - 1) Assessment tools
 - 2) Work Sampling

Internal Environment Measurement: Physiological Exposure Indices

- 10. Laboratory Techniques III: Muscle Activity and Surface EMG.
 - a. Standardization: Maximum Voluntary Contraction, Others
 - b. Measurement of Fatigue
- 11. Stress Measurement; Physiological and Behavioral Assessment
- 12. Integrated Exposure Modeling
 - a. Decisions about What to Measure, Level of Detail, Use of Information
 - b. Combined Qualitative, Quantitative and Laboratory Techniques
 - 1) Complimentary features of self-reported, observational, quantitative and medical measurements
 - 2) Conflicts between modalities
 - 3) Modalities matched to data needed; what each modality can do better than the others.
 - c. Analysis of sample job by multilevel exposure characterization
 - 1) Task level
 - 2) Product flow
 - 3) Work organization
 - 4) Organizational risk factors
 - 5) Cultural, political, economic environment

13. Student Presentations