

Introduction to Ergonomics



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Session Description

- Ergonomics is the scientific study of people at work
- The goal of ergonomics is to reduce stress and eliminate injuries and disorders associated with the overuse of muscles, bad posture, and repeated tasks
- This is accomplished by designing tasks, work spaces, controls, displays, tools, lighting, and equipment to fit the employee's physical capabilities and limitations
- Attend this session to gain a better understanding of ergonomics



Ergonomics Definition

Ergonomics (or human factors) is the scientific discipline concerned with the understanding of the interactions among human and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance



(International Ergonomics Association Executive Council, August 2000)



What is Ergonomics

- Inter-disciplinary science which explores human capabilities and limitations and uses this knowledge to improve the design of things that people use and the ways in which they work
- Contributing disciplines include psychology, industrial engineering, computer science, biomechanics, safety engineering and a host of others
- Data and methods developed by the ergonomics profession are widely used to improve such things as office equipment and systems, technology for assisting disabled individuals, control rooms, educational and training materials, and consumer products



A 'Real' Scientific Discipline

- Ergonomics is a globally-recognized science with a body of validated research findings and practices, and a worldwide community of scholars
- The International Ergonomics Association, a federation of national ergonomics societies, has 29 member organizations, representing 16,000 ergonomists world-wide
- In the United States, the profession publishes in numerous peer-reviewed journals including the quarterly journal, Human Factors, which began publication in 1957
- There are more than 75 graduate and undergraduate ergonomics programs in accredited universities in the U.S. and Canada



Development of Ergonomics

- **Origin**
 - Ergonomics was derived from the Greek words: Ergon – work and Nomos - natural law
 - The name ergonomics officially proposed 7/12/49 at a meeting of the British Admiralty
 - The name ergonomics officially accepted in 1950
 - First use of the word is traced to a series of four articles written by a professor in Poland in 1857
 - In Britain, Ergonomic Society was formed in 1952 with psychology, biology, physiology, & design professionals
- **United States**
 - The Human Factors Society was formed in 1957
 - In the US "human factors engineering" was emphasized by the US military with concentration on human engineering and engineering psychology
 - US efforts also focused on the "role" of an individual within a complex system



Development of Ergonomics

- In the US, ergonomics became a real concern during World War II for improving the performance and safety of military systems such as aircraft, naval ships, and large-scale weapons
- Based on work conducted by early researchers, designers began to recognize the importance of reflecting the characteristics of the operator in the equipment they designed
- Post-war research expanded into the commercial sector to include space systems, consumer products, industrial and office settings, and computer systems
- In Europe, ergonomics began with an emphasis on human productivity and work physiology
- As the discipline matured, other fundamental objectives were recognized, such as the provision of safer and healthier working environments and the improvement of the quality of life
- Today, the global ergonomics community is equally concerned with improving the design of products and systems, and with improving conditions in industrial and office workplaces



How is Ergonomics Used

Companies adopt ergonomic principles to reduce the incidence of costly injuries in their facilities, or to make their products more marketable and user-friendly



Ergonomics Is Not Expensive

- Ergonomics is a cost-effective means of product enhancement
- Ergonomics applications-based on solid research findings-not only improve the workplace, but make products and processes more competitive in the world market
- The result is an improved bottom line for business, whether by decreased worker compensation and health care costs, or by increased marketability of products



Boundaries for Ergonomics

Ergonomics includes study of the following:

- Work Environment
- Psychosocial Environment
- Physical Environment
- Technology



Work Environment

1. Physical demands (e.g. lifting objects, moving objects)
2. Skill demands (e.g. typing at 110 words per minute)
3. Risk demands (e.g. working on wet floors)
4. Time demands (e.g. trying to finish by the end of shift)



Psychosocial Environment

1. Social (e.g. working in teams)
2. Cultural (e.g. pace of life)
3. Lifestyle (e.g. work vs. leisure time)



Physical Environment

- 1. Physical agents (e.g. heat, noise, vibration)
- 2. Chemical agents (e.g. air pollutants)
- 3. Biological agents (e.g. airborne diseases)



Technology

- 1. Product design
(e.g. designing product dimensions using anthropometrics, biomechanics data)
- 2. Hardware interface design
(e.g. designing controls and displays to meet user expectations)
- 3. Software interface design
(e.g. designing icons and commands to meet user expectations)



Ergonomic Considerations

- 1. Physical factors - ambient conditions; objects (tools, furniture, etc.)
- 2. Biological factors - body dimensions, body capabilities, physiological processes
- 3. Psychological factors - mental workload, information processing, training, motivation
- 4. Work factors - job demands (time, rate, etc.), job design
- 5. Organizational factors - organization type/climate, management regimes



Ergonomic Objectives

Enhance the efficiency and effectiveness with which work is carried out

- A vital difference between people and machines is that people make mistakes
- If we look positively at how people make mistakes to decrease errors, we can increase ease of use and reliability of performance
- This can increase productivity and the effectiveness of the system

Enhance certain desirable human values at work

- Increase safety
- Increase comfort (of using technology)
- Decrease stress and fatigue of operator (e.g. by providing more rest breaks)
- Increase user satisfaction
- Increase quality of life for all people



Musculoskeletal Disorders (MSDs)

- MSDs affect muscles, nerves, blood vessels, ligaments and tendons
- Workers in many different occupations can be exposed to risk factors at work
- Risk factors include lifting heavy items, bending, reaching overhead, pushing and pulling heavy loads, working in awkward body postures and performing the same or similar tasks repetitively
- Exposure to these known risk factors for MSDs increases a worker's risk of injury
- Work-related MSDs can be prevented
- Ergonomics --- fitting a job to a person --- helps lessen muscle fatigue, increases productivity and reduces the number and severity of work-related MSDs



Examples of Musculoskeletal Disorders

- Carpal tunnel syndrome
- Tendinitis
- Rotator cuff injuries (affects the shoulder)
- Epicondylitis (affects the elbow)
- Trigger finger
- Muscle strains and low back injuries



Impact of MSDs in the Workplace

•Work related MSDs are among the most frequently reported causes of lost or restricted work time

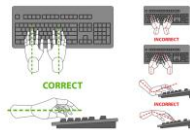
•According to the Bureau of Labor Statistics (BLS) in 2013, MSD cases accounted for 33% of all worker injury and illness cases



A Process for Protecting Workers

• Employers are responsible for providing a safe and healthful workplace for their workers

• In the workplace, the number and severity of MSDs resulting from physical overexertion, and their associated costs, can be substantially reduced by applying ergonomic principles



A Process for Protecting Workers

Implementing an ergonomic process is effective in reducing the risk of developing MSDs in high-risk industries as diverse as food processing, office jobs, transportation and warehousing

High Risk Occupations for MSDs

- Registered nurses, nursing assistants and psychiatric aides
- Firefighters and prevention workers
- Laborers and freight, stock and material movers
- Truck drivers
- Warehouse and storage workers
- Motor and tractor/trailer truck drivers
- Refuse and recyclable material collectors
- Stock clerks and order fillers
- Mail and messenger/clerks/light truck or delivery services drivers
- Telecommunications line installers and repairers
- Bus drivers, transit and taxi
- Production workers
- Police and sheriff/patrol officers
- Heating, air conditioning, and refrigeration mechanics and installers
- Painters, paperhangers and glaziers
- Manufacturing and repair workers, general

Source: Bureau of Labor Statistics, Economic News Release



Elements of an Ergonomic Process

The following are important elements of an ergonomic process:

- Provide management support
- Involve workers
- Provide training
- Identify problems
- Encourage early reporting of MSD symptoms
- Implement solutions to control hazards
- Evaluate progress



Provide Management Support

- A strong commitment by management is critical to the overall success of an ergonomic process
- Management should define clear goals and objectives for the ergonomic process, discuss them with their workers, assign responsibilities to designated staff members, and communicate clearly with the workforce

Goals & Objectives



Involve Workers

A participatory ergonomic approach, where workers are directly involved in worksite assessments, solution development and implementation is the essence of a successful ergonomic process. Workers can:

- Identify and provide important information about hazards in their workplaces
- Assist in the ergonomic process by voicing their concerns and suggestions for reducing exposure to risk factors and by evaluating the changes made as a result of an ergonomic assessment



Provide Training

- Training is an important element in the ergonomic process
- It ensures that workers are aware of ergonomics and its benefits, become informed about ergonomics related concerns in the workplace, and understand the importance of reporting early symptoms of MSDs



Identify Problems

An important step in the ergonomic process is to identify and assess ergonomic problems in the workplace before they result in MSDs



Encourage Early Reporting

Early reporting of MSD symptoms can accelerate the job assessment and improvement process, helping to prevent or reduce the progression of symptoms, the development of serious injuries, and subsequent lost-time claims



Implement Solutions

There are many possible solutions that can be implemented to reduce, control or eliminate workplace MSDs



Implement Solutions - Kitchen



Implement Solutions - Laundry



Implement Solutions - Offices



Office Ergonomics



Implement Solutions - Teachers



Implement Solutions - Custodial



Implement Solutions – Material Handling



Implement Solutions - Grounds



Implement Solutions

- Cultural change
- Training
- Teamwork
- Incorporating equipment
- Changing out equipment
- Personal protective equipment
- Risk avoidance or contracting out services
- Behavior focused
- Scheduling – split shifts
- Review loss runs to identify issues
- Seek assistance



Evaluate Progress

- Established evaluation and corrective action procedures are required to periodically assess the effectiveness of the ergonomic process and to ensure its continuous improvement and long-term success
- As an ergonomic process is first developing, assessments should include determining whether goals set for the ergonomic process have been met and determining the success of the implemented ergonomic solutions



Ergonomic Process

An ergonomic process uses the principles of a safety and health program to address MSD hazards

Such a process should be viewed as an ongoing function that is incorporated into the daily operations, rather than as an individual project



Preventing Injuries Reduces Costs

- AT&T Global Information Solutions, analyzed its injury logs and identified its three most frequent types of injuries: lifting, fastening, and keyboarding
- By making workstation improvements and providing proper lift training for all employees, the company's work comp costs dropped by 75% in the first year
- In a second round of changes, the company moved from conveyor systems to individual scissor-lift platforms and shifted from an assembly line process to allowing each worker to build an entire computer cabinet
- These changes allowed workers to readily shift from a standing to sitting position
- All told, the company's ergonomic changes enabled it to go from 298 work days lost from injury in 1990, to zero days lost to injury in 1993 and 1994
- That translated into work comp cost savings of \$1.48 million over the period



Incorporating Ergonomics

- Beginning in 1979, John Deere and Company, began using ergonomics principles to redesign and reduce physical stresses on the job
- Employees were extensively involved
- Since 1979, Deere has seen an 83% reduction in employee back injuries
- Within five years, worker compensation costs were cut by 32%



Summary

- Ergonomics looks at the work you do, the tools you use and your job environment
- The aim is to find the best fit between you and your job conditions
- Examples of ergonomic changes to your work may include
 - Adjusting the position of your computer keyboard to prevent carpal tunnel
 - Making sure that the height of your desk chair allows your feet to rest flat on floor
 - Learning the right way to lift heavy objects to prevent back injuries
 - Using handle coatings or special gloves to suppress vibrations from power tools
- No matter the job, the goal is to make sure that you are safe, comfortable, and less prone to work-related injuries

