

THE ROLE OF EPIDEMIOLOGICAL STUDIES IN ERGONOMICS RESEARCH

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INTRODUCTION

Epidemiology is a set of established and developing methodological approaches for understanding injury and illness causation and prevention in human populations. It can help answer questions such as:

1. Did anything unusual occur just before the occurrence of an injury in the workplace?
2. Is there a dose-response effect between physical load from lifting and the incidence of low back pain claims?
3. Are lifting aids in a nursing home effective for reducing the incidence and injury-related costs of low back pain claims?
4. How can I estimate the risk of injury to workers from robots?
5. How can I evaluate the effectiveness of a new exercise program being planned for my company?

The answers to these questions are difficult to achieve without first carefully describing the nature of the problem at the outset, then selecting the most efficient epidemiological method to achieve the best answer, testing the methods of exposure assessment and outcome definition for reliability and validity,

and finally interpreting the results with caution in light of other published literature [Burdorf and van der Beek 1999; Riihimäki 1999]. In a recent symposium [Courtney et al. 1997], researchers from many institutions summarized the state of the art of epidemiological methods as applied to occupational injury. The August 1997 issue of the *American Journal of Industrial Medicine* contains the collected papers from that symposium. Our conclusions generally pointed to the need for more well-planned, controlled epidemiological studies in ergonomics research. Studies using case-control, case-crossover or prospective cohort methods are much needed. The role of such studies are essential for reaching conclusions about effects that can have profound impacts on people at work.

Panelists

Following is a synopsis of each panelist's presentation and views on the topic of the role of epidemiological studies in ergonomics research. All panelists have considerable field experience and will present a real-world view of the potential and difficulties associated with epidemiological research in work settings.

Comprehensive Company-Based Injury Surveillance System

Gordon R. Reeve, Ph.D.
Ford Motor Company

Employers need to better understand the magnitude and rates of injuries and illnesses occurring in their operations. With the installation of a comprehensive injury surveillance system in 1994 The Ford Motor Company has integrated the use of injury surveillance data in nearly all of their injury prevention/intervention activities. This data system contains detailed information for all initial occupation visits to plant medical departments. It permits the calculation of injury rates by type of injury, by body part affected, department or sub-department unit, and by job class. It also links Workers Compensation data to injury clusters. The Company's ergonomic process at the plant-level uses the injury data to prioritize the activities to modify or re-design manufacturing processes. The groups involved with acute injury prevention regularly use the data system to track trends and to identify safety failures. Recently, studies at Ford have been completed which identified serious injury risk of acute injuries from robots and which documented the failure of work conditioning programs to reduce injuries. These and other examples of how injury data can be used in a manufacturing setting will be presented.

Ergonomic Solutions for Transferring Residents in Nursing Homes

James W. Collins, Ph.D.
National Institute for Occupational Safety and Health

The Bureau of Labor Statistics data indicates that nursing homes have the highest incidence rate for nonfatal injuries for industries with 100,000 or more injury cases. The National Institute for Occupational Safety and Health (NIOSH) is conducting research to identify strategies to reduce the risk of musculoskeletal injuries to nursing home workers. NIOSH funded a laboratory study to evaluate the biomechanical stress placed on nursing

personnel, the safety and comfort of the residents, and the time efficiency of 12 methods of transferring residents. The full-body lifts and overhead lift devices significantly reduced the biomechanical loading on the nursing assistants' backs when transferring totally dependent residents. The stand-up lifts and walking belt were shown to reduce the perceived stress on the lower back and whole body of nursing assistants. A NIOSH field study was developed to evaluate the effectiveness of these lab-tested methods in the context of an ergonomics program (patient lifting equipment, lifting training, and medical management of injured workers) in a study population of 1,000 nursing home workers over a six-year period. Results will be presented on the process of implementing the program and the programs impact on reducing the incidence, disability, and injury-related costs associated with back and other injuries among nursing staff in nursing homes.

The Role of Epidemiology In Demonstrating Effectiveness of Ergonomic Improvements

Alex Burdorf
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There is a clear need to demonstrate that ergonomic improvements are effective and efficient in preventing the occurrence of musculoskeletal disorders. Epidemiologic studies may contribute to establishing this evidence, but its usefulness is limited to interventions aimed at well-known associations between risk factors and musculoskeletal complaints, musculoskeletal sickness absence, and return to work. Appropriate study designs vary from pre-and-post-intervention assessments and cross-over designs to randomized controlled trials and community intervention trials. The choice for a particular design has strong implications for the intervention effect (i.e. health effect) to be addressed. For example, a cross-over design is not suitable to evaluate the effect of a new keyboard on the incidence of carpal tunnel syndrome. A randomized trial on a back school should not assess its effect on the prevalence of back pain but rather study changes in incidence and

recurrence of back pain and aggravation of existing back complaints. Several examples will be presented on how to tailor the epidemiologic study design to the ergonomic intervention of interest.

Acute Injury Vs. Cumulative Disorder or Disease Process? How Conceptualization of the Problem Drives Our Measurements of Exposure.

Hester J. Lipscomb, Ph.D.
Duke University Medical Center

A series of challenges for injury epidemiology will be presented in the context of the assessment of exposures relevant to back injuries among construction workers. Ideally, the goal of epidemiologic research is to measure relationships between disease and quantified levels of exposure specific to individual workers. This allows for the estimation of dose-response relationships that could be generalized to other settings. Methods of defining temporal relationships between exposure and outcome are also needed to allow the study of events that occur in relevant exposure periods. These issues have been addressed much more widely in chronic disease epidemiology than in the systematic study of injuries.

Measures of exposure are driven by how the investigator conceptualizes the problem. Is this a disease process relevant to cumulative exposure or an acute event with a short window of relevant exposure? Or could it be both? If so, how might short term peak exposure interact with cumulative exposures to produce injury or disease? What periods of cumulative dose are relevant? How do we deal with latency and the rate at which exposure is accrued? How we deal with these issues will influence the inferences made about exposures and injuries and recommendations for interventions.

SESSION FORMAT

After introducing the panelists, the chair will give a brief (five minute) introduction of the topic and the need for the panel discussion. Then each panelist will have 15 minutes to present their views on the topic. The audience will be asked to hold questions until the 30-minute discussion session at the end.

SUMMARY

Epidemiological research in work settings is mostly observational in nature, often lacking the experimental rigor found in clinical trials [Sorock and Courtney 1996]. This panel discussion will be an excellent forum for identifying the strengths and limitations of epidemiological research on acute traumatic injury and musculoskeletal disorders at work. It will also suggest what the role of such research can be to reduce the burden of injury and illnesses in the workplace.

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PREFACE

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