



**56** Extramural  
Research Projects

**23** Intramural  
Research Projects

# MUSCULOSKELETAL DISORDERS

**NIOSH RESEARCH PROJECTS**  
January 1997



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service  
Centers for Disease Control and Prevention  
National Institute for Occupational Safety and Health



# Extramural and Intramural Research Projects

## Extramural Research Projects

### Grants

- Disease/Injury (determination of adverse effects)

#### I. Low Back/Hip

##### Effect of Load Asymmetry on Internal Loading of the Trunk

**Researcher:** Ali Sheikhzadeh  
**Affiliation:** Hospital for Joint Disease  
 New York, New York  
 (212) 255-6690  
**Keywords:** Trunk muscles, electromyography, isometric exertion

**Purpose:**  
 To quantify the activities of ten trunk muscles by using the surface electromyography (EMG) during maximal and sub-maximal isometric exertion under pure and combined loading conditions of the trunk.

**Abstract:**  
 In industry, carrying and lifting objects asymmetrically is the rule rather than the exception. This situation is hazardous to the musculoskeletal system due to an increase in coactivation of the musculature and an increase of the forces of the spine. This study will provide a better understanding of the effect of asymmetrical lifting on mechanical and neuromuscular performance and on the risk of injury to the back using EMG. The primary hypotheses are: (1) the peak EMG activity of trunk muscles will be higher during maximal combined exertion than during pure maximal exertion, (2) the mean RMS-EMG of ten selected trunk muscles will change significantly with the orientation of the net resultant moments of the trunk, and (3) the compression and shear forces will be changed significantly by the orientation of the resultant moment.

##### Occupational Physical Loads and Hip Osteoarthritis

**Researcher:** Bradley Evanoff, M.D.  
**Affiliation:** Washington University  
 St. Louis, Missouri  
 (314) 362-4355  
**Keywords:** Physical factors, hip osteoarthritis, case-control study

**Purpose:**  
 To examine the associations between various physical factors and hip osteoarthritis in a case-control study.

**Abstract:**  
 Osteoarthritis is a common degenerative joint disease which causes substantial illness and large attendant costs. Establishing an association between this disease and heavy physical loading may help to reduce harmful physical exposures in the workplace. In this case control study, the cases and controls will come from a Health Maintenance Organization (HMO). All subjects will be age, sex, geographic area, and length of HMO enrollment matched. Participants will complete a self-administered exposure questionnaire. A telephone follow-up interview will be performed with subjects unable to complete the written questionnaire. Exposures to be evaluated include lifting, jumping, climbing, whole-body vibration, and work postures. Recreational physical activity and body-weight will be controlled in the analysis of the data.

#### II. Upper Extremities

##### Cumulative Trauma Disorder: Skeletal Muscle Dysfunction

**Researcher:** William T. Stauber, Ph.D.  
**Affiliation:** West Virginia University  
 Morgantown, West Virginia  
 (304) 293-1491

**Keywords:** Cumulative trauma disorder, skeletal muscle dysfunction, injury in hand-intensive jobs

**Purpose:**  
 To study the factors which produce muscle injury and result in cumulative trauma disorder (CTD) experienced in hand-intensive industrial jobs.

**Abstract:**  
 Muscle pain is often experienced by workers who have to move repeatedly and/or forcibly. The cumulative trauma disorder that results from repetitive movements is difficult to anticipate and prevent. The present study uses a rodent model to: (1) determine the factors which produce dysfunctional muscles, (2) document changes in the matrix and myofibers which lead to pathologic muscles, and (3) study the impact of speed and acceleration on the function and reversibility of repeated injury experienced by hand-intensive jobs. In this research, muscles are chronically injured by mechanical overloading. Tissues are surveyed for specific cellular markers involved in tissue injury and repair. The functional outcome of repeated injury is assessed. This research will aid in the design of preventive regimens for individuals in specific industrial settings.

##### Age and Cumulative Trauma Disorder in Garment Workers

**Researcher:** Jacqueline Agnew, Ph.D.  
**Affiliation:** Johns Hopkins University  
 Baltimore, Maryland  
 (410) 955-4082

**Keywords:** Age, cumulative trauma disorders, garment workers, ergonomic stresses

**Purpose:**  
 To investigate age and other risk factors for the development of cumulative trauma disorders (CTD) in garment workers.

**Abstract:**  
 This study examines the association between age and CTD in garment workers exposed to ergonomic stresses. Ergonomic factors will be analyzed and the interaction between age and these factors will be assessed, controlling for other important confounding or effect-modifying variables. In this study CTD symptoms, CTD

history, CTD diagnosis, age, other individual factors and ergonomic exposures will be assessed. The prevalence of CTD symptoms among the cohort will be determined. Workers will be directly observed on the job to characterize ergonomic exposures. Worker cumulative ergonomic stress will be assessed. Potential interactive effects between age and ergonomic risk factors on CTD symptom prevalence will be evaluated. A baseline for the cohort of garment workers will be established for future study.

### Ergonomic Risk Factors and Cumulative Trauma Disorders

**Researcher:** Alfred Franzblau, M.D.  
**Affiliation:** University of Michigan  
 Ann Arbor, Michigan  
 (313) 936-0758  
**Keywords:** Cumulative trauma disorder, upper extremities, wrist, ergonomics

**Purpose:**  
 To perform medical screening of workers at risk of developing upper extremity cumulative trauma disorders (CTD).

**Abstract:**  
 This study will compare the health of workers in jobs that are stratified on different levels of repetition. Jobs will be analyzed for repetitiveness, force, mechanical stress, posture, vibration, and temperature extremes. Workers in these jobs will undergo standardized medical evaluations that will include a questionnaire, physical examination of the upper extremities, and limited electrodiagnostic studies at the wrists. Exposure-response relationships will be examined through univariate and multivariate analyses. This research will help to develop models of quantitative dose-response relationships between generic job exposures and medical outcomes, to evaluate the efficacy of the various medical screening techniques employed to detect CTDs, and to provide specific recommendations for participating plants and workers about how to reduce ergonomic risk factors.

### Musculoskeletal Disorders Among VDT Operators

**Researcher:** Fredric E. Gerr, M.D.  
**Affiliation:** Emory University  
 Atlanta, Georgia  
 (404) 727-3697  
**Keywords:** Musculoskeletal disorders, video display terminals, upper extremity

**Purpose:**  
 To determine the relationship between occupational use of video display terminals (VDT) and upper-extremity musculoskeletal symptoms and disorders.

**Abstract:**  
 The specific aims of this study are to: (1) determine the incidence of self-reported upper-extremity musculoskeletal symptoms and clinically verified upper-extremity disorders among VDT users, (2) estimate the effect of specific ergonomic, work practice, and occupational psychosocial stress variables on these outcomes, (3) determine whether those with musculoskeletal symptoms or disorders are more likely to leave work requiring use of VDTs, and (4) determine the time for symptoms to occur and the disorder to develop. Direct assessment of workstation physical characteristics and worker posture will be performed at the worksite. Participants will complete weekly VDT use diaries and symptoms diaries (to identify subjects who have experienced change in symptoms). These subjects will be offered a standard clinical assessment, including an interview, physical exam, and median nerve distal motor latency tests.

## • Work Environment

### Organization of Work

#### Organization Support: Contribution to CTD Risk

**Researcher:** Robert Karasek, Ph.D.  
**Affiliation:** University of Massachusetts  
 Lowell, Massachusetts  
 (508) 934-3274  
**Keywords:** Work organizational risk factors, psychosocial risk factors, stress, musculoskeletal disorders

**Purpose:**  
 To study the relationships among characteristics of organizations, individual psychosocial and physical stressors, health outcomes, and the risk of musculoskeletal disorders.

**Abstract:**  
 This research utilizes a database developed through a study in the Netherlands of 782 companies. The project consists of a multilevel examination and characterization of the associations between organization-level characteristics, individual-level psychosocial and physical stressors, intermediate measures of musculoskeletal and psychological strain and the health-related outcomes of musculoskeletal and stress-related absenteeism and disability. This research will generate new information about the etiology of disease and its relationship to both individual and larger organizational influences. The results will provide information to prioritize and guide future organization-level intervention strategies.

## • Research Tools and Approaches

### I. Control Technology

#### An Ergonomic Study of Alternative Keyboard Designs

**Researcher:** Richard W. Marklin, Ph.D.  
**Affiliation:** Marquette University  
 Milwaukee, Wisconsin  
 (414) 288-3622  
**Keywords:** Carpel tunnel syndrome, wrist, computer operators, computer keyboards, forearm

**Purpose:**  
 To determine if the fundamental designs of alternative keyboards have a beneficial effect on the posture of the wrist and forearm on the data entry operator compared to the conventional, flat keyboard.

**Abstract:**  
 Carpel tunnel syndrome (CTS) is a growing occupational problem for computer operators. This research will assess whether alternative keyboards impose less ulnar deviation and forearm pronation on the data entry operator than the conventional flat keyboard and whether the keyboard design affects the upper extremity motion patterns of operators in the early stage of CTS differently than health operators. Electrogoniometers and video equipment will monitor the motion patterns of the finger, wrist, forearm, elbow, shoulder, and neck of 20 subjects with CTS and 20 controls. This research will help to reduce the incidence, severity, and costs of musculoskeletal disorders in computer work environments.

## Invalid Patient Transfer-Transport-Lift-Weigh System

**Researcher:** Theodore A. Williamson  
**Affiliation:** Black Mountain MedCrafters  
 Charlotte, North Carolina  
 (704) 373-9069  
**Keywords:** Manual lifting, SCAT!™, moving patients,  
 transport of patients

**Purpose:**  
 To develop a device to eliminate manual lifting of patients, incorporate self-contained features for emergency equipment and oxygen, and provide savings in time and personnel effort during the transfer-transport process.

**Abstract:**  
 The NIOSH lifting equation, which specifies safe manual lifting limits to industry, disallows the current method of transferring patients from a hospital bed to a stretcher for intra-facility transport. A new device the SCAT!™ eliminates manual lifting of patients, requires less time, and fewer personnel for the transfer-transport process. It includes emergency equipment, weighs patients accurately, eliminates back flow contamination and the need for IV poles, and provides a privacy curtain for patients. This project will consist of 2 phases. Phase I will fabricate and evaluate the prototype SCAT!™. Phase II will allow fabricating 50 units to demonstrate the benefits and advantages that the SCAT!™ will provide in improving quality patient care within clinical facilities.

## II. Economic and Social Consequences

### Upper Extremity RSI: Extent and Costs

**Researcher:** Charles F. Dillon, Ph.D., M.D.  
**Affiliation:** University of Connecticut Health Center  
 Farmington, Connecticut  
 (860) 679-2366  
**Keywords:** Repetitive strain injuries, upper extremity,  
 surveillance

**Purpose:**  
 To delineate repetitive strain injuries (RSI) in Connecticut's working population, to define the history of RSIs and to develop a set of intervention trials to define diagnostic criteria and intervention effectiveness of various upper extremity disorders.

**Abstract:**  
 Epidemiological and clinical studies will be conducted to assess unreported worker RSIs in Connecticut. These cases will be contrasted with RSI cases reported to the state Workers' Compensation system and controls. This study proposes to define key variables and features of the work placement environment which affect worker reporting of RSIs. The current distribution of ergonomic interventions in Connecticut will be delineated and compared to outcomes. A clinical case confirmation is included for self-reported work related RSI cases who have not entered the workers' compensation system. Follow-up surveillance of RSI cases identified will be conducted. These studies are an effort to improve existing surveillance systems, guide policy making, develop prevention and intervention strategies, and provide insight for future research.

## III. Exposure Assessment Methods

### Intracarpal Pressure During Hand Maneuvers

**Researcher:** David Rempel, M.D.  
**Affiliation:** University of California  
 San Francisco, California  
 (510) 231-5720  
**Keywords:** Intracarpal pressure, carpal tunnel syndrome, wrist

**Purpose:**  
 To develop data on intracarpal pressure (ICP) changes in relationship to both hand movements and simulated work tasks and attempt to develop a mathematical model that will predict ICP during specific maneuvers related to the relationship of hand activities to ICP.

**Abstract:**  
 There is strong evidence that carpal tunnel syndrome is related to occupations involving hand intensive work. The objective of this research is to use intracarpal pressure to specify hand maneuvers that can be safely performed in the workplace to prevent carpal tunnel syndrome and wrist tendinitis. In this research the investigators will identify the relationship between intracarpal pressure and hand movements, determine whether ICP varies significantly within individuals, and develop a mathematical model that will predict intracarpal pressure as a function of elementary hand motions. Hand maneuvers to be evaluated are: wrist extension/flexion angle and wrist ulnar/radial deviation angle, metacarpophalangeal joint angle, and pinch force. Phase I will collect elementary hand maneuver data. Phase II will assess typing tasks to clarify hand maneuvers and intracarpal pressure.

### Stochastic Model of Trunk Musculature During Lifting

**Researcher:** Gary Mirka, Ph.D.  
**Affiliation:** North Carolina State University  
 Raleigh, North Carolina  
 (919) 515-6399  
**Keywords:** Stochastic model, lumbar trunk muscles, lifting, spine

**Purpose:**  
 To develop a model which will give an accurate representation of internal trunk muscle forces, as well as spine reaction forces, as a worker performs a job.

**Abstract:**  
 The object of this research is to develop a stochastic model of the lumbar trunk during lifting. This model will use stochastic principles to predict the activation levels of ten trunk muscles under occupational lifting conditions including varied weights, postures, dynamic components, and asymmetric lifting. This stochastic model will be developed in two phases. In the experimental phase, human subjects will be asked to perform highly controlled simulated lifting motions repeatedly. The electromyographic (EMG) activity of ten trunk muscles will be sampled and used to develop a database describing that particular lifting motion. In the modeling phase, this database will be used in a simulation model which will generate potential muscle activities.

### Evaluation of Determinants of Lifting Capacity

**Researcher:** Mohamed M. Ayoub, Ph.D.  
**Affiliation:** Texas Tech University  
 Lubbock, Texas  
 (806) 742-3543  
**Keywords:** Lifting capacity, manual material handling, power

**Purpose:**  
 To investigate the role of power (product of force and velocity) in lifting capacity and to evaluate the relative importance of various measures of strength in predicting lifting capacity.

**Abstract:**  
 Injuries associated with manual material handling (MMH) continue to pose a significant problem to industry, both in terms of human suffering and economic losses. This research will investigate the role of power in determining lifting capacity and the relative importance that strengths measured by various techniques have in predicting lifting capacity by using isokinetic and isoinertial techniques, and isoinertial lifting capacity techniques. At this time, the relative contributions of various strengths to lifting capacity are unclear, and this pilot study will reduce this uncertainty.

### Musculoskeletal Performance Capacity Envelope Estimation

**Researcher:** George V. Kondraske, Ph.D.  
**Affiliation:** University of Texas  
 Arlington, Texas  
 (817) 273-2335  
**Keywords:** Knee extensor, performance capacity envelope, musculoskeletal subsystem, workstations

**Purpose:**  
 To develop and test a method to obtain high fidelity estimates of the multidimensional performance capacity envelope that accurately characterizes a musculoskeletal subsystem.

**Abstract:**  
 Musculoskeletal work-related injuries account for considerable human suffering and loss of productivity. To better understand cause-and-effect relationships, recent research has included quantitative task analysis, measurements of human performance capacities, and models to inter-relate these factors. This research will develop and test a general methodology to obtain high fidelity estimates of the multidimensional (strength, range, and speed) performance capacity envelope that more accurately characterizes a musculoskeletal subsystem (trunk extensor, wrist extensor, knee flexor, etc.). The central idea is to use information contained in the shape of performance envelopes in combinations with a minimal set of human subject-specific measurements to estimate the desired envelope. This hypothesis will be tested in 40 volunteers in a representative subsystem, the knee extensor. This model could be used to design improved workstations.

### Validity Assessment of Self-Reported Construction Tasks

**Researcher:** Kathrine L. Hunting, Ph.D.  
**Affiliation:** George Washington University  
 Washington, D.C.  
 (202) 994-1734  
**Keywords:** Ergonomics, self-reported exposures, sheet metal workers, construction

**Purpose:**  
 To evaluate the validity of self-reported exposures to construction work tasks among sheet metal workers.

**Abstract:**  
 Work-related musculoskeletal disorders (WMDs) are a problem among construction workers. Previous work done using observation or measurement methods to assess the ergonomic features of work tasks are impractical in a large epidemiological study. This research will develop and evaluate a questionnaire method for assessing the amount or proportion of time individuals spend doing specified tasks. It will evaluate the validity of self-reported exposures to construction work tasks among sheet metal workers. Data on time spent at each task could be combined with expert ergonomic characterization of hazards to derive semi-quantitative estimates of ergonomic hazards for each worker. This method could be useful in epidemiological studies of WMDs to identify risky tasks, explore exposure thresholds and dose-response effects, and to evaluate the effectiveness of intervention studies.

### Worker Monitoring for Carpal Tunnel Syndrome

**Researcher:** Robert Radwin, Ph.D.  
**Affiliation:** University of Wisconsin  
 Madison, Wisconsin  
 (608) 263-6596  
**Keywords:** Carpal tunnel syndrome, psychomotor and sensory tests

**Purpose:**  
 To investigate the use of a battery of psychomotor and sensory tests to periodically monitor industrial workers for subtle functional deficits associated with carpal tunnel syndrome (CTS).

**Abstract:**  
 Psychomotor and sensory tests are proposed as being sensitive enough to detect early CTS deficits and be more specific for CTS than other monitoring instruments (self-reported or structured symptom surveys). The proposed research is a prospective study to investigate if temporal changes in the test parameters can be observed among workers developing CTS symptoms. Two hundred and fifty workers exposed to risk factors associated with CTS in industries with high CTS incidence rates will be periodically tested for changes in psychomotor and sensory functional test parameters over a four year period. Workers will annually undergo examinations for CTS, including electrophysiological testing. Outcomes having positive/negative functional changes and positive/negative self-reported symptoms will be ascertained and sensitivity, specificity, and predictive value will be compared. In addition, new parameters for these instruments will be investigated using outpatient subjects and controls.

## IV. Health Services Research

### Outcomes of Upper Extremity Cumulative Trauma Disorders

**Researcher:** James P. Keogh, M.D.  
**Affiliation:** University of Maryland  
 Baltimore, Maryland  
 (410) 706-7464  
**Keywords:** Cumulative trauma disorder, upper extremity, upper extremity cumulative trauma disorder

**Purpose:**  
 To explore the relationships between characteristics of the worker, the workplace, the health care delivery system and outcomes in patients with upper extremity cumulative trauma disorders (UECTD).

**Abstract:**

UECTDs are common in a variety of occupations, require medical treatment, have relatively short latency between exposure and effect, are often work-related, have serious health outcomes, and are typically addressed through secondary prevention. This research will consist of a descriptive epidemiological study to explore the relationships between characteristics of the work, the workplace, and the health care delivery system and outcomes in patients with UECTDs. The study will combine existing data with data collected by telephone survey. Three different populations will be surveyed. Surveys will assess the delay from onset of symptoms to medical care, the relationship between delay and outcome, and factors that influence preventive actions to protect workers. This research will provide an early examination of the events in the health care process, compare the outcomes between occupational and non-occupational cumulative trauma disorder outcomes, and identify the costs of shifting between workers compensation and other health insurance.

**V. Intervention Effectiveness Research****Field Evaluation of NIOSH Lifting Equations**

**Researcher:** Mohamed M. Ayoub, Ph.D.  
**Affiliation:** Texas Tech University  
 Lubbock, Texas  
 (806) 742-3543

**Keywords:** Low-back injuries, NIOSH lifting equations

**Purpose:**

To determine the ability of the 1981 and 1991 NIOSH lifting equations to predict and control low back injuries.

**Abstract:**

A 3-year prospective field investigation using subjects from a variety of occupations will be conducted. Comprehensive job data will be collected including workplace geometry, task durations, etc. Personal data of subjects will also be collected such as age, gender, ethnicity, history of lost time low-back injuries, etc. This study will investigate the relationship between the ratios of the magnitude of loads lifted or lowered to the recommended NIOSH levels and the form of the multipliers included in the NIOSH equations. This research will advance the knowledge of job and task design principles aimed at reducing the incidence and severity of low-back injuries in industry. The results will benefit workers and employers by reducing injuries and related costs and provide NIOSH with information regarding the adequacy of the current lifting guidelines and will be useful in future revisions of the guidelines.

**Effect of VDT Mouse Design on CTD Risk and User Skill**

**Researcher:** Ann E. Barr  
**Affiliation:** Hospital For Joint Diseases  
 New York, New York  
 (212) 598-6589

**Keywords:** Video display terminals, computer mouse, cumulative trauma disorder

**Purpose:**

To evaluate the risks associated with mouse use during video display terminal (VDT) work.

**Abstract:**

The biomechanical requirements for electronic mouse operation may be risk factors for cumulative trauma disorder (CTD) of the forearm and wrist and may limit skill acquisition and proficiency among both highly skilled and new mouse users. This study will document the extent of CTD risk factors among occupational mouse users. The objectives of the study are to: (1) evaluate the

biomechanical effects of mouse use on the forearm and wrist, (2) design an alternative mouse that reduces the risk of forearm and wrist CTD and determine the biomechanical effects of mouse design, and (3) determine the effect of mouse design on skill acquisition and proficiency. Participants (125) skilled and new occupational mouse users will be tested five times over seven weeks. Knowledge from this study will help prevent CTD in computerized offices and enhance understanding of the limits to skill imposed by constraints in the human-machine interface.

**Do Lifting Belts Protect the Back During Sudden Loading?**

**Researcher:** Steven Lavender, Ph.D.  
**Affiliation:** Rush Presbyterian St. Luke's Medical Center  
 Chicago, Illinois  
 (312) 942-5850

**Keywords:** Lifting belts, spine, low-back disorder, electromyography

**Purpose:**

To investigate the efficacy of lifting belts in reducing the internal forces acting on the spine during sagittally symmetric and asymmetric sudden loading.

**Abstract:**

The biomechanical role lifting belts play in the prevention of low back injury has been the subject of considerable debate. Epidemiological studies have shown that sudden unexpected loading is frequently related to the onset of low-back disorder (LBD) because of the effect on the spine. The objective of the two studies described here is to determine whether lifting belts protect individuals exposed to sudden loading of the torso. Twenty subjects will be assessed. Both studies will investigate the effect of the lifting belt combined with the expectancy of loading and whether the load is asymmetric with regard to the body's mid-sagittal plane. Ten trunk muscles will be sampled with surface electromyography. These data will be used in an inverse dynamic biomechanical model to determine the change in the new moments of the ankle, knee, hip, and L5/S1 level due to the lifting belt.

**Effect of Squeegee Design on Carpal Tunnel Pressure**

**Researcher:** William H. Musser  
**Affiliation:** Squeegee Plus  
 Florence, Oregon  
 (503) 342-1540

**Keywords:** Carpal tunnel syndrome, carpal tunnel pressure, hand tools

**Purpose:**

To determine the feasibility of preventing carpal tunnel syndrome (CTS) by redesigning the shape of the handle used on squeegees in the screenprinting industry.

**Abstract:**

Repetitive use of hand tools, in particular those that compress the palm of the hand and held with a pinch or precision grip may be a large part of the high incidence of carpal tunnel syndrome in the industrial workplace. This research will investigate the relationship of carpal tunnel pressure (CTP) to the design of handles used on squeegees and related hand tools such as pliers and screwdrivers. The purpose of the research will be to determine the feasibility of preventing CTS using the squeegee handle as a hand tool model and redesigning the standard shape. Initially the investigators will evaluate how handle shape and size affects CTP to determine the feasibility of designing an ergonomically sound squeegee handle. If the 1st phase seems to prevent CTS then the second phase of the study will design and test a prototype squeegee handle and develop the biomechanics to properly use this ergonomic handle.

## Health Services in Occupational Safety and Health

**Researcher:** Kenneth D. Rosenman, M.D.  
**Affiliation:** (517) 353-1846  
**Keywords:** Back, wrist, hand, repetitive motion injuries, workers' compensation

### Purpose:

To examine the experience of workers with back or wrist and hand repetitive motion injuries as they interact with the workers' compensation system in Michigan.

### Abstract:

This project focuses on who files workers' compensation claims, what is the difference in financial and social costs, and quality of life for injured workers who do file workers' compensations versus those that do not. This is a longitudinal study, where the course of injury and the factors that affect the outcomes of interest are observed over a 2-year period. The project will use administrative data and collected data. A sample of 1600 workers with back or wrist and hand injuries stratified by employer size and whether or not the worker had applied for workers' compensation will be drawn from the Michigan Public Health Department Occupational Disease Reports. The employees and employers will be surveyed to determine the factors that affect the decision to file a claim. The employees will be surveyed two years later to evaluate the different experience of those who did and did not file claims. Lost wages of workers will also be calculated.

## Physicians & the Return-to-Work-Process

**Researcher:** Linda Rudolph, M.D.  
**Affiliation:** (415) 557-8160  
**Keywords:** Work related low back injuries, workers' compensation, managed care

### Purpose:

To improve the return to work outcome for workers sustaining disabling work-related low back injuries, and to provide information of value in the planning and evaluation of workers' compensation managed care programs.

### Abstract:

This research will study physicians decisions regarding the release of workers to return to work. This study use a sample of 300 physicians from different health care delivery systems. Medical charts of workers with low back injuries will be abstracted to obtain information about the release to return to work and work restrictions. Physicians will be interviewed about their knowledge and practices regarding return to work. Patients will be interviewed six months after their release to work to obtain their perceptions of this process. This study will elucidate physician factors which influence return to work outcome. This information will aid in the design of workers' compensation managed care programs, facilitate improved management of the process, and provide insight into injured workers' return to work experience.

## Back Injury Intervention for Small Contractors

**Researcher:** Gary Mirka, Ph.D.  
**Affiliation:** North Carolina State University  
 Raleigh, North Carolina  
 (919) 515-6399  
**Keywords:** Low back injury, stochastic hazard assessment model, ergonomic interventions, engineering solutions, administrative controls, education and training

### Purpose:

To evaluate high risk populations for low back injury.

### Abstract:

This research will focus on masons, carpenters, and roofers in North Carolina. The first phase of this project will be to conduct a symptom survey of a large sample of workers from each of these trade groups to develop a baseline for low back pain symptoms. A subset of this group will undergo more in-depth evaluation through a symptoms survey and several simple physical tests. A stochastic hazard assessment model will be used to quantify the biomechanical demands of these jobs. The second phase will be to develop and implement ergonomic interventions to reduce the biomechanical stress experienced by these workers. This will include engineering solutions, administrative controls, and education and training. The third phase will be to test the effectiveness and efficacy of these solutions. The final phase will be a demonstration project that will be conducted on a home site where the solutions developed and evaluated during the course of the project will be put on display for other small residential contractors.

## Cooperative Agreements

### Greater Cincinnati Occupational Health Clinic

#### For more information contact:

The National Institute for Occupational Safety and Health  
 1-800-35-NIOSH (356-4674)

**Keywords:** Carpenters, musculoskeletal disorders, shoulder, carpal tunnel syndrome, back, screw gun

#### Purpose:

To characterize the prevalence of work-related musculoskeletal disorders in journeyman carpenters.

#### Abstract:

In this project 560 Union Carpenters underwent telephone interviews in 1992 about their jobs and musculoskeletal symptoms, of these 100 carpenters were given physical exams. Follow up evaluations of these participants will be conducted. A high prevalence of symptom-based shoulder disorders (18%) and carpal tunnel syndrome (11%) were reported and diagnostically confirmed. Ergonomic exposures, predominantly to the shoulder and back, were characterized by a variety of methods. A pilot education intervention program was conducted at a carpenter apprentice school as well as tool box ergonomic talks for journeyman carpenters at a number of work sites. Evaluation of modifications made to a screw gun are being completed. Work is underway to institutionalize the progress of the cooperative agreement by building support in a Labor Management Committee to disseminate information and to establish an on-going ergonomic program.

### Prevention Center for Occupational Safety and Health in the Construction Industry

**Researcher:** Susan Moir  
**Affiliation:** University of Massachusetts-Lowell  
 Lowell, Massachusetts  
 (508) 934-3258

**Researcher:** Laura Welch, M.D.  
**Affiliation:** George Washington University  
 Washington, D.C.  
 (202) 994-1734

**Researcher:** Thomas M. Cook, Ph.D., P.T.

**Affiliation:** University of Iowa  
Iowa City, Iowa  
(319) 335-4533

**Researcher:** Steve Hecker

**Affiliation:** University of Oregon  
Eugene, Oregon  
(541) 346-5054

**Keywords:** Longitudinal studies, ergonomics, musculoskeletal disorders, surveillance, exposure assessment, construction workers

**Purpose:**

To conduct research on issues related to the health and safety of construction workers.

**Abstract:**

Ten institutions conducting 13 projects are funded under a cooperative agreement with the Center to Protect Workers' Rights in Washington D.C. In the study proposed under this agreement, laborers and workers from construction trades will be asked to complete a health survey in 1997 and then will be followed into the future. They will fill out additional health surveys at periodic intervals. These databases will be maintained for many years on large numbers of workers and used to track the prevalence, and perhaps the causes, of musculoskeletal disorders, identify which trades are at highest risk and possibly the types of exposures that are causing the problems. Other ergonomic programs include development of new intervention strategies and demonstration projects for reduction of work-related musculoskeletal disorders, development of exposure assessment tools, and development of surveillance tools.

### Promoting Health Among the Nation's Health Care Workers: Implementing Employee Management Advisory Teams

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Employee- Management Advisory Teams, musculoskeletal disorders, nursing homes, urban hospital, patient transporters, laboratory technician, back injuries

**Purpose:**

To develop programs to encourage health care employee participation in safety and health activities.

**Abstract:**

The goal of this project is to reduce occupational disease and injury among the nation's health care workers by implementing and evaluating the effectiveness of Employee-Management Advisory Teams (E-MATs) to encourage employee participation in safety and health activities. To achieve this, NIOSH funded two cooperative agreements. One with Washington University (WU) in St. Louis, Missouri was funded to implement the model in 3 departments of a large urban hospital. In FY96 the WU program successfully implemented and trained two E-MATs consisting of patient transporters and biomedical laboratory technicians. The second award with the University of Wisconsin (UW) at Milwaukee, Wisconsin was funded to implement E-MATs at 4 rural long-term care nursing facilities. UW successfully established 4 E-MATs concerned with patient handling and back injuries each in a different nursing home in rural Wisconsin, Minnesota, and Maine. At 3 of the health care sites, workers' compensation losses related to musculoskeletal disorders were reduced by an average of \$50,000 in less than one year.

### Evaluation of Effect of Medical Management and Rehabilitation Programs for Work-Related Musculoskeletal Disorders

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Medical management, rehabilitation of employees, evaluation, work-related musculoskeletal disorders

**Purpose:**

To evaluate the effectiveness of medical management and rehabilitation on successful return-to-work of employees with work-related musculoskeletal disorders.

**Abstract:**

There is little documented scientific evidence on the effectiveness of medical management and rehabilitation on successful return-to-work of employees with work-related musculoskeletal disorders. The objective of this cooperative agreement is the development of demonstration projects to evaluate the effectiveness of the critical elements of such programs. These data will be useful to many in the medical, industrial, and scientific communities.

## SENSOR Programs

### Wisconsin Sentinel Event Notification System for Occupational Risks (SENSOR)- Carpal Tunnel Syndrome Surveillance

**Researcher:** Lawrence P. Hanrahan, Ph.D.

**Affiliation:** Wisconsin Department of Health and Social Services  
(608) 267-7173

**Keywords:** Carpal tunnel syndrome, surgery, surveillance, incidence

**Purpose:**

To estimate the incidence of surgically treated occupational carpal tunnel syndrome (CTS).

**Abstract:**

Data collected to date from this project suggest overall rates of work-related CTS is 207/100,000 in females and 130/100,000 in males. Highest rates of incidence are in the 45-54 age group. All surgeries are followed for industry and occupation. This program focuses on educational seminars on CTS prevention to target high risk industries and trades and to improve health care professionals consultation with industries for the prevention of CTS. These activities will develop a forum for industry-specific ergonomic problem-solving and serve as a basis for issuing hazard alerts and specialized surveillance communications. The Wisconsin CTS-surveillance program identifies clusters of occupational CTS from the surgery data. Work places requesting ergonomic consultation to prevent CTS are supported by the Wisconsin CTS-surveillance program.



**Massachusetts Sentinel Event Notification System for Occupational Risks (SENSOR)- Carpal Tunnel Syndrome Surveillance**

**Researcher:** Letitia K. Davis, Sc.D.  
**Affiliation:** Massachusetts Department of Health (617) 624-5621  
**Keywords:** Carpal tunnel syndrome, incidence, prevalence

**Purpose:**  
 To collect data through physician case reports and workers' compensation records on the incidence and prevalence of carpal tunnel syndrome (CTS).

**Abstract:**  
 This surveillance program for occupational carpal tunnel syndrome requires physicians to report cases to the Massachusetts Department of Health. The data collected from this information is used to determine the incidence and prevalence of CTS. The program collects information on affected hands, where surgeries were performed, job duties, training received by symptomatic-coworkers, and work-related risk factors. This is used to identify high risk workplaces, occupations and industries. This program provides educational material to patients. It also makes determinations about employer follow-up when three or more cases are identified doing the same job in the same workplace. This program has identified 1146 physician reported and 2818 cases from workers' compensation records since its inception in 1992.

**NIOSH- Supported ERC Ergonomics Training Programs**

**For more information contact:**  
 John Talty  
 The National Institute for Occupational Safety and Health  
 (513) 533-8241

ERC Institution	Program Title
Auburn University, Alabama	Occupational Safety and Ergonomics
University of California at San Francisco, California	Ergonomics
University of Southern California, California	Safety and Health
University of Cincinnati, Ohio	Occupational Safety
University of Michigan, Michigan	Occupational Safety Engineering and Ergonomics
New Jersey Institute of Technology, New York/ New Jersey	Occupational Safety and Health Engineering
University of Utah, Utah	Ergonomics and Safety
University of Washington, Washington	Occupational Safety

**NIOSH- Supported TPG Ergonomics Training Programs**

**For more information contact:**  
 John Talty  
 The National Institute for Occupational Safety and Health  
 (513) 533-8241

TPG Institution	Program Title
University of Massachusetts, Massachusetts	Safety/Ergonomics
University of Miami, Florida	Occupational Safety and Health
Texas A & M, Texas	Safety Engineering
Texas Tech, Texas	Occupational Safety and Health
Virginia Tech, Virginia	Safety Engineering Program
West Virginia, West Virginia	Occupational Hygiene and Occupational Safety

**NIOSH- Supported Agricultural Center Programs and Projects Targeting Ergonomic Issues**

**University of California Agricultural Health and Safety Center**

**Director:** Marc B. Schenker, M.D., M.P.H.  
**Affiliation:** University of California Davis, California (916) 752-4050

- Projects:**
- Organizational Dimensions of Farm Enterprises and Injury Reduction
  - Improved Worksite and Community Injury Prevention
  - Reducing Farm Injuries by Safety Law Enforcement
  - Agricultural Ergonomic Intervention Feasibility Analysis
  - Epidemiology of Agricultural Machinery-Related Deaths in California
  - Incident Injury Among a Cohort of California Farmers and Farm Operators

**High Plains Intermountain Center for Agricultural Health and Safety**

**Director:** Roy M. Buchan, Dr. P.H.  
**Affiliation:** Colorado State University  
 Fort Collins, Colorado  
 (970) 491-6152

**Project:**

- Project planned: Assessment of Incidence of TB, Low Back Pain and Vehicle Accident Injuries Among Migrant Farm Workers

**Great Plains Center for Agricultural Health**

**Director:** James Merchant, M.D., Dr. P.H.  
**Affiliation:** University of Iowa  
 Iowa City, Iowa  
 (319) 335-4415

**Projects:**

- Agricultural Equipment Seat Design and the Human Response to Whole-Body Vibration
- Development of a Database to Support Guidelines for Children's Agricultural Tasks
- Evaluation of Assisting Technologies in Agricultural and Rural Settings

**Southeast Center for Agricultural Health and Injury Prevention**

**Director:** Robert McKnight, M.P.H., Sc.D.  
**Affiliation:** University of Kentucky  
 Lexington, Kentucky  
 (606) 323-6836

**Project:**

- Kinematic Motion Analysis by Farmers with Leg Amputation

**Northeast Center for Agricultural and Occupational Health (NEC)**

**Director:** John J. May, M.D.  
**Affiliation:** New York Center for Agricultural Medicine and Health  
 Cooperstown, New York  
 (607) 547-6023

**Projects:**

- Ergonomic Problems in Fishers
- Project Planned: Ergonomic Problems in Vegetable Workers

**Center for Agricultural Research, Education and Disease and Injury Prevention**

**Director:** Paul D. Gunderson, Ph.D.  
**Affiliation:** National Farm Medicine Center  
 Marshfield, Wisconsin  
 (715) 387-9298

**Project:**

- A Prospective Randomized Outcome Analysis For Treatment of Acute Low Back Pain in Agricultural Occupations

**Intramural Research Projects**

**Household Appliance & Intervention Study**

**For more information contact:**  
 The National Institute for Occupational Safety and Health  
 1-800-35-NIOSH (356-4674)

**Keywords:** Ergonomic stressors, psychosocial factors, musculoskeletal symptoms, appliance manufacturing, engineering controls

**Purpose:**  
 To assess ergonomic factors in an appliance manufacturing facility.

**Abstract:**  
 An ergonomic intervention evaluation is being conducted at an appliance manufacturing facility, involving a baseline survey of health and exposure and two follow-up surveys. The objectives of this research are to evaluate the process of implementing engineering-based controls, and to assess the effect of "front-end" engineering on workers exposed to ergonomic stressors and on the incidence of work-related injury and illness. Additional objectives of the study are to evaluate the association between exposure to ergonomic and psychosocial factors and musculoskeletal symptoms.

**Surveillance of Regional Cumulative Trauma Disorders (CTDs)**

**For more information contact:**  
 The National Institute for Occupational Safety and Health  
 1-800-35-NIOSH (356-4674)

**Keywords:** Cumulative trauma disorder, National Health Interview Survey, Bureau of Labor Statistics, back, hand, knee

**Purpose:**  
 To provide national estimates of cumulative trauma disorder (CTD) for various regions of the body.

**Abstract:**  
 This research will analyze available national data from the National Health Interview Survey (NHIS), the Bureau of Labor Statistics (BLS), and workers' compensation data from various studies, to provide policy makers (as well as labor, industry, academia, and the public) with national estimates of various CTDs. In FY 1997, data analysis for back pain and tendinitis of the hand from the NHIS data will be completed. Also, a portion of the BLS data on the knee will be examined for occupational knee disorders.

**Laboratory Evaluation of Back Support Belts**

**For more information contact:**  
 The National Institute for Occupational Safety and Health  
 1-800-35-NIOSH (356-4674)

**Keywords:** Lifting activities, back support belts

**Purpose:**  
 To determine if back support devices help protect workers during controlled lifting activities.

**Abstract:**  
 The objective of this laboratory investigation is to determine if back support devices reduce various stresses to workers during controlled lifting activities. The anticipated accomplishments will

be comprehensive results of the test of six hypotheses from which the positive and negative effects of using back support belts during lifting tasks would be answered: (1) the use of back support belts physically limits the worker's range of motion; (2) the back belt serves as a "reminder" to prevent the workers from bending over excessively; (3) the use of back support belts result in a decreased loading on the lower back; (4) the use of back support belts may cause workers to experience increased heart rate and increased blood pressure; (5) the use of back support belts cause localized muscle fatigue; and (6) the use of back support belts cause increased skin temperatures.

### Ergonomic Evaluation of Carpenters' Tasks

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Carpenters, frame scaffold, field study, computer simulation

**Purpose:**

To identify carpenters' high-risk activities, associated hazards, and assess risk reduction techniques.

**Abstract:**

The objectives of this project are to identify carpenters' high-risk activities and associated hazards (mainly fall and overexertion) during the erection and dismantling of frame scaffolds and to assess risk reduction techniques such as improvement of work methods, scaffold components, and tools to reduce the hazard. The project includes a field study involving 12 construction sites, a computer simulation study, and three laboratory studies. The field evaluation and computer simulation components suggest that scaffold erectors are at increased risk of overexertion and falls due to biomechanical stress. The three laboratory studies will explore the effects of work methods, floor firmness, and scaffold-end-frame type on subject postural stability and motor response times. Study results will be used to determine appropriate/optimal scaffold lifting and carrying methods and the design of simple lifting assist devices to reduce falls.

### Biomechanical Stress Control in Drywall Installation Industry

**For more information contact:**

The National Institute for Occupational Safety and Health

**Telephone:** 1-800-NIOSH (356-4764)

**Keywords:** Drywall installers, drywall installation

**Purpose:**

To assess drywall installers' activities, associated hazards, and possible risk-reduction techniques.

**Abstract:**

This is a field and laboratory project to identify drywall installers' activities and associated hazards during drywall installation work and to assess risk-reduction techniques to reduce the hazard exposure, such as improvement of work methods and tools.

### Evaluation of Muscular Strength Capability for Handling Large-Size Materials

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Whole body isometric strength, scaffold end frame lifting, plywood handling, posture, hand, construction

**Purpose:**

To determine the best posture and hand location during large-size material handling.

**Abstract:**

This study will quantify the whole body isometric strength capability of subjects during simulated large-size material handling (scaffold end frame lifting and plywood handling) to determine the least stressful posture and hand location. The results of this study will aid the construction/scaffold industry in assessing the performance of existing designs, serve as a database for the design of material sizes and new end-frame structures, or the design of simple assistive lifting devices for material/scaffold handling.

### Monitoring System for Human Response to Workplace Conditions

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Stress, real time monitoring

**Purpose:**

To develop a system to monitor human stress exposure in real time.

**Abstract:**

This project will develop a system to allow researchers to oversee, quantify, and correlate job activities and stress exposures by video, electromyography, heart rate, energy consumption, and other measurements in a real-time synchronized manner. The monitoring system will be used in field and laboratory studies for safety and ergonomic projects to collect and identify the critical task elements that contribute to the overall stress exposure of a worker to a job.

### Evaluation of the Efficacy of Back Belts in Material Handling Workers

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Back belts, material handling workers

**Purpose:**

To assess the effect of back belts and other factors on back injury in a retail merchandise store chain.

**Abstract:**

The objectives of this project are to: (1) determine the efficacy of lumbar-supporting flexible back belts in preventing back injuries in 8000 material handling workers (these workers are employed in a retail merchandise store chain consisting of 160 stores); (2) estimate the effects of psychosocial, fitness, strength, and work exposure variables on injury incidence, independent of the belt effects; and (3) determine if an expert panel approach to evaluating back-stressing potential of tasks is an adequate replacement for systematic observations in epidemiological studies.

### Nursing Home Back Intervention Study

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Lifting equipment, medical management, nursing home

**Purpose:**

To evaluate lifting equipment and medical management programs for their effectiveness in reducing the incidence, cost, and disability associated with work-related injuries and complaints of pain.

**Abstract:**

This research will assess worker compensation records, first reports of the incident, company payroll and personnel data, records from the Health Care Financing Administration, and information obtained from worker interviews to measure the impact of lifting equipment and medical management programs in the study population.

### Applied Ergonomic Evaluation and Intervention

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4764)

**Keywords:** Ergonomics, biological laboratories, musculoskeletal disorders, laboratory technicians

**Purpose:**

To develop ergonomic solutions for laboratory technicians.

**Abstract:**

Researchers from the Engineering Control Technology Branch have been working with laboratory technicians at the National Cancer Institute in Ft. Detrick, Md. to reduce musculoskeletal disorders caused by laboratory bench work. Included in the ergonomic evaluation is redesign of laboratory hoods, and pipettes.

### Applied Control Technology Studies

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Small business, ergonomics

**Purpose:**

To help small businesses with ergonomic problems.

**Abstract:**

Ergonomic assistance is given in the area of small businesses. Engineering control projects have an ergonomic component. Projects already completed include dry cleaning, and manual dye weigh-out. Projects that are being worked on currently or are proposed include small printing operations, tractor cabs, and welding. Reports are available for the completed projects.

### Powered Hand Tools

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Powered hand tools, construction industry, tool-based ventilation, musculoskeletal disorders, airborne chemicals, dust

**Purpose:**

To reduce injury to workers caused by using powered hand tools.

**Abstract:**

This project will concentrate on contaminant generating powered hand tools, such as sanders, saws, and drills used in the construction industry. Tool-based ventilation will be studied as a means of reducing exposure to airborne chemicals and dusts. Parameters, such as vibration that may cause musculoskeletal disorders, will be evaluated and attempts made to control them. In addition, the overall tool design and ease of use for workers will be addressed. A historical impediment to the use of tool based ventilation to control contaminants has been the awkwardness of the tool design, making the tool difficult to use compared to tools without ventilation. In-house research will be conducted to evaluate tool-based control methods.

### Engineering Controls for Construction (RebarTying)

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Rebar tying, ergonomics, occupational health engineering

**Purpose:**

To eliminate ergonomic hazards associated with rebar tying.

**Abstract:**

A University of Cincinnati Student Engineering Design team has been sponsored to develop an engineering control to eliminate the ergonomic hazards associated with rebar tying. This research has proven to be a cost-effective approach to engineering control design while emphasizing the field of occupational health engineering to graduating engineers.

### Job Assessment Protocol for Ergonomic Evaluations

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Task based ergonomic check lists, high-risk construction tasks, ergonomic hazards

**Purpose:**

To develop a series of task-based ergonomic check lists (TB-ECLs) for common high-risk construction tasks.

**Abstract:**

This program is developing TB-ECLs (similar to material safety data sheets) which can be used by workers at construction sites or in apprenticeship training to identify potential ergonomic hazards for common high-risk construction tasks. Each checklist is derived from comments of focus groups of employees and supervisors, and from the results of conducting an exposure assessment for select high-risk construction jobs, e.g., cement finishing, roofing, drywall, etc. Once hazards are identified, a simplified ten-point checklist will be compiled that reflects the ergonomic hazards workers are likely to encounter in doing the job task. The hazards range from requirements to manually lift and carry heavy loads to few obvious hazards that stem from working for long periods with arms overhead. Four TB-ECLs are currently being generated based on task analysis data and notes from focus groups. This project provides important information about the hazards posed by doing certain high-risk construction tasks.

### Excessive Fatigue from Demanding Work Schedules: Guidelines for Shiftwork

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Fatigue, work-rest cycling, shift time, rest/sleep/recovery strategies

**Purpose:**

To reduce job fatigue.

**Abstract:**

Work-rest schedule design interventions and development of design guidelines are needed to reduce excessive fatigue from demanding or stressful work schedules. This project seeks to reduce fatigue through work-rest cycling during the work shift, through improved rest/sleep/recovery strategies following the work shift, and through re-design of shift timing and rotation patterns. Successful implementation of these design interventions should reduce the incidence of both acute and chronic injury of workers in a broad range of occupational and industries engaged in shiftwork or long workdays.

### Development of OS&H Training Using Emerging Training Technologies: CD-ROM tutorial on how to use the Revised NIOSH Lifting Equation

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Revised NIOSH lifting equation, training modules, CD-ROM

**Purpose:**

To teach workers about the NIOSH lifting equation.

**Abstract:**

The NIOSH lifting equation is a method for the hazard assessment of two-handed lifting tasks. Currently, the Interactive Multimedia Instruction on the Revised NIOSH Lifting Equation (RNLE) consists of 6 training "modules" or lessons, each covering one aspect of the measurement and calculation involved in the NIOSH Lifting Equation. Subjects of the modules include: definition of the factors in the equation, an introduction to the RNLE, lifting task conditions (actions and circumstances), task variables, instruction on calculating the multipliers in the equation, and the RNLE tutorial. During FY97 additional modules will be developed to complement existing modules, and product elements will be revised based upon user evaluations of the beta-test version of the CD-ROM.

### Reliability and Validity of Ergonomic Exposure Assessment

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Exposure assessment, work-related musculoskeletal disorders, automotive industry

**Purpose:**

To compare the value of different exposure assessment methods in predicting incident work-related musculoskeletal disorders in the automotive industry.

**Abstract:**

Reliable, valid, and practical ergonomic exposure assessment tools are needed to conduct studies that evaluate dose-response relationships between ergonomic exposures and work-related musculoskeletal disorders (WRMD), and to evaluate the impact of preventive interventions. The few studies that have addressed the reliability and validity of the various methods have been hindered by insufficient power, cross-sectional nature, or limited statistical analysis. This study will compare the value of different exposure assessment methods in predicting incident WRMDs in a large, prospective study in the automotive industry. In FY96, data analyses were completed to evaluate the interrater reliability of the exposure assessment tool. In FY97 analyses will be completed to compare two methods of exposure assessment and to evaluate the value of self-reports and ergonomists' observations of ergonomic exposures in predicting musculoskeletal outcomes.

### Printing Operation

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Printing industry, lift tables, gravity feed conveyors, musculoskeletal disorders, upper extremities

**Purpose:**

To reduce musculoskeletal disorders of the upper extremities and low back in the printing industry.

**Abstract:**

The Engineering Control Technology Branch (ECTB) researchers have been working with representatives of the printing industry to reduce musculoskeletal disorders of the lower back and upper extremities. The objective of this study is to develop low cost solutions, such as lift tables and gravity feed conveyors to reduce manual material handling tasks. These solutions will be videotaped and disseminated to the printing industry.

### Priority Document Development (Work Organization and Ergonomics)

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Job stress, computer keyboards, shiftwork, ergonomic problems, current information

**Purpose:**

To provide understandable scientific information on job stress, ergonomic aspects of computer keyboards, and shiftwork.

**Abstract:**

The objective of this project is to produce information documents on (1) job stress, (2) ergonomic aspects of computer keyboards, and (3) shiftwork. Each document has a summary of the latest information on the scope of the problem, etiologic factors, and control technologies. Available case studies or demonstration reports of intervention methods and effectiveness will be presented, along with a listing of additional resources. All these documents are scheduled for completion in FY 1997.

### NIOSH Lifting Equation Study

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Lifting equation, lifting index, low back, manual material handling

**Purpose:**

The purpose of this study is to provide epidemiologic data to define the relationship between the lifting index and the incidence and severity of lifting-related low back pain.

**Abstract:**

The National Institute for Occupational Safety and Health (NIOSH) lifting equation was developed as a practical analysis tool for evaluating the physical demands of two-handed manual lifting tasks. The equation is based on the concept that the risk of lifting related back pain increases as the demands of the lifting task increases. The feasibility portion of this study began during FY96. The NIOSH lifting equation was used to evaluate 50 manual material handling jobs. A total of 281 persons working in these jobs, as well as 99 persons in jobs without risk factors for back pain, completed a self administered questionnaire. A peer review meeting will be held FY97 to discuss the feasibility findings and to provide input on future directions. Additional surveys will be conducted at the four original sites as well as new facilities.

### Ergonomic Interventions in the Printing Industry

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Engineering controls, carpal tunnel disorders, lithography, printing industry, musculoskeletal injuries

**Purpose:**

To develop engineering controls for the prevention of musculoskeletal disorders in high carpal tunnel disorder (CTD)-rate industries in the lithography printing industry.

**Abstract:**

The effectiveness of the engineering controls developed through this research will be disseminated through the development of a videotape that shows before and after changes in high-risk manual handling jobs. The videotape will be distributed by the Southeast Ohio Printing Industry Association to several member printing companies. In addition, an article will be written and published in a printing industry trade journal discussing how to reduce job-related musculoskeletal injuries.

### Ergonomic Evaluations and Interventions in the Furniture Manufacturing Industry

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Furniture manufacturing, musculoskeletal disorders, engineering controls, ergonomic job risk factor evaluation, control feasibility assessment, product design

**Purpose:**

The purpose of this research is to develop cost-effective solutions to control and prevent employee work-related musculoskeletal disorders in the furniture manufacturing industry.

**Abstract:**

This project will involve an ergonomic evaluation of jobs in the furniture manufacturing industry to determine the extent of musculoskeletal stress to the employee. The evaluation will be followed by the development of engineering controls for specific tasks. The procedures to accomplish this will include ergonomic job risk factor evaluation and analyses, control feasibility assessments, engineering control development, and product design. Successful interventions will be disseminated through peer-reviewed journals and trade journals specific to this industry.

### Work Organization Interventions and Prevention of Musculoskeletal Disorders

**For more information contact:**

The National Institute for Occupational Safety and Health  
1-800-35-NIOSH (356-4674)

**Keywords:** Video display terminal work, work-related musculoskeletal disorders

**Purpose:**

To formulate recommendations regarding optimal work-rest and job design strategies to prevent stress and musculoskeletal disorders in video display terminal (VDT) work.

**Abstract:**

Through large-scale prospective worksite studies at a large government agency and other similar sites, NIOSH is examining the efficacy of various work organization interventions (e.g., alternative work-rest schedules, task rotation/job enlargement) in preventing stress and musculoskeletal disorders in repetitive VDT work. Outcome measures include psychological fatigue and strain, musculoskeletal discomfort and disorders, and performance. Project work will conclude in 1998, at which time recommendations regarding effective work organization strategies will be developed and distributed.

**For Information on Other  
Occupational Safety  
and Health Concerns**

Call NIOSH at:  
1-800-35-NIOSH (356-4674)

or visit the NIOSH Homepage at:  
<http://www.cdc.gov/niosh/homepage.html>

