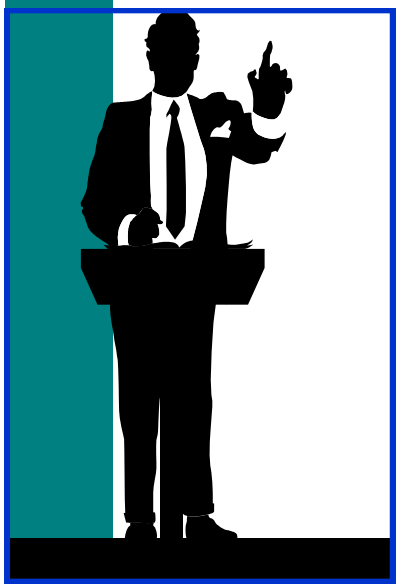
UNIVERSITY OF Cincinnati

7th Annual Pilot Research Project Symposium
Abstract Booklet

University of Cincinnati Education and Research Center (ERC) Supported by the National Institute for Occupational Safety and Health (NIOSH)

7th Annual
Pilot Research
Project Symposium

OCTOBER 12– 13, 2006
KEHOE AUDITORIUM
IN THE KETTERING LABORATORY
DEPARTMENT OF ENVIRONMENTAL HEALTH
UNIVERSITY OF CINCINNATI
THURSDAY, OCT. 12TH 1 PM—5:30 PM
FRIDAY, OCT. 13TH 8 AM—12:30 PM
DEPARTMENT OF ENVIRONMENTAL HEALTH
UNIVERSITY OF CINCINNATI



Keynote Speakers:

Dr. R. DeLon Hull, Ph.D.,
National Institute for Occupational Safety and Health (NIOSH)

And

Dr. Gurumurthy Ramachandran, Ph.D., CIH,
Professor,
University of Minnesota—Twin Cities

0.5 ABIH (IH) CM Points Per Day

Pilot Research Training Program & Symposium

October 12– 13, 2006 marks the University of Cincinnati Education and Research Center's (ERC) 7th Annual Pilot Research Project (PRP) Symposium here at the University's Kehoe Auditorium (located in the Kettering Laboratory Building). The purpose of the PRP is to increase the research capacity of research trainees and young investigators in occupational health and safety and to encourage those in related disciplines to pursue occupational health and safety research.

Under the administrative direction of Dr. Amit Bhattacharya, research proposals are solicited and peer-reviewed annually from qualifying faculty and graduate students from the University of Cincinnati and the following PRP partnering institutions - Bowling Green State University, University of Toledo – Medical Science Campus, Central State University, Purdue University, University of Kentucky, Western Kentucky University, Eastern Kentucky University, Murray State University and Kentucky State University.

At this symposium, the 2005-06 awardees will be presenting results of their research and the 2006-07 awardees will make poster presentations of their proposed work. This year's keynote speakers will be Dr. DeLon Hull, Associate Director for Research & Technology Transfer, National Institute for Occupational Safety and Health (NIOSH) and Dr. Gurumurthy Ramachandran, Professor, University of Minnesota – Twin Cities. They will speak on: *"Moving Research to Practice at NIOSH"* and *"Evaluating Professional Judgment in Industrial Hygiene Decision-Making"*, respectfully. There will also be opportunities to speak with all of the presenters individually.

The University of Cincinnati's Education and Research Center is one of 16 such centers funded by the National Institute of Occupational Safety and Health (NIOSH) nationally. Dr. C. Scott Clark serves as the director of the ERC, which is based in the university's Department of Environmental Health within the College of Medicine. The ERC's purpose is to train professionals in the didactic and research skills necessary to lead the occupational safety and health disciplines. Results of research are translated into action through an outreach program and shared with professionals and practitioners in the region via continuing education.

Since 1999, the PRP program has allocated over $500 thousand dollars to support pilot research projects. These projects have served as a catalyst in bringing over $3.6 million in additional research support to the region from sources independent of the PRP program, such as, the National Institute of Occupational Safety and Health (NIOSH), United States Department of Agriculture (USDA) and the Centers for Disease Control and Prevention (CDC). Additionally, the PRP also brought 15 new investigators from other fields of expertise to the area of occupational safety and health research.

The 7th Annual PRP Symposium is free and open to the public.
Symposium attendees are eligible for 1 ABIH CM points.

For more information about the PRP program, please contact
Dr. Amit Bhattacharya, PRP Program Director, at (513) 558-0503 or
Amit.Bhattacharya@uc.edu.

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Thursday, October 12, 2006
Keynote Speaker



R. DeLon Hull, Ph.D.

Dr. Hull is the Associate Director for Research and Technology Transfer at NIOSH. In this capacity, he leads the Research to Practice (r2p) effort and facilitates and develops partnerships between NIOSH and stakeholders. Research to Practice is an initiative to enhance the relevance and impact of NIOSH funded research and applies to all research conducted or funded by NIOSH. He is also responsible for diversity efforts in NIOSH, research related to economics of safety and health, and the Institutional Review Board.

Dr. Hull joined NIOSH in 1976 and has held a number of scientific and managerial positions throughout the Institute. As a researcher, he developed numerous NIOSH analytical methods for industrial hygiene and biological samples, led the Inhalation Toxicology Program, led the Immunochemistry Research Program and served in several other technical and leadership roles. Prior to his current assignment, Dr. Hull served as the Acting Deputy Director of NIOSH in Washington DC and the Acting Director of NIOSH's field research division which conducts health hazard evaluations; epidemiologic and industrial hygiene research; and hazard, illness and medical surveillance. He was involved in developing the National Occupational Research Agenda, was lead author of the NIOSH Alert on Latex Allergy, and has authored numerous research publications and NIOSH analytical methods. As the Acting Deputy Director of NIOSH immediately before and for the year following 9/11, Dr. Hull was involved in the many response efforts around these events in addition to the anthrax issues in Congress and the Post Offices.

Friday, October 13, 2006
Keynote Speaker



Gurumurthy Ramachandran, Ph.D., CIH

Gurumurthy Ramachandran, Ph. D., CIH is currently a Professor of Industrial Hygiene in the Division of Environmental and Occupational Health in the School of Public Health at the University of Minnesota, Minneapolis. His research involves using Bayesian methods for exposure reconstruction as well as for occupational hygiene decision-making, developing mathematical methods for modeling and analyzing occupational measurements, retrospective exposure assessment, and conducting fundamental physical studies of the performance of sampling devices for aerosols. The focus of these interests is the development of more effective and accurate methods to assess health-related human exposure. He has a Bachelor's degree in Electrical Engineering, a Master's degree in Environmental Engineering, and a Ph. D. in Environmental Sciences and Engineering from the University of North Carolina.



2006 PRP Symposium Agenda
Thursday, October 12, 2006

Moderator: Kermit Davis, Ph.D., University of Cincinnati

1—1:10 pm	Welcome and Opening Remarks Dr. Shuk-Mei Ho, Director, Department of Environmental Health Dr. C. Scott Clark, Director, ERC Dr. Amit Bhattacharya, PRP Program Director
1:10-1:15 pm	Introduction of Keynote Lecturer: Dr. R. DeLon Hull, NIOSH by Dr. Amit Bhattacharya
1:15—2:00 pm	Keynote Address: "***Moving Research To Practice at NIOSH***" by Dr. R. DeLon Hull
2:00-2:10 pm	Keynote Q & A
2:10-2:30 pm	"***Physical and Psychosocial Demands on Day and Night Shift Workers***" Chunhui He, University of Cincinnati
2:30– 2:50 pm	"***Evaluating Vapor Intrusion from Gasoline Underground Storage Tanks***" Sheryl Milz, Ph.D.; University of Toledo– Medical Science Campus
2:50—3:10 pm	"***Obesity Effects of Postural Stability During Standing***" Woojin Park, Ph.D.; University of Cincinnati
3:10-3:30 pm	"***Trunk Postural Load in Nurses-Can it Be Measured?***" Jie Chen, University of Cincinnati

Poster Session I and Break (Kettering Lobby) 3:30—4:15 pm

4:15-4:35 pm	***"Health and Safety Training for Direct Care Providers of People with Dementia"*** Jennifer Gillespie, Ph.D., Bowling Green State University
4:35-4:55 pm	***"Comparison of Two Methods for Measurement of Fungal (1-3)-β-d-Glucan"*** Yulia Iossifova, University of Cincinnati
4:55—5:15 pm	Program Q & A

PRP Networking Picnic
Sponsored by the Academy of Kettering Fellows,
5:30 – 7 pm, Kettering Lawn

2006 PRP Symposium Agenda
Friday, October 13, 2006

Moderator: Sue Jones, Ph.D., Western Kentucky University

8-8:10 am	Opening Remarks by Dr. Amit Bhattacharya
8:10—8:15	Introduction of Keynote Lecturer: Dr. Gurumurthy Ramachandran, University of Minnesota—Twin Cities by Dr. Amit Bhattacharya
8:15– 9 am	Keynote Address: "Evaluating Professional Judgment in Industrial Hygiene Decision-Making" by Dr. Gurumurthy Ramachandran, Ph.D., CIH
9—9:10 am	Keynote Q & A
9:10-9:30 am	"***Workplace Incivility Among Nursing Staff and Losses in Productivity'*** Scott Hutton, University of Cincinnati
9:30—9:50 am	"***Do Optical Properties of Obstacles Affect the Risk of Tripping in Construction Workers?"*** Christopher Rhea, Purdue University
9:50—10:10 am	***HEPA Filter Efficiency Testing During Filter Installation"*** Farhang Akbar-Hhandzadeh, University of Toledo– Medical Science Campus
10:10-10:30 am	"***Relationship Between Indoor and Outdoor (1-3)- β-d-Glucan, Fungal Spore and Pollen"*** Taekhee Lee, University of Cincinnati

Poster Session II and Break (Kettering Lobby) 10:30—11 am

11- 11:20 am	"***Predicting Farm Youth Injury: A Psychological Perspective"*** Jennifer Yugo, Bowling Green State University
11:20—11:50 am	"***Evaluating the NOSH Lifting Equation for Obese Workers"*** Devender Singh, University of Cincinnati
11:50-12:10 pm	"***Effectiveness of Work Compatibility in Evaluating and Improving Worker Health"*** Setenay Tuncel, University of Cincinnati

Closing Remarks and Program Evaluation

2006 PODIUM PRESENTATIONS



Physical and Psychosocial Demands on Day and Night Shift in Nursing Homes

Chunhui He & Kermit Davis, Ph.D.
University of Cincinnati

National data compiled by the Bureau of Labor Statistics (BLS) show that the rate of work-related injury or illness requiring medical treatment or lost work was 13.5 per 100 among nursing home workers in 2001. In addition to the highly involved physical demand, the nursing aids have extra stress from working extended hours (12 hours work days), dealing with life and death situations, high mental demands, less of social activities (shift work) and potential violent acts from residents. These demands may be directly related to the shift that the nurse works (e.g. more demanding physically during day shift) and the risk of developing MSDs. The objective of this study is to differentiate and quantify the physical and psychosocial demands among nurses working on day and night as well as 8 hour and 12 hour shift, and to investigate any musculoskeletal disorders among day and night shift nursing assistants working in nursing homes. Methods: Observing 12 female nursing aids (NA) from each shift of 8 hour and 12 hour shifts using REBA check list on a PDA and attached activity monitor to NAs to measure energy expenditure, and the percentage of time spent on sitting, standing and stepping. Psychosocial questionnaries were filled out to measure mental stress. Subjects: 60 female permanent NAs working on 8 hour and 12 hour shifts. Reslults: ANOVA procudure in SAS program was used to test any differece between each shift. There was significant difference between 8 hour and 12 hour shift on energy expenditure (P= 0.0001). As for energy expenditure consumed on day and night shift, the difference was significant between day and night shift on 8 hours (P=0.0092) as well as on 12 hours shift (P=0.0066). However, the difference between evening and day (P= 0.0548), and evening and night (P= 0.1294) on energy expenditure was not significant. No significant difference was found for time spent on sitting, standing and stepping on 8 and 12-hour shift when time was adjusted,. The data analysis is in progress for observation data and psychosocial questionnaire data.

Evaluating Vapor Intrusion from Gasoline Underground Storage Tanks

Sheryl Milz, Ph.D., April L. Ames, MSOH & Melisa K. Witherspoon, MSOH
University of Toledo–Medical Science Campus

Vapor intrusion is the movement of volatile chemicals from contaminated soil into buildings and their airspace. Gasoline releases result in petroleum constituents contaminating soil. The overall goal of this pilot project was to evaluate the potential for exposure from vapor intrusion of workers within operating establishments surrounded with petroleum contaminated soil from previously leaking underground storage tanks. The volatile petroleum constituents of interest were benzene, toluene, ethyl benzene and xylenes (BTEX). Specific aims of the project were to systematically characterize the airborne concentrations of the volatile petroleum constituents of interest (BTEX), to

determine the proportion of the airborne concentrations attributed to vapor intrusion and then to compare the measured airborne concentration with the results from the USEPA vapor intrusion model. Air sampling was conducted over a 24-hour period both inside and outside of three sites with a prior gasoline release. Most of the air samples collected were less than the limit of detection for the analytical method, except for toluene inside the building at Site 1. Overall, the air samples indicated that no hazard to building occupants would be expected from vapor intrusion. The air sampling result is the opposite of the Johnson & Ettinger and BUSTR modeling results, indicating the there is a potential exposure to building occupants from soil and groundwater contamination; especially from benzene. The finding needs further investigation.

Obesity Effects of Postural Stability During Standing

Woojin Park, Ph.D.
University of Cincinnati

This study had three objectives: 1) to examine the effects of obesity on postural stability during static manual work, 2) to determine the obesity effects on Functional Reach (FR) and 3) to evaluate the relative sensitivity of center-of-pressure (COP)-based measures to changes in postural steadiness related to obesity level. 20 subjects (10 non-obese and 10 extremely obese) were recruited for this study. Both the groups had 5 male and 5 female subjects. Each subject was asked to perform a quite standing task with both their feet together for one hour "as still as possible". The CoP (Center-of-Pressure) for the task was computed based on time trajectory data obtained using force plate (FP4060-08, Bertec Corp.). T-test revealed that there was a significant obesity effect on postural stability ($p<0.0001$). Rank ANOVA showed that obesity level and gender had a significant effect on FR ($p<0.0001$) while there was no interaction effect ($p=0.8027$). Obese subjects (both male and female) had lower FR than non-obese. MANOVA results demonstrated that there was a significant overall obesity and time interval effects on measures of postural steadiness ($p<0.001$), while there was no significant gender effect ($p=0.3414$). Fischer's Z-test showed that there was no correlation between the obese and non-obese (both genders) among the measures of postural steadiness. Based on the results, we conclude: 1) that obese individuals have compromised postural stability and hence may be at higher risks of falling during prolonged static tasks, 2) Obesity compromises the functional reach ability of individuals. Hence, obese workers may be at a disadvantage while performing reach tasks (e.g. construction, manufacturing, and service industries), 3) Since all the measures of postural steadiness were uncorrelated between obese and non-obese, therefore, these measures can be used to investigate/characterize the postural steadiness of obese individuals.their feet together for one-hour. A force plate (FP4060-08, Bertec Corp., Columbus, Ohio) will be used to record the center-of-pressure (CoP) position over time. The one-hour period will be divided into sixty one-minute intervals. For each interval, several CoP-based postural sway measures will be computed based on the CoP-time trajectory data: mean distance, RMS distance, mean velocity and peak velocity in both the medio-lateral (ML) and the anterior-posterior (AP) direction. Also, the CoP sway area will be computed as a postural sway measure. For each time interval and for each dependent postural sway measure, a t-test will be performed to compare the obese and the non-obese subject group. Linear regression analyses will be performed to evaluate changes in dependent postural sway measures with respect to time, and the significance of the slopes will be determined (10). Significance of all statistical tests are accepted when P£0.05.

The proposed pilot study, when completed, will provide an initial estimate of obesity effects on postural stability during prolonged standing task. Such preliminary data will provide a basis for further investigating obesity effects for various prolonged occupational tasks in the construction, manufacturing, and service industries.

Trunk Postural Load in Nurses—Can It Be Measured?

Jie Chen[1], Nancy Daraiseh[2], Ph.D., L. Sue Davis[1], Ph.D. & Kermit Davis[1], Ph.D.
[1]University of Cincinnati & [2]Center for Professional Excellence of the Cincinnati Children's Hospital Medical Center

Background: Limited studies are available on the risk of trunk postural load to the prevalence of musculoskeletal disorders in nurses. The objective of this pilot study was to quantify and characterize trunk postural load in nurses with consideration of variation in the exposure in a hospital setting.

Method: A comprehensive measurement approach combining continuous measurement by goniometer, direct observation, physical activity monitor and self-report methods was applied to 8 female nurses to simultaneously record bending of the trunk, working activities, energy expenditure, heart rate, perceived workload and body musculoskeletal symptoms during sixteen 12-hour day shifts.

Results: It was found that the percentage of patient care time spent on trunk flexion >20° was 14.7% ($p=0.001$). The "high strain" trunk postures occurred three times every 10 minutes of the patient care time ($p=0.000$), and nearly half of the resting intervals were less than 1 minute ($p<0.023$). Eighty percent of "high strain" trunk postures stayed within bending range of up to 15° ($p<0.01$) and spent 68% of the total time length of "high strain" trunk postures ($p<0.03$). Furthermore, more than one-quarter of "high strain" trunk postures lasted more than 30 seconds. Frustration and temporal demand were found significantly correlated with some characteristics of trunk postures. Shift total energy expenditure intensity was found negatively correlated with body musculoskeletal discomforts.

Conclusion: The presented measurement strategy has the potential to quantify and characterize the trunk postural load, and can be particularly useful for assessing static postural load in field studies.

Health and Safety Training for Direct Care Providers Of People with Dementia

Jennifer Gillespie[1], Ph.D., Cheryl J. Conley[2], Salli Bollin[2] & Lynn Ritter[2], Ph.D.
Bowling Green State University[1]Alzheimer's Association, NW Ohio Chapter[2]

Health care providers encounter emotionally demanding events on the job. In particular, direct care providers of people with dementia are subject to violence, harassment, and incivility while at work. In situations like these, employees are expected to comply with organizational requirements governing the expression of emotions. These requirements are called display rules, and the act of managing one's emotions to comply with these display rules is called emotional labor. It is important to recognize that direct care providers of people with dementia engage in emotional labor, and that certain types of emotional labor, such as emotion suppression, are linked to burnout and all-cause mortality. Moreover, it is important to develop, conduct, and assess training for direct care providers of people with dementia that will help them to manage their emotions in ways that will increase the health and safety of both parties within the care-giving relationship.

In this pilot study, we accomplished three things. First, we conducted a review of basic research on emotion regulation and then we applied this literature to develop emotional labor training for direct care providers of people with dementia. During this training, which was administered in the field, employees were provided with alternatives to emotional suppression – namely, reappraisal, acceptance and commitment, and social support. Second, although a low response rate to the post-training survey precluded a proper assessment of the training we developed, we conducted exploratory analyses using responses to the pre-training survey. This survey included measures such as affective disposition, emotional labor strategies, job satisfaction, stress in general, and incivility, and the results of our analyses shed light on how these variables relate to one another in this population. Finally, we conducted a series of focus groups, and through this we gained a better understanding of the types of emotionally demanding events that direct care providers of people with dementia experience while they are at work.

Comparison of Two Methods for Measurement of Fungal (1-3) -β-d-Glucan

Yulia Iossifova, MD
University of Cincinnati

Exposure to fungal (1-3)-b-D-glucan is associated with various respiratory responses. It has been speculated whether (1-3)-b-D-glucan exposure can be used as a surrogate for mold exposure. Currently there are two methods available for the analysis of (1-3)-b-D-glucan: the *Limulus Amebocyte* Lysate assay (LAL) and the inhibition Enzyme Immunoassay (EIA). The aim of this study was to compare the specificity of these two methods in detecting eight alpha and beta-Glucan standards, and their sensitivity for the analysis of (1-3)-b-D-glucan content of common indoor fungal species and dust samples. Twelve fungal species (two *Cladosporium* species, five *Aspergillus* species, *Aureobasidium pullulans, Penicillium brevicompactum, Epiccocum nigrum, Wallemia sebi,* and *Stachybotrys chartarum*) were cultured from pure ATCC strains on agar media. All samples were analyzed for (1-3)-b-D-glucan content by both the LAL assay (Glucatell™, Associates of Cape Cod, East Falmouth, MA) and the EIA (antibody purchased from

Biosupplies Australia). We found that the LAL assay is more specific in measuring both linear and branched (1-3)-b-D-glucans than the EIA assay. Although *E. nigrum* was the species of greatest (1-3)-β-D-glucan content per spore (241 pg/spore), this was mainly due to having also the largest spore size (28 □ m). The biomass-normalized (1-3)-β-D-Glucan content measured by both assays was within similar range (LAL-0.003 to 146.33 pg/□m^2, 0.22-240.54 pg/□m^3; EIA-0.04 – 197.00 pg/□m^2, 0.03-300 pg/□m^3), but several samples were below the detection limit of the EIA assay. Furthermore, the (1-3)-b-D-glucan content per spore measured by the LAL correlated with the fungal spore size and their respective prevalence in indoor dust samples, and therefore it may be used as a measure of total mold.

The Effects of Jet Fuel (JP-8) on Dermal Absorption of Used Engine Oil

Gerald Kasting, Ph.D., & Paul Broering
University of Cincinnati

A number of polycyclic aromatic hydrocarbons (PAHs) have a well-documented history of being animal carcinogens when these PAHs are applied to the skin of rats or mice. A number of governmental and international agencies have also listed these same PAHs as suspected human carcinogens. A commonly tested PAH mixture used for this research is used gasoline engine oil (UGEO). Talaska *et al*. (1999) have shown that kerosene can act to facilitate the absorption of UGEO through the skin and lead to increased DNA adducts in the lung. This study intends to determine whether other commonly used organic solvents will increase the passage of UGEO through the skin as well as re-confirming kerosene's ability to facilitate UGEO through the skin. The study specifically analyzes the effects of gasoline, jet fuel (JP-8), and kerosene on UGEO absorption through cadaver skin. Franz cells will be used to create the in-vivo environment needed for this experiment. It is hypothesized that each of these organic solvents will also increase the permeation rate of UGEO through the skin. This is based on the knowledge of the similar chemical structures these organic solvents share with kerosene, which has already been identified as a UGEO facilitator through the skin. Data analysis will be performed via high pressure liquid chromatography (HPLC) to identify and quantify the PAHs that have permeated through the cadaver skin.

This research is very important to the understanding of how certain solvents may facilitate the absorption of PAHs. It may lead to the use of PPE and the awareness of the dermal exposure dangers of certain combinations of compounds. Future studies need to be done to verify and confirm the results found from this pilot study. The safety of employees can not be based on a one time study but must be cross checked by a number of research facilities to better determine the most accurate data and the most effective means of protection for employees. Future studies also needs to accrue more data on DNA adduct levels in the lung and skin after dermal exposure to UGEO with these organic solvents, which is not evaluated in this study.

Workplace Incivility Among Nursing Staff and Losses in Productivity

Scott Hutton & Donna Gates, EdD, RN, FAAN
University of Cincinnati

Workplace incivility is low level deviant behavior with ambiguous intent to harm the target in violation of workplace norms (Anderson and Pearson, 1999). Workplace incivility has never been studied in direct care workers in tertiary care settings. This study set out to examine if there was a relationship between workplace incivility and productivity among direct care staff. The sample (n-184) was 91% female, 77% European American. Of the 18 participants surveyed, 71% had an associates degree or above and 81% were registered nurses. Two survey tools, the Work Limitation Questionnaire and the Incivility in Healthcare Questionnaire were distributed to all direct care staff at a major metropolitan hospital in the Midwest. A response rate of 22% was accomplished. Using regression analysis the researcher found a relationship between productivity and workplace incivility from direct supervisors as well as workplace incivility from patients, families, and visitors ($F=9.27$ $p=.0001$ $R^2=.0948$). Other sources of workplace

incivility investigated, but not shown to have a significant relationship to productivity, were workplace incivility from physicians, other direct care staff, and general environmental workplace incivility. Further, unlike workplace incivility research done by other investigators, demographic characteristics were not found to be related to perceived levels of workplace incivility. The findings of this study are important because it appears that workplace incivility from patients and management has a greater impact on employees' productivity than workplace incivility from other sources. Future research on workplace incivility will need to focus on the underlying causes of workplace incivility.

Do Optical Properties of Obstacles Affect the Risk of Tripping in Construction Workers?

Christopher Rhea, Shirley Rietdyk, Ph.D., Jim McGlothlin, Ph.D.
Purdue University

Slips, trips, and falls are a major contributor to injuries in the construction industry. While recent research has found that industry workers adequately perceive the risk of slipping on a surface, the risk of tripping over obstacles has not been investigated. Toe clearance, a quantity of the risk of tripping, increases from level walking to stepping over obstacles and further increases with visual interference. Obstacle position cues mitigated the changes due to the visual interference (Rietdyk and Rhea, 2006). Construction workers navigate a cluttered environment where obstacles are frequently in their walking path. In addition, construction workers regularly carry objects that obstruct their view of the ground and a potential obstacle. This project will investigate if construction workers can accurately perceive various obstacle heights and will assess the risk of tripping based on perception-action theory. Obstacles with reduced visual structure (i.e. dowel rod hanging in the air) will be examined to determine the effect of the optical properties of the obstacle. Also, this project will attempt to identify if construction workers have developed different obstacle crossing strategies compared to non-construction workers. This project addresses the National Occupational Research Agenda (NORA) Priority Research Areas: **Traumatic Injuries** and **Risk Assessment Methods.** Research outcomes combined with past and future research will potentially identify strategies for avoiding tripping hazards thus reducing injuries and fatalities from such hazards in the construction industry. Results from this pilot research will enable future project proposals that will identify risk factors and prevention strategies for falling from tripping in construction environments.

HEPA Filter Efficiency Testing During Filter Installation

Fahang Akbar-Hhanzadeh, Ph.D. & Ken Smigielski
University of Toledo– Medical Science Campus

HEPA filters are claimed by vendors to have 99.97% collection efficiency for particles down to 0.3 microns in diameter. Installation of a HEPA filter in its frame introduces a series of variables that can jeopardize the HEPA filter's efficiency specified by its manufacturer. The main objective of this pilot project was to set up and test a "filter testing unit" that can be used to evaluate filter installation variables that affect the HEPA filter efficiencies. A uniquely designed closed system "filter testing unit" was assembled within the laboratory. The main components of the unit were: a fan, an industrial damper, a duct with two ports (one to inject the challenge aerosol and the other to monitor its concentration up-stream filter), filter housing (consisted of a mixing chamber, filter frame equipped with brackets to hold the filter in place and two ports for measuring and adjusting the pressure-drop across the filter), another duct with a port down-stream to monitor the concentration of the challenge aerosol in the filtered air before entering the fan. The concentrations of the challenge aerosol up-stream and down-stream were used to calculate the filter's capture efficiency. Six common size HEPA filters (two each from three manufacturers) and 2 common non-HEPA filters (from one manufacturer) were evaluated based on design principles, particulate capture efficiency, and consistency of effective installation. When the filters were received and during the unpacking, the filters were visually inspected to determine the integrity of outer package, observe technical issues related to pulling the filter out of its container, filter structure and texture, labels and signs. Removing the filter out of its container was generally difficult. Each vendor

provided a different type of gasketing method for the HEPA filter. A significant tear was discovered when one of the filters was unpacked. The filter damage was extensive enough to prevent the filter from passing the HEPA filter efficiency test. One vendor did not include the gaskets in the package. When the vendor was contacted, the gaskets were immediately mailed to the researchers.

The filter without the appropriate gasket failed the efficiency test. The filter was installed and tested using several different methods varying the orientation and the tension applied to the frame and gasket of the filter. The efficiency of filters was determined after the filters were subjected to numerous installation flaw scenarios. In addition, the filter efficiency was determined for possible filter or gasket damages such as holes, cracks and so on. The damages were artificially created to simulate those happen in the field. The results of this pilot study indicated that any damage of the filter or flaw in the installation process can compromise the performance of HEPA filters significantly.

Relationship Between Indoor and Outdoor (1-3)-β-d-Glucan, Fungal Spore and Pollen

Taekhee Lee, Sergey A. Grinshpun, Ph.D., Ki Youn Kim, Yulia Iossifova, atin Adhikari, Ph.D. Tiina Reponen, Ph.D.
University of Cincinnati

In this exploratory study, indoor and outdoor airborne fungal spores, pollen, and (1→3)-β-D-glucan levels were determined through long-term sampling (24-hour) using a Button Personal Inhalable Aerosol Sampler. The air samples were collected in five Cincinnati area homes that had no visible mold growth. The total count of fungal spores and pollen in the collected samples was conducted under the microscope and *Limulus Amebocyte* Lysate (LAL) chromogenic assay method was utilized for the determination of the (1→3)-β-D-glucan concentration. For the combined number concentration of fungal spores and pollen, the indoor and outdoor geometric mean values were 573 and 6,435 mP^{-3P}, respectively, with a geometric mean of the I/O ratio of 0.09. The geometric means of indoor and outdoor (1→3)-β-D-glucan concentrations were 0.92 and 6.44 ng mP^{-3P}, respectively, with a geometric mean of the Indoor/Outdoor (I/O) ratio equal to 0.14. The I/O ratio of (1→3)-β-D-glucan concentration was found to be marginally greater than that calculated based on the combined number concentration of fungal spores and pollen. This suggests that (1→3)-β-D-glucan data are affected not only by intact spores and pollen grains but also by the airborne fragments of fungi, pollen, and plant material, which are ignored by traditional enumeration methodologies. Since the (1→3)-β-D-glucan level may elucidate the total exposure to fungal spores, pollen, and fungal fragments, its I/O ratio may be used as a risk marker for mold and pollen exposure in indoor environments.

Predicting Farm Youth Injury: A Psychological Perspective

Jennifer Yugo, May Colatat & Gabe De La Rosa
Bowling Green State University

Agriculture is among the most dangerous industries for young workers. The nature of adolescence and characteristics of the work environment both contribute to the high injury and mortality rate of the industry (Frone, 1998). One unexamined variable is the influence parent attitudes and behavior has on safety behaviors, attitudes and injuries of youth farm workers. The present study assessed these issues and found that parent behaviors and attitudes moderate the relationship between youth attitudes and behaviors/injury. This study also found that experience with injury does not have an affect on future safety behaviors and attitudes.

Evaluating the NIOSH Lifting Equation for Obese Workers

Devender Singh & Woojin Park, Ph.D.
University of Cincinnati

The goal of this study was to determine whether a widely used lifting task evaluation/design tool, the 1991 NIOSH lifting equation, is capable of determining the safe load weight limits for the obese population, and if necessary, identify a need for modifying the NIOSH lifting equation for the special population of the obese individuals in future studies. 40 subjects (20 non-obese and 20 extremely obese) were recruited for this study. Both the groups had 10 male and 10 female subjects. Each subject performed lifting tasks for 16 different lifting conditions with the corresponding NIOSH RWLs: 16 lifting conditions= 2 horizontal locations (H= 48 and 60 cm) × 2 vertical locations (V= 93 and 143.5cm) × 2 vertical travel distances (D= 85 and 130 cm) ×2 angles of asymmetry (A= 0˚ and 105˚).The lifting tasks were divided into two phases: initial location and final destination. Our results indicate that for each lifting tasks, during both the initial and final destination, obese male and female subjects had average L5/S1 spinal disc compression force higher than the NIOSH action limit ($p<0.0001$). The average L5/S1 spinal disc compression force for the non-obese male and female was lower than the NIOSH action limit ($p<0.0001$). An Analysis of Variance based on 6 factors: obesity level, gender, H, V, D and A and their interactions showed that all the main effects and their interactions had significant effect on disc compression force. Based on the results of this study, three conclusions were drawn: 1) the current NIOSH RWL does not accommodate obese workers and hence may not be able to protect them from the risks of work-related LBDs, 2) Obese male experience higher biomechanical stresses than obese females and hence may be at a higher risks of work-related injuries, 3) based on the biomechanical criterion, the new RWL should be developed for obese workers.

Effectiveness of Work Compatibility in Evaluating and Improving Worker Health

Setenay Tuncel, Richard L. Shell, Ph.D. & Judy Jarrell, Ed.D.
University of Cincinnati

Background Even though health is the "total social, psychological and physical well-being" of individuals, past efforts have concentrated on specific parts of it. Furthermore, such efforts have overlooked the need of a detailed assessment of physical and non-physical work environments before determining the appropriate intervention(s).

Objective The goal of this pilot study is to critically examine the feasibility of Work Compatibility Improvement Framework (WCIF) as a tool to evaluate and improve the workers' health in an organization. The first specific aim is to examine the association between Work Compatibility Level (WCL) and prevalence of adverse musculoskeletal and stress outcomes reported by workers. The second specific aim is to compare the change in the prevalence of self-reported adverse musculoskeletal disorders and stress outcomes between the intervention (WCIF was implemented to improve worker health) and control groups (basic intervention is assigned without implementing WCIF).

Methods Work Compatibility integrates the extensive number of work variables based on their effect on workers' social, psychological and physical health: they may replenish worker's energy as an energizer, or deplete the energy as a demand. The level of balance between them reveals how urgent an intervention is needed in that area. Embedding Work Compatibility concept into Six Sigma's problem solving tool DMAIC (Define-Measure-Analyze-Improve-Control) is called Work Compatibility Improvement Framework. A prospective cohort with intervention and control groups was proposed to examine the feasibility of WCIF as a tool to evaluate and improve the workers' health in an organization. Baseline measurements to determine the level of performance in terms of demands and energizers, and the prevalence of adverse musculoskeletal and stress outcomes were performed for both groups. The association between work environment and prevalence of adverse musculoskeletal and stress outcomes was tested

by implementing Fisher's Exact Test. It is also expected that adverse musculoskeletal and stress outcomes in the intervention group will be reduced more than those in the control group.

Results Baseline measurement was conducted for intervention (n=86) and control (n=26) groups. There is a statistically insignificant association between WCL and self-reported adverse musculoskeletal disorders and stress outcomes at 0.05 level. For example, of the participants in intervention group showing the "low" WCL in organizational environment, 19% reported heartburn and acid troubles, whereas prevalence of heartburn and acid troubles were 10% among the participants with "high" WCL in the same group (p=0.36, two-sided Fisher's exact test). The physical and non-physical elements of work environment were prioritized to determine the changes in workplace of intervention group. The study is still in progress, and comparison of the groups in terms of the prevalence of adverse musculoskeletal and stress outcomes will be conducted at the end of the study.

Poster Presentations

Reducing Job Stress: A Comparison of CBT and ACT Based Work Stress Interventions

Heather Schwetschenau, Eileen Delaney, Steve Jex, Ph.D., Jebediah Northern & William O'Brien
Bowling Green State University

Since the early 1980s, work stress has been listed among the top ten occupational health problems in the United States (Sauter, Murphy, & Hurrell, 1990). Work stress has been linked with many physical, psychological, and behavioral health problems. Specifically, work stress has been demonstrated to be significantly correlated with cardiovascular disease, hypertension, lower back pain, diminished immunological functioning, depression, anxiety, increased alcohol use, absenteeism and poor job performance (Belkic, Landsbergis, Schnall, & Baker, 2004; Grunberg, Moore, Anderson-Connolly, & Greenberg, 1999; Pelletier & Lutz, 1991; Wiesner, Windle, & Freeman, 2005).The proposed study will evaluate the effectiveness of two interventions designed to reduce work stress among mental health agency employees. One intervention uses traditional cognitive-behavioral techniques (CBT), while the second intervention uses a newly developed approach to behavior change known as acceptance and commitment therapy (ACT). There have been no studies to date that have compared ACT with CBT interventions aimed to decrease stress in work settings, and recent research suggests that ACT interventions may be more effective than CBT interventions in a variety of settings.

This research project addresses the Intervention Effectiveness Research needs as stated in the NORA research agenda on Organization of Work (NIOSH, 2006). The research agenda identifies a need for developing practical strategies and techniques that effectively reduce or prevent workplace injuries and illnesses. The proposed study aims to accomplish this by implementing interventions aimed to decrease job stress, which have been previously correlated with improved physical, mental and behavioral health outcomes Furthermore, the research agenda poses a need for testing and evaluating interventions and programs. For this project, we will be systematically evaluating which intervention (CBT or ACT) is more effective at decreasing employees' experience of work stress through the use of both objective and subjective measures. This systematic evaluation will facilitate the determination of the most effective stress management program, which corporations can use to ensure the best possible use of limited resources.

A Nanotube Immonosensor for Rapid Screening of Bone Health in Occupational Safety

Mark Schulz, Ph.D., Yun Yeo-Heung,Ph.D.
University of Cincinnati

The objective of the proposed study are: (a) to test an electrotechnical immunosensor with standard IgG with anti-IgG conjugations and (b) evaluate the electrochemical immunosensor to detect bone turnover makers that indicate bone health. The goal of the project is to develop a nanotechnology based sensor that can measure bone turnover outcomes such as N-terminal telopeptide (N-Tx) and C-Terminal teleopeptide in test solutions. The long range goal of our research is to integrate the nanosensor for bone turnover markers with measures of bone quality into a single simple nanobionic measurement system that will enable rapid screening of bone quality for occupational health. The biosensor will screen bone health and identify individuals that may be at increased risk of injury for certain occupations.

A Longitudinal Study of Workplace Incivility in Hospitals

Scott Hutton & Donna M. Gates, EdD, RN, FAAN & Paul Succop, Ph.D.
University of Cincinnati

The financial costs of workplace violence is estimated to be 4.2 billion dollars a year. Workplace violence is often started by a minor incident such as workplace incivility that spirals out of control. Workplace incivility known as low-intensity, deviant behavior with ambiguous intent to harm, may initiate a spiral that for one thousand people a year ends in workplace homicide. If an initial minor incident such as incivility could be mitigated, then the financial and human capital that could be realized is substantial. Staff in healthcare are at particularly high risk of being targets of workplace incivility. This increase in risk is secondary to uncertainty in the work environment, the increase acuity of hospitalized patients, increased use of part-time/temporary agency staff and generalized loss of environmental control. The purpose of this longitudinal study is to examine variation in the workplace incivility experienced by employees of healthcare organizations. The specific aim of this study is to assess if the level of workplace incivility changes over time in hospital setting.

Specific research questions are 1) How does the mean monthly perceived level of workplace incivility at the organizational level change over the course of a year, 2) In what way does a sample of different hospitals' levels of workplace incivility vary 3) What is the relationship between the hospital workforce demographics and the perceived level of workplace incivility? Two survey instruments will be used in this study 1) Demographic Survey and 2) the incivility in Healthcare Survey (HIS). The HIS will assess hospital staff' perceptions of incivility in the healthcare work environment. The surveys will be distributed to 200 randomly selected employees form each hospital every month. For research question one analysis of variance will be used to test how the mean perceived level of incivility changes at the organizational level.. For research question two, an F-max test will be utilized to compare the variance in workplace incivility at individual hospitals compared across a sample of hospitals. For research questions three, a regression analysis will be utilized to determine if there is a sample of hospitals. For research question three, a regression analysis will be utilized to determine if there is a relationship between the hospital workforce demographics and the perceived level of workplace incivility at each hospital. The information obtained will serve two purposes: First, it will be shared with the hospitals in aggregate form to provide information for planning changes. Second it will provide a base for further research into intervention studies to mange incivility.

Filtration Performance of N99 & N100 Facepiece

Robert M. Eninger & Sergey Grinshpun, Ph.D.
University of Cincinnati

Respiratory protection using filtering facepiece devices has increased in recent years, particularly in healthcare settings, among nanoparticle users, and among emergency responders. Common in media images after 9-11 and the 2003 SARS outbreak, they offer protection that is inexpensive, readily available, and disposable. Nanotechnology users and makers of engineered nanoparticles have begun to rely on them for worker protection from yet unknown health effects. Filtering-facepiece respirators are certified by the National Institute for Occupational Safety and Health against a 300 nanometer (nm) aerosol for filtration efficiencies of 95, 99, and 99.97%. Despite their increasing use, only the N95 type respirators have been evaluated extensively against very small particles (ultrafines, < 100 nm). Such studies have shown that, contrary to theory, particles 30 - 70 nm penetrate in greater numbers than those at 300 nm, and that the N95 respirator may not provide 95% reduction against nanoparticles or viruses in laboratory tests and field settings. A critical gap exists in the literature for the same data on N99 and N100 type respirators. We hypothesize that N99 & N100 respirators provide significantly greater filtration efficiency than N95 respirators, but may not exceed 99% and 99.97% protection—as required by NIOSH certification—for particles from 10 to 600 nanometers in diameter at low and high inhalation flow rates.

The proposed study will evaluate N99 and N100 devices against a nanoparticle aerosol using a manikin-based protocol to simulate inhalation of the human head airways. Two models of N99 and N100 respirators will be tested. A laboratory test aerosol 10 - 600 nm in diameter will be measured inside and outside the device and the concentrations compared to previous data on the N95 respirator. We anticipate N99 and N100 respirators will exhibit superior performance to the N95, but will not meet NIOSH filtration criteria for all observed particle sizes. This research will directly impact 281,000 U.S. workplaces which currently use air-purifying respirators and 23,000 workplaces using filtering-facepiece devices to protect against biological hazards. Filtering-facepiece respirators are increasingly used to control aerosol exposure in emergency response, in hospital settings, and in workplaces with engineered nanoparticle exposures. The proposed research will result in data that will enhance respiratory protective practices, plans, and decisions for approximately four million workers.

Maganese and Hearing Loss

Scott Schneider & Mary Beth Genter, Ph.D.
University of Cincinnati

We propose pilot studies to ascertain whether there is likely to be a risk of hearing loss in humans exposed to manganese (Mn). Although Mn exposure has been linked in multiple studies to parkinsonism, particularly in welders exposed via inhalation, more recent evidence shows neurological impairments in individuals exposed via the drinking water. Several reports link metals, specifically arsenic and Mn, to hearing impairment. Because of widespread occupational exposure to Mn, we propose studies aimed at 1) determining whether Mn accumulates in the ear of 2 strains of mice; 2) using the acoustic startle response to determine whether Mn exposure can be linked to hearing impairment; and 3) examining the inner ear for expression of ZIP8, a metal transporter that transports Mn and appears to sensitize mouse strains that express it to cadmium toxicity.

Energy Expenditure, Heart Rate and Perceived Physical Exertion in ER Nurses

Jie Chen & L. Sue Davis, Ph.D.
University of Cincinnati

The question about positive versus negative impact of shift work on nurses' health and performance will remain unless the characteristics of the shifts can be systematically examined. However, while most studies focused on comparing the effects of different shifts to nurses' health and safety and quality of patient care, there are few studies comparing the differences between different shifts on work exposure

and nurses' body responses. Therefore, the goal of the proposed descriptive study is to compare a12-hour with an 8-hour day shift with respect to energy expenditure, heart rate, and perceived physical exertion among female hospital staff nurses. In this descriptive study, we only investigate shift period of 7am-7:30pm in 12-hour shift system and 7am-15:30pm in 8-hour shift system. The above goal can be achieved by the following specific aims. Specific Aim 1: to determine during which type of day shift (12-hour versus 8-hour) nurses tend to spend, on average, higher energy per hour on their work activity while controlling for nurses' age. Both physical activity and heart rate (HR) over entire working hours (excluding official break time) within one shift will be continuously recorded and transformed as energy expenditure (EE) by a caloric expenditure monitoring system.

Specific Aim 2: to determine during which type of day shift (12-hour versus 8-hour) nurses tend to experience higher heart rate while controlling for nurses' body mass index (BMI). The percentages of total working hours for durations of HR ranging of 91-100 bpm and >100 bpm will be compared for the two shifts. Specific Aim 3: to determine during which type of day shift (12-hour versus 8-hour) nurses tend to experience greater physical exertion while controlling for nurses' age, caring for family member, fatigue and sleep quality. Subjects will rate their physical exertion level at upon waking, before the shift, every 2 hours during the shift, and bed time.

Once the goal of this study is accomplished through above specific aims, the findings will help to determine if current 12-hour shift system significantly increases hospital staff nurses' physiological workload and body response by comparing with traditional 8-hour system, and may lead to potential schedule modifications that improve the health and performance outcomes for health care workers.

Genetic Susceptibility of Organophosphate-Induced Toxicity

Rickey Yuet-Kin Leung, Ph.D.
University of Cincinnati

Agriculture industry is one of the biggest industries in the U.S. It involves several millions of people working in the field exposing their health to different kinds of occupational hazards and risks. In order to maintain high productivity of each crop, application of pesticides to the crop is necessary. Although several safety measures have been implemented, farm workers still suffer from different degrees of pesticide-related illnesses. Exposure to small amount of pesticide could cause severe health problems including rashes, vomiting, excessive sweating, dizziness, headaches, muscle pains and cramps, eye irritation and respiratory difficulty if acutely exposed. It also causes long-term damages to our nervous system resulting in a loss of motor function, paralysis and muscle atrophy, loss of intellectual functioning including impaired concentration, information processing, psychomotor speed, memory and language, neurobehavioral effects including anxiety, irritability and depression. Therefore, the work-related death rate of farming industry was the highest among all occupations. This could be because of poor access to health care and insufficient public health education as well as limitation in early diagnosis of pesticide exposure. Individual variation to pesticide toxicity may further limit the accuracy of early diagnosis. It is still a great challenge for medical professional to identify pesticide-related illness. In this proposal, we attempt to investigate the role of genetic predisposition of each individual to pesticide toxicity so as to determine a population that may have a higher risk of pesticide exposure. As a result, early warning signals and frequent health check-up can be given to the high susceptibility group of people.

β-Glucan Level in Sub-Micrometer Particles Released from Different Moldy Buildings

Sung-Chul Seo & Tiina Reponen, Ph.D.
University of Cincinnati

Many epidemiological studies have shown that people living or working in mold problem buildings have more respiratory symptoms and diseases than people in non-problem buildings. Moreover, recent epidemiological studies have reported that fine particles (<2.5 um) were found to be significantly associated with elevated mortality and morbidity risk. A recent study (Cho et al., 2005) showed that

the average concentration of small sized fragments released from S. chartarum grown on agar was about 514 times higher than that of spores, while the number of fragments and spores was about the same for A. versicolor. Thus, the purpose of this study is to characterize the release of submicrometer size fungal particles from different moldy building materials and determine β-(1-->3)-D-Glucan levels of collected submicrometer size fungal particles. To determine the size distribution of submicrometer particles, the electrical low pressure impactor (ELPI) will be employed. In order to compare β-(1-->3)-D-Glucan concentrations of S. chartarum in submicrometer size range to those of A. versicolor, a newly developed collection system consisting of two sharp-cut cyclones (PM2.5 and PM1.0) and a filter sampler will be used. Based on preliminary test results, this collection system was proven to separate submicrometer size particles from fungal propagules well. Thus, submicrometer size particles of S. chartarum and A. versicolor grown on different moldy building materials will be collected by this collection system. Collected samples will be analyzed for β-(1-->3)-D-Glucan levels by the kinetic chromogenic Limulus Amebocyte Lysate assay (LAL). The amount of β-(1-->3)-D-Glucan of both S. chartarum and A. versicolor in submicrometer size range and that of each fungal species grown on both ceiling tiles and gypsum boards will be compared using either t-test (Gaussian) or Wilcoxon test (Non-Gaussian)..

Tailored Messages and Their Effects on Intentional Physical Activity

Tracey Yap & L. Sue Davis, Ph.D.
University of Cincinnati

The purpose of this study is to design a series of theory-based tailored messages geared towards increasing intentional physical activity for employees of a manufacturing distribution plant in Northern Kentucky. The messages will be designed based on the Transtheoretical Model stages of behavior change using literature and occupational health experts working with the selected population. Then a series of focus groups (consisting of a sample of workers from the manufacturing setting) will be held to validate the messages for effectiveness in moving the worker toward the behavioral goal of intentional activity. Once the tailored messages are designed, they will be used in a larger study that will test the effectiveness and efficacy of the message as a strategy to increase intentional physical activity and prevent weight gain in employees of a manufacturing distribution plant. In 1990, 11.6% of the US population was obese compared to 22.1% in 2002. This is a 10.5% increase over 12 years and the trend is continuing. In Kentucky, where this project will be implemented, the numbers for obesity are even more alarming; 24% of adults are obese, and when combined with those adults who are overweight, the numbers go up to almost 63% compared to 60% in the nation. One way to slow this trend is through an increase in physical activity. Over one fourth of U.S. adults do no physical activity and Kentuckians, who rank at the bottom of physical activity levels in the nation, are at 35% for inactivity. The objectives of this proposed study are relevant to the National Occupational Research Agenda (NORA) priorities. NORA has identified musculoskeletal disorders, as well as, social and economic consequences of workplace illness and injury as priority areas for research. It has been well established that a physically fit individual is less prone to injury and therefore, this study geared towards ultimately improving physical health within the working population is in keeping with the NORA priorities. As well, a physically fit individual will reduce the economic burden associated with illness and injury.

Postural Strain in Obese During Standardized Holding Task

Devender Singh & Woojin Park, Ph.D.
University of Cincinnati

In the United States, obesity has become a major workplace concern. Nearly one third of the U.S. worker population is obese (Hertz et al., 2004), and it is predicted that obesity will continue to increase in the United States (Flegal et al., 2002). Obesity represents a major public health problem , in relation with the

inherent increase in the medical risks of both morbidity and mortality (Visscher *et al.*, 2001; Flegal, 1999; Mokdad *et al*., 2000)..

Despite the prevalence of obesity and the associated challenges, the effects of obesity on risks of work-related musculoskeletal disorders (WMSDs) have not been researched extensively. Currently, ergonomic tasks design guidelines that are based on considerations of obese workers' physical capacities and limitations or proven to effectively protect the obese workforce from WMSD risks do not seem to exist..

Awkward and prolonged static postures cause postural strains and have been widely acknowledged as one of the leading cause of work-related injuries. Based on this finding, studies have developed ergonomic posture evaluation tools, such as OWAS, RULA, and REBA. Despite these developments in the field of ergonomics, quantifications of postural strains of obese workers have rarely been investigated.

Therefore, the objectives of this pilot study are: 1) to develop a database of postural strain measurements associated with various working postures selected based on the OWAS posture classification scheme for both obese and non-obese worker group, 2) to examine the obesity effects on postural strain measurements for different postures, 3) to provide suggestions on how to modify the current OWAS for the obese worker population based on the obesity effects identified. The postural strain measurements will be conducted using two psychophysical scales: a) Corlett's (1976) Body Part Discomfort (BPD) Scale, b) Borg's (1982) Rated Perceived Exertion (RPE).

20 extremely obese [BMI>40 kg/m^2] and 20 non-obese (BMI < 25 kg/m^2) male individuals recruited from the University of Cincinnati (UC) community. Subjects will be asked to statically hold a 5 kg box (310 x 250x 205 mm) for 20 s in a randomly ordered 84 standard OWAS postures (84 postures= a combination of three arm postures, four back postures, and seven leg postures). After the 20s, subjects will be asked to immediately report their perceived exertion on the 10-point Borg RPE scale, and also their Body Part Discomfort (BPD) on the 5-point scale, which range from 0 (No discomfort) to 5 (Intolerable discomfort). A total of 3360 postural data (40 subjects x 84 static postures) will be collected. Each subject will be asked to come on three different sessions for the experiment. Each session will last for one hour. T-tests will be conducted to investigate the effect of obesity on postural strain measurements for each of the 84 postures. Significance of the statistical test will be accepted when $p \leq 0.05$.

A Novel Approach to Understanding the link Between Low Back Pain and Brain Response

Lisa Lemen, Ph.D., Susan Kotowski
University of Cincinnati

Low back pain (LBP) has a tremendous impact on industry and society with respect to financial burden, pain and suffering, and disability. At some point in their working lifetime, 80% of the workforce will develop LBP, and 85% of these individuals will not be provided with a specific diagnosis. Although LBP is very prevalent, the pain process is not well understood and not well researched, particularly in individuals with non-specific low back pain. Therefore, the *objective* of the proposed study is to delineate the role of inflammation in the muscle in the development of pain and determine whether this inflammation can be directly linked to a functional response within the brain. The proposed study has been designed to test the following two *hypotheses*: 1) The development of pain in the lumbar musculature during a static exertion (a Biering-Sorensen test) will induce significant levels of inflammation within the muscles, changes in metabolite levels in the brain, and significant levels of perceived pain, and 2) Levels of muscular inflammation, brain metabolites, and perceived pain will be significantly different between subjects with non-specific LBP and healthy individuals. In order complete the proposed project and test the above hypothesis, the following *specific aims* will be accomplished: 1) Quantify the muscle inflammation in individuals with low back pain and individuals without low back pain using magnetic resonance imaging (MRI) at baseline (resting) and 24 hours after a physically demanding task, 2) Acquire a magnetic resonance (MR) spectra scan of the anterior cortex and thalamus to (determine metabolite changes

between subjects with and without low back pain at baseline (resting) and 24 hours after a physically demanding task, and 3) Quantify subjective pain levels of individuals with and without low back pain at baseline (resting) and 24 hours after a physically demanding task. Ten individuals, 5 males and 5 females, clinically diagnosed with chronic non-specific LBP, and ten matched healthy controls, will be recruited. Muscle inflammation quantification will consist of comparing calculated T2 values collected at baseline and post-exercise using MRI of the lumbar region. The response in the brain will be quantified by comparing baseline and post-exercise levels of several brain metabolites. In addition, subjective pain response will be measured using a visual analog scale. Repeated measures ANOVA will be used to determine if there are significant differences in levels of muscular inflammation, brain metabolites, and subjective pain ratings. This study is unique in that it is the first to attempt to understand the linkage between the muscles and the brain concurrently. Understanding this linkage could provide researchers with a better understanding of what causes low back pain, why some individuals recover and others do not, and better methods for treatment..

Ergonomics of Electronic Medical Records

Susan Kotowski & Kermit Davis, Ph.D.
University of Cincinnati

With advances in technology, health care facilities are beginning to embrace Electronic Medical Record (EMR) technology for numerous reasons including: ease of information sharing, reduced expenses, increased user and patient satisfaction over conventional paper record methods, increased productivity, and decreased medical errors. While numerous studies on EMR technology have examined satisfaction by users and patients, compatibility between the user and the interface (software), and economic impact of the technology; there has been a failure to investigate the potential ergonomic issues associated with implementation of EMR technology. Potential ergonomic issues include adaptability of the user to the technology (e.g. computer savvy individuals vs. individuals not as familiar with computers), issues with an aging healthcare workforce (e.g. declining vision, decreased dexterity), musculoskeletal discomfort associated with use of the technology (e.g. repetition during information input, and postures associated with using the device), and issues unique to the specific type of EMR input device (e.g. tablet, desktop, or laptop). There are two hypotheses for the proposed study. *First, it is hypothesized that musculoskeletal strain for EMR users will be prevalent in body regions different than those in the current paper and pen record keeping method.* It would be expected that how the nurses and doctors interact with the recording method would be significantly different and potentially stressful to different parts of the body. *Secondly, there will be ergonomic risk factors unique to each type of input device (tablet, desktop, laptop).* The size of the EMR will have a direct influence into how users interact with the devices, potentially resulting in different musculoskeletal stress. The proposed study will provide the first extensive ergonomic stress evaluation to determine the nuances of the interaction between the used and EMR.

The Impact of Injury Status on Pain Response During Physical and Mental Stress

Kari Dunning, Ph.D., Susan Kotowski
University of Cincinnati

The majority of the research on low back injuries has focused on how physical task parameters influence loading of the spine and therefore risk of injury. Much less focus has been placed on factors such as injury history, pain perception, personality type and coping style. With such a large portion of the population likely to be impacted by a low back injury, another critical factor is determining what changes happen once an injury has occurred and how these changes affect outcomes such as spinal loading. Therefore, the purpose of this investigation is to determine how injury status impacts biomechanical (spinal loading), biological (hormone levels) and perceived pain responses to different types of stressors

physical and mental). There are three specific aims for the proposed study: 1) Quantify the biological pain response during unstressed and stressed conditions using measures of salivary cortisol, 2) Quantify the perceived pain response to stressed and unstressed conditions using self-reported ratings of perceived exertion, task risk ratings and pain level scoring, and 3) Using a series of comprehensive measurements including EMG, goniometers and force plates along with biomechanical modeling, determine the spinal loads during tasks involving physical and mental stress. The proposed study will address several of the National Occupational Research Agenda priorities. First, it has direct implication into understanding the development of musculoskeletal disorders, particularly low back disorders. Secondly, the study will investigate injured individuals, who are a special population at risk. Lastly, factors such as stress (both physical and mental) which are related to organization of work will be explored. Forty individuals will be recruited into two groups: healthy without low back pain and injured with low back pain. Each individual will perform two different types of tasks. Physical stress will be induced using a decoding task. It is expected that individuals with low back pain will have significantly greater perceived pain response and biological Pain response than individual without low back pain in both unstressed and stressed conditions. Additionally, individual with low back pain will have greater spinal loads than individual without low back pain.

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Department of Environmental Health
Kettering Laboratory, Suite 222
3223 Eden Avenue, ML 0056
Cincinnati, Ohio 45267-0056
Phone: (513) 558-5710 ◊ Fax: (513) 558-2722
Website: WWW.EH.UC.EDU/ERC

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