University of Cincinnati Education and Research Center (ERC)
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Fifth Annual

Pilot Research Project Symposium

October 21 & 22, 2004

Abstract Booklet

Presentations by

2003 and 2004 Awardees

Kehoe Auditorium

Kettering Laboratory

University of Cincinnati

Thursday 10/21/04 1:00 p.m. — 5:30 p.m.

5:30 p.m. – Picnic Sponsored by the Academy of Kettering Fellows

Friday 10/22/04 8:00 a.m. — 12:00 p.m.

0.5 ABIH (IH) CM Points Per Day

UNIVERSITY OF Cincinnati

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Abstract Booklet

10/21/04 Presentation Schedule – Table of Contents
1:20 p.m. – 5:30 p.m.

UC = University of Cincinnati
UI = University of Iowa
PU = Purdue University
UK = University of Kentucky
BGSU = Bowling Green State University
(1) = Funding Period 8/15/03— 6/30/04
(2) = Funding Period 8/01/04— 6/30/05

10/22/04 Presentation Schedule – Table of Contents
8:30 a.m. – 12:00 p.m.

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Abstract Booklet

Platform

Co-Exposure Of Arsenite And Benzo(a)pyrene: Effect Of Glutathione On DNA Adduct Levels

J. Vietas, G. Talaska,
University of Cincinnati, Cincinnati, OH

Humans are considered the most sensitive species to arsenic exposure with increased risk to skin, lung and bladder cancer. Epidemiologic studies of workers simultaneously exposed to benzo[a]pyrene (BaP) and arsenite (As) report additive to multiplicative effects. These studies are supported by both in vitro and in animal studies demonstrating an increase in BaP DNA adduct levels when co-treated with BaP and arsenite than when treated with BaP alone. Glutathione, the major thiol compound responsible for maintaining redox homeostasis, may provide cellular protection against arsenite's ability to increase the likelihood of DNA damage. We characterized the effect of modulating glutathione levels, through the use of buthionine sulfoximine (BSO) and glutathione ethyl ester (GSHEE) treatment as well as by using glutathione deficient knockout mice, on the formation of DNA adduct levels after co-exposure to arsenite and benzo(a)pyrene. Lung and skin tissues were analyzed for DNA adducts using ^{32}P-postlabeling. Arsenic cotreatment increased average BaP adduct levels in both lung and skin; the increase was statistically significant in the lung ($p=0.048$). A reduction in glutathione level increased BaP adduct levels, although only significantly in the skin of mice treated with BSO ($p=0.028$). Treatment with GSHEE reduced adduct levels, although not significantly ($p > 0.05$) in any tissue measured. These results are consistent with previous in vitro and in vivo findings and suggest that glutathione plays a minor role in arsenic's ability to potentiate BaP DNA adduct formation.

Platform

Multi-Fractal Analysis for Occupational Health Research

Jay H. Kim, PhD, Associate Professor, Department of Mechanical Industrial and Nuclear Engineering – University of Cincinnati,

As a part of the Cincinnati Lead Program Project (CLPP), postural balance signals from postural sway motions of lead exposed children have been measured and studied in an effort to relate the motions and the blood-lead levels. We developed several signal analysis techniques including advanced time-frequency analysis such as the analytic wavelet transform and the wavelet based multi fractal analysis to the postural balance data that had been measured by the CLPP.

Like many other types of biological signals, postural sway motion signals are highly transient and multi-fractal. The wavelet analysis is very well suited for analysis of such transient signals because it uses time-frequency atoms of different sizes that depend on the frequency to break down the signal. The Wavelet based Multiple-Fractal Formalism (WMFF) and the analytic wavelet transform are two techniques adopted in this research to study the postural sway motion characteristics of lead exposed children. The main goal pursued in this study is to develop quantitative metrics to relate the postural balance motion and the blood lead level of children.

WMFF calculates singularity spectra of signals; therefore can be used to identify abnormalities of the signals. Theories and procedures of wavelet based multi-fractal analysis are studied. The global singularities and multifractalities are obtained for the postural sway signals of 13 low blood lead level and 10 high blood lead level children. Multi-fractal characteristics of the signals from the two groups are compared with each other by using various data representations. The result shows that the WMFF can be a very useful tool in studying the effect of lead exposure by characterizing the motions in

quantitative metrics namely the maximum spectrum level and the spectrum.

Various time-frequency signal analysis and representation techniques are also developed to aid qualitative analysis of the sway signals. The analytic wavelet transform technique is believed to be extremely useful because it has all the advantages of the wavelet analysis as well as those of the conventional Fourier transform. Possible applications of the analytic wavelet transform to medical signal analysis are suggested with some preliminary results.

Platform

Impact of Realistic Sudden Loading on Back Biomechanics

Susan E. Kotowski, Doctoral Student and Kermit G. Davis, PhD, Asst. Prof.
Occupational Safety and Ergonomics, Department of Environmental Health – University of Cincinnati

Manual material handling (MMH) tasks involving lifting are well documented as increasing the risk for low back injuries which are common and costly injuries. Traditionally, MMH research has focused on lifting task variables such as load magnitude, task asymmetry, lifting heights at origin and destination, and lifting frequency or rate where the load was constant and known to the lifter. However, sudden loading or non-constant loads have been less frequently investigated although they commonly occur in industries such as parcel transportation and airport baggage handling. The current pilot study evaluated the kinematic, kinetic, and perceptual response of individuals to five different lifting tasks which consisted of varying visual cues and weight sequences. Both random weight and visual cues impacted the trunk kinematics during repeated lifting tasks. However, the kinematic and perceptual response differed between genders. Lifting random unknown weight appears to significantly alter the kinematic responses, particularly for males. Females attempt to moderate the affects of the random unknown weight conditions by altering the lifting style. Future work will investigate the muscular response to the same sudden loading tasks to determine the spinal loads and the risk of a low back injury from performing sudden loading tasks.

Platform

Respiratory Protection Against Viruses: The Protection Provided by Respirators Against SARS-causing Corona Virus Simulated by Non-biological Particles

Shu-An Lee, Doctoral Student and Tiina Reponen, Ph.D., Associate Professor
Environmental and Industrial Hygiene, Department of Environmental Health - University of Cincinnati

Recently, viruses have caught worldwide concern because the outbreaks of SARS (Severe Acute Respiratory Syndrome) prevail in Asian area such as Hong Kong, China, Singapore, Taiwan, and Vietnam. Some studies have shown that corona virus may be a possible cause of SARS since it has been found from patient's body fluids or respiratory secretions such as feces, saliva, and sneezing and coughing droplets from nose and mouth. In order to prevent people from SARS infection through air transmission, surgical masks and N95 filtering face-piece respirators have been recommended by the Center for Disease Control and Prevention (CDC) and World Health Organization (WHO) against SARS. So far, it is known that the size of corona virus ranges from 0.1 to 0.2 μm. There are only a few human studies available for the protection provided by surgical masks and N95 filtering face-piece respirators against particles in the viral size range. Therefore, in this study, we used our newly-developed personal sampling system for collecting airborne dust and microorganisms and modified it to fit to the pilot experiments for investigating the protection provided by surgical masks and N95 filtering face-piece respirators against non-biological particles of viral size range (0.02 to 0.3 μm). The test were performed with one manikin and six human subjects. In the manikin-based studies, the results shows that the protection factors for N95 filtering face-piece respirators are higher than those for surgical masks and increasing inhalation rate decreased protection factors in both types of res-

pirators. In the human-based study, five out of six subjects passed the fit test when they wore a N95 filtering face-piece respirator whereas only two out of six subjects passed the fit test when they wore a surgical mask. We also found that the human activities which were performed following the OSHA fit testing protocol (29 CFR 1910.134) did not affect the protection provided by these two types of respirators against particles in the viral size range. The mean protection factors provided by N95 filtering face-piece respirators were 4 to 8 times higher than those provided by surgical masks. There was no size dependence on protection factors provided surgical masks and N95 filtering face-piece respirators in the viral size range. The protection factors provided by these two types of respirators against particles in the fungal spore size range (2 to 5 μm) were greater than in the viral size range (0.02 to 0.3 μm).

Platform

The Study of Applicability of Activated Carbon Fibers (ACF) for Removal of Volatile Organic Compounds (VOCs) in Indoor Environments

Huajun Lu, Industrial Hygiene Graduate Student , Neil Zimmerman, PhD, Associate Professor, School of Health Sciences – Purdue University

Indoor air quality (IAQ) is an issue of rising concern in the United States. Indoor VOCs contribute significantly to Sick Building Syndrome (SBS), the symptoms of which include irritation of eyes, nose, and throat, erythema, mental fatigue, headache, nausea and dizziness. This research focuses on examining the applicability of indoor VOC adsorption onto activated carbon fibers. The goals of this research were: 1) to examine the applicability and capacity of ACF for removal of selected typical VOCs at indoor concentrations; and 2) to develop suitable mathematical models for predicting breakthrough time and adsorption capacity of ACF.

Dilution air from house air was passed through a zero air generator to generate purified air which contains less than 0.1ppm hydrocarbons measured as methane. Two common VOCs with different boiling points and different polarities, toluene and acetone, were tested. Different challenge levels of VOCs were obtained by diluting gas from calibrated cylinders with zero air. Adsorption capacities of activated carbon for the VOCs individually and in mixtures were tested in the concentration range of 100ppb to 10ppm with a contact time of 0.1 seconds. Air samples collected by activated charcoal tubes were analyzed by Varian GC Analyzer equipped with a flame ionization detector.

ACF has shown excellent adsorption capacities on toluene even in the ppb level with the 50% breakthrough time at 60 ppb being greater than two months. The knowledge gained in this study can be applied to the question of applicability of activated carbon in indoor applications with long-term low VOC emission.

Platform

How Do Home Health Nurses Deal with Care Errors?

Said K. Abu-Salem, Doctoral Student, and Juliann G. Sebastian, PhD, Professor, College of Nursing– University of Kentucky

The purpose of this study is to assess how home health nurses perceive and cope with health care errors. The Institute of Medicine report on medical errors in November 2000 brought this issue to the public's attention and has resulted in an increased effort to reduce medical errors. This report indicated that between 44,000 to 98,000 people die each year due to medical errors in hospitals. The cost of medical errors is approximately $37.6 billion each year; $17 billion has been attributed to preventable errors (IOM, 1999). Unfortunately, data are not available on the extent of the problem outside the hospitals.

Home health nurses in southeastern State were surveyed to determine how they perceive and cope with errors. A southeastern Home Health Association provided a list of home health agencies names. Mailing was done in two waves. The di-

rectors of home health agencies were contacted to obtain their agreement and support for the study. The investigator sent a package that contained the surveys, self-addressed envelopes, a flier for recruitment for the study, and a description of the study method and procedure to the clinical directors of participating home health agencies. The clinical directors distributed the surveys in their agencies. Reminder cards were sent after 2 weeks. Thank you fliers were sent after 2 weeks of the reminder card.

Three hundred surveys were mailed with a response rate of 41percent (123 survey). The most frequently reported error was a medication administration error caused by communication problems between nurses or doctors office. Fifty percent reported that the error occurred to another nurses' assigned patient that the nurse was covering for. Nurses experienced emotional distress in response to the care error, and used a variety of strategies to cope. Communication can be improved between nurses especially when one nurse covers for another or a doctor office call for order changes.

Platform

Preliminary Report: A Comprehensive Ergonomic Assessment of a Respiratory Intervention for Tuckpointing Workers

Scott Collingwood, Guest Student Speaker from ERC, University of Iowa

Powered hand tools are a risk factor for upper extremity musculoskeletal disorders (UEMSD). Masonry restoration workers performing tuckpointing, a process that includes mortar removal with a powered hand-held grinder, experience high exposures to respirable silica and dust as well as musculoskeletal stress. A new intervention (shroud) has been shown to reduce the respiratory exposures in tuckpointing workers. The purpose of this study is to quantitatively assess using surface electromyography (EMG) the difference in forearm muscle activity of tuckpointing workers while performing work both with and without the shroud. In addition, a self-reported subjective assessment of perceived exertion was obtained following tuckpointing with a shroud and without a shroud. Of 6 subjects studied to date, all self-reported their perceived exertion as being greater when using the shrouded grinder. The analysis of the EMG data is currently underway. This information may result in ergonomic improvements to the shroud with the ultimate goal of ensuring the shroud not be burdensome so its use will be adopted by masonry workers. The respiratory benefits will be realized only if the shroud is utilized. The proposed study directly engages three NORA priority areas. This study is *intervention effectiveness research* and contrasts two *exposure assessment methods* never before examined in tuckpointing workers with an ultimate objective to contain or reduce the risk factors for *UEMSD*.

Platform

Aerosolization of Fine Particles from Metalworking Fluids Contaminated with Microorganisms

Hongxia Wang, Doctoral Student and Tiina Reponen, Ph.D., Associate Professor

Environmental and Industrial Hygiene – University of Cincinnati

Metalworking fluid (MWF) exposures have been found to be associated with dermatitis, respiratory symptoms, hypersensitivity pneumonitis and asthma. No sufficient information has yet been collected on the particle number size distribution and the endotoxin size distribution aerosolized from MWFs contaminated with microorganisms. Our preliminary study showed increased aerosolization of fine particles from semi-synthetic MWF after it was contaminated with *Pseudomonas fluorescens* and that the peak of the fine particles was around 0.37 μm. This study compared the aerosolization of fine particles from two types of water-soluble MWFs with *P. fluorescens*: semi-synthetic MWF and soluble oil. It was found out that after bacterial contamination, semi-synthetic MWF had a greater increase of fine particle aerosolization than soluble oil. Both the fine particles and the bacteria cells aerosolized from *P. fluorescens* suspension in semi-synthetic MWF contained significant concentration of endotoxin. This indicates that some of these fine particles may come from the cell wall of the bacteria in the MWFs.

Platform

Learning In Intelligent Systems for Process Hazards Analysis

Venkat Venkatasubramanian, PhD, Associate Professor and Chunhua Zhao, PhD, Postdoctoral Research Associate, Department of Chemical Engineering – Purdue University

Occupational safety and health are very important issues in process industries. As modern chemical plants have become large and extremely complex, it has become very difficult to analyze and assess in detail the inherent hazards in the plants, to effectively and safely manage changes, to perform maintenance safely, to better control of abnormal events online, and to effectively train operators. The federal government, through OSHA and EPA, has responded to the public's concern on process safety with regulations that require a mandatory and periodic PHA review of both continuous and batch chemical plants. Hazard and Operability (HAZOP) analysis is the most commonly practiced PHA methodology. HAZOP analysis is the study of systematically identifying every conceivable deviation from normal plant operation, and finding all the possible abnormal causes and the adverse hazardous consequences of those deviations. An automated approach is needed as HAZOP analysis is a difficult, labor-intensive and time-consuming. An automated approach can cut down on the time and effort involved in performing a safety review, make the review more thorough, detailed, and minimize or eliminate human errors. PHA is knowledge intensive, and the analysis capacity and quality of the automated system depend exclusively on the quality of domain knowledge. It is impossible and impractical to encode all kinds of knowledge into the knowledge base during development phase of the automated system. Thus, the major aim of this project is to address the important practical learning needs using advanced AI and Information Technology (IT) concepts, techniques and tools. Open architecture to cope with complex structure of safety knowledge, and learning-from-experience strategy by using case-based reasoning (CBR) methodologies, have been investigated in this project.

Platform

Prediction of Postural Stability in the Workplace

Ali A. Minai, PhD, Associate Professor, Electrical and Computer Engineering and Computer Science(ECECS), Kermit G. Davis, PhD, Assistant Professor, Occupational Safety and Ergonomics, and Jayaram Venkatesan, ECECS– University of Cincinnati

Prediction and prevention of falls is a very important part of creating safe and productive workplaces. The risk of falling

during workplace activity is related to postural stability. However, assessing postural stability during task performance such as bending and reaching is difficult, and requires elaborate testing. This is because the task conditions used in testing themselves trigger slips, necessitating the use of strict protocols and protective equipment. However, obtaining postural data under stationary, non-task conditions is quite simple and poses no risk. Thus, it would be extremely useful if postural stability under dynamic task conditions could be determined from postural data obtained under static conditions. The present study focuses on determining the feasibility of this approach using center of pressure (COP) data obtained from human subjects under static and dynamic conditions. A suite of stability measures is defined based on well-known biomechanical and physical considerations. Each measure can be computed directly from a COP dataset. The specific issues addressed by the study are:

1) How well can dynamic stability be determined from the static stability data?
2) Is the relationship between static and dynamic stability significantly nonlinear?
3) What features of the static dataset are essential to the prediction of dynamic stability? These issues are addressed by systematicically using multivariate linear and nonlinear (neural network) models predict the dynamic stability measures based on the static stability measures and other static COP data features. The relative prediction error in each case provides information on the three issues of interest.

Platform

Detection of Indoor Airborne Fungal Contamination through Examination of Building Heating, Ventilating and Air Conditioning (HVAC) Filters

Hernando Perez, Industrial Hygiene Graduate Student, and Neil Zimmerman, PhD, Associate Professor, School of Health Sciences – Purdue University

The purpose of this research was to assess viable particle quantification from building HVAC filters as a means of assessing indoor airborne fungal levels. This assessment was performed through the comparison of filter quantification results to the results of single stage viable impactor samples taken at regular intervals while test filters were in service. The filter quantification method involved the immersion of filter samples in 0.9% sterile saline, the shaking of the filter/saline combination, and the plating of aliquots of the shaking solution onto solid growth media. The inoculated media plates were incubated at room temperature for 96 hours at which time colonies were counted. Research was conducted in three homes, an administrative office building, an academic research facility and an outpatient healthcare facility. Test filters were installed in ventilation systems for periods ranging from 4 days to 7 weeks (loading periods). Results of data collected in the outpatient facility and three homes indicated statistically significant relationships between filter quantification and air sampling results over short term (1 and 2 week) loading periods, but not over a longer term (7 week) loading period. The results of longer (6 week) loading periods in the administrative and research facilities indicate the presence of a statistically significant relationship between filter quantification and air sampling results. Results also indicated that the filter quantification procedure performed on filters loaded for one week demonstrated an increased ability to distinguish between different building air concentrations when compared to single stage impactor sampling. The study outcomes suggest that the development of filter quantification as a method for the assessment of indoor airborne viable fungal levels may provide a very useful and sensitive tool for indoor air quality investigations in the future.

Platform

Characterization of Release and Immunochemical Activity of Fragments Released from Surfaces Contaminated with *Stachybotrys chartarum*

Seung-Hyun Cho, Doctoral Student and Tiina Reponen, PhD, Associate Professor Environmental and Industrial Hygiene – University of Cincinnati

Recently there have been human health concerns associated with the occurrence of *Stachybotrys chartarum* in water-damaged building, but published reports fail to establish a clear cause-and-effect relationship between inhalation of *S. chartarum* spores and human disease. In this pilot study, we hypothesized that fungal fragments of *S. chartarum* are aerosolized in large quantities compared to spores from contaminated surfaces. It was proposed to characterize the release of fungal propagules of *S. chartarum* under different environmental conditions and to compare the biological activity of fragments and spores using immunochemical methods.

The size distribution of aerosolized fungal propagules of *S. chartarum* have been analyzed using an electrical low-pressure impactor (ELPI). Fungal fragments were simultaneously collected in lower stages of impactor plates from fungal spores separately. First of all, three different types of sample collection methods [spray type of grease (DS-125), water soluble adhesive material (zefon), and a humidification system] have been tested in order to achieve the high collection and size discrimination efficiency of fungal propagules by reducing bounce-off of fungal propagules from the impactor plates. Second, four different types of agar media [dichloran 18% glycerol agar (DG18), malt extract agar (MEA), potato dextrose agar (PDA), and V-8 agar] were tested for abundance of sporulation with spore counting after 10 days incubation.

Among three sample collection methods, Zefon was found to be a good collection media compared to spray grease and humidification system showing lowest number of fungal spores at low impactor stages of ELPI, and it has the advantage of being applicable to biochemical analysis since it is water soluble. However, clear size discrimination still remains as a critical problem to analyze immunological reactivity of fungal fragments.

For growth media test, PDA and V-8 agar showed better growth condition of *S. chartarum* compared to MEA and DG18. It is suggesting that various detection media should be used for fungal exposure assessment in water-damaged buildings.

Platform

Psychosocial Factors and Musculoskeletal Symptoms (MSS) Among Construction Workers

Sam Salem, PhD, Assistant Professor,
Department of Civil and Environmental Engineering – University of Cincinnati

Musculoskeletal symptoms (MSS) are common among construction workers and were responsible for almost 40% of the injuries and illnesses requiring days away from work in 2002. In recent years, there has been a growing body of evidence suggesting the increased role of psychosocial factors in MSS in addition to the traditional physical workload; however few studies have studied such factors among construction workers. The aim of this study was to investigate the prevalence of MSS among construction workers and to utilize a data collection/ analysis instrument to assess the psychosocial factors contributing to musculoskeletal symptoms among various construction trades. Twenty eight construction workers representing 8 trades (e.g. carpenters, bricklayers, plumbers) participated in the study. The workers were recruited from 2 mid-sized con-

struction companies operating in the Greater Cincinnati area. The workers' mean age (± SD) was 33.9 (±8.6) years with a mean experience of 12.5 (± 10.4) years on the job. A modified version of the Nordic questionnaire was used to collect information regarding the MSS in ten body regions. Lower back and knee symptoms had the highest prevalence (35.7%) followed by shoulder (21.4%) and hand/wrist symptoms (14.3%). The remaining body regions (elbow/forearm, fingers, upper back, hips/thighs, and ankle/feet) had an equal prevalence of 10.7% with the exception of the neck region where none of the workers reported any symptoms. We collected information regarding organizational psychosocial variables (time organization, work responsibility, task meaningfulness, and job control) in addition to the physical loads of the job (required strength and body posture) and work environment conditions (e.g. noise, vibration, temperature). The demands of each variable were rated by the workers and classified into three categories (low, moderate, and high). Environmental demands of the job were the highest with 40% of the subjects reporting working under highly demanding environmental conditions, 50% considered them to be moderately demanding and only 10% reported them as low demanding. The physical demands of the job were reported by 65% of the workers to be moderate, while 10% reported low physical demands and 25% reported their job physical demands to be high. Psychosocial demands were rated as being moderate by 58% of the workers, 17% considered them to be of low demand while 25% reported the psychosocial work conditions to be highly demanding. The results show that physical and psychosocial demands of the job in the construction industry may be of equal importance as rated by the workers. This is of particular importance when designing an intervention program to reduce musculoskeletal injuries where classical programs focus only on the physical aspects of the job. The results also indicate the importance of the environmental factors, and how they may act as stressors especially in the construction industry. Further work is being conducted to relate the MSS to the collected physical, environmental, and psychosocial variables.

Poster

An Investigation of the Impact of Incivility Among Nurses

Ashley M. Guidroz, Jennifer L. Burnfield, Olga L. Clark, Heather M. Schwetschenau, and Steve M. Jex, Ph.D. - Bowling Green State University

Workplace incivility is defined as any deviant behaviors that violate social norms for respect and conduct at work (Andersson & Pearson, 1999) and its deleterious effects have attracted heightened attention in recent years. One of the greatest concerns is that incivility may escalate to more overt forms of aggression at work, including violence (Andersson & Pearson, 1999). Because nursing is such a stressful occupation and hospitals have to work harder to retain nurses due to the nursing shortage, it is now more important than ever to understand stressors, like incivility, that may be causes for nurses to quit their positions or leave the field of nursing altogether. This pilot project will provide the information needed to design an effective intervention to workplace incivility.

There are two phases proposed to this project. During the first phase, researchers will conduct focus groups and interviews with nurses and managers at a hospital. This information will be used to tailor a measure of incivility for a healthcare setting and to guide the development of a survey. During the second phase, a survey will be administered to nurses working in the same hospital. The results of the survey will provide information about the validity of the healthcare measure of incivility. We will determine the antecedents (e.g. climate, patient load, social support) of incivility as well as examine how inci-

vility relates to a number of outcomes (e.g. commitment, intentions to quit, physical health, burnout). Additionally, we hope to obtain a better estimate of the prevalence of incivility in the workplace. In sum, this pilot study will provide the researchers with the preliminary information needed to develop an intervention while advancing research knowledge in the area of inquiry.

Poster

Co-exposure of Arsenic and Benzo(a)pyrene: In Vivo effects of arsenic speciation on DNA adduct levels

Jay A. Vietas and Glenn Talaska, Ph.D., Professor, Department of Environmental Health - University of Cincinnati

Arsenic exposure commonly occurs from both man-made and naturally occurring processes and its toxicological consequences have a long, well-documented history. Despite this legacy, its mode of carcinogenesis is not well understood, possibly obscured by the lack of an adequate animal model. Co-carcinogenesis offers the potential to identify the mechanism. Many *in vitro* studies have suggested potential carcinogenic mechanisms, including arsenic's impact on DNA repair processes and arsenic's effect upon the formation of reactive oxygen species. Maier *et al.* (2002) demonstrated that exposure to arsenic, with concomitant exposure to benzo(a)pyrene, a classic carcinogen, reduced glutathione levels and that this reduction was related to the amount of DNA adducts formed. Kitchin's (2001) model of arsenic metabolism suggests that the reduction of glutathione occurs during methylation and as a result increase the amount of intracellular reactive oxygen species. This study intends to test this theory of arsenic carcinogenesis by observing the effects of concomitant exposure to arsenic and benzo(a)pyrene in mice which rapidly metabolize arsenic and in guinea pigs which do not metabolize arsenic. It is hypothesized that inorganic arsenic administration will deplete glutathione levels in target tissues of mice more than in the target tissues of mice treated with the methylated forms of arsenic. Additionally, when concomitant exposure to benzo (a)pyrene occurs, inorganic arsenic administration will increase BaP DNA adduct levels more than the administration of methylated forms of arsenic in mice. This is in contrast to guinea pigs in which reduction in glutathione levels are not expected to occur and consequently, BaP DNA adduct levels are expected to remain the same. The methods used to test the hypotheses of this study will be to treat three groups of each of the two different model animals, respectively with inorganic arsenic, monomethyl arsenic, and dimethylarsenic in drinking water. While continuing arsenic treatment, BaP will be applied daily until mice are sacrificed. BaP DNA adduct levels will be measured in target tissues; lung and skin. Data analysis will be performed to determine arsenic speciation effect on BaP DNA adduct formation. This study will address two important research areas of interest; mixed exposure and cancer research methods. Results from this study will be used to address arsenic speciation effects upon DNA repair mechanisms as well as their effects upon enzyme induction, specifically CYP 450 and GST enzymes. In addition, they will be used in the development of new human population studies. These population studies will be needed to define susceptible populations, test current methods of risk assessment and analysis, and to define acceptable co-exposure levels for these chemicals.

Poster

Predicting Nurses' Compliance with Universal Precautions

Olga L. Clark, M. A., and Steve Jex, Ph.D., Department of Psychology - Bowling Green State University,

This research is directly related to occupational safety and health. Specifically, it is aimed at reducing occupational injury and illness associated with exposure to blood-borne infections. Accidental exposure to blood-borne pathogens is a serious occupational hazard for thousands of health care workers. It inflicts a tremendous toll in terms of human and economic costs. The population at risk includes thousands of health care workers who have contact with patients and patient specimens in hospital and laboratory settings. Universal precautions are safe work practice guidelines that were developed by the

Centers for the Disease Control and Prevention. Universal Precautions (UP) are effective at preventing accidental exposure. However, according to surveillance evidence, the level of compliance with universal precautions among health care workers is often low. The investigators will integrate two distinct areas of research: occupational safety and industrial/ organizational psychology, to identify organizational and individual factors that influence compliance with universal precautions. The aim of this study is to explore the psychological processes involved in adhering to safer work practices. The results of this study may tell us under what conditions health care workers are less likely to follow universal precautions and what could be done to increase compliance. The results of this exploratory study will inform future research efforts and help improve work practices by guiding the development of a training program.

Poster

N-Glucuronidation in Arylamine-induced Breast Genotoxicity

Mustafa Al-Zoughool and Glenn Talaska, Ph.D., Professor
Department of Environmental Health-Molecular Toxicology Division - University of Cincinnati

The breast is the most important incident site for cancer in women and the second leading cause of their cancer death. Only 50% of cases can be understood in terms of known risk factors. Environmental causes are assumed to contribute significantly to the reminder but their impact is unknown. Tobacco smoking has been shown to contribute to breast cancer. Tobacco smoke has long been associated with increased risk of breast cancer. Aromatic amines are major carcinogenic components in tobacco smoke and are also best characterized occupational carcinogens. Arylamines must be activated by metabolic enzymes to exert their mutagenic and carcinogenic effect. Phase I and phase II metabolic enzymes operate on arylamines to yield activated and detoxified products. The quantitative and qualitative differences in the activities of these enzymes determine the potency of the specific arylamines as well as dictate the target organ. 4-ABP is metabolized in the liver by oxidation, N-acetylation and /or N- or O-glucuronidation. There might be an individual variation in the rate of bioactivation of arylamines which should be reflected on their carcinogenic risk. Women who are known to be slow glucuronidators when compared to men and a wide distribution in rates of glucuronidation of women has been seen using substrates such as cotinine. The focus of this research is to conduct the first investigation of the role of procarcinogen glucuronidation phenotype in human breast cancer. Our hypothesis is that the ability of breast tissue samples to glucuronidate a specific aromatic amine procarcinogen, 4-aminobiohenyl (4-ABP) well be inversely related to the levels of 4-ABP-DNA adducts seen in the same samples. Toward this purpose, A new high performance liquid chromatography (HPLC) method has been developed to determine the N-glucuronidation activity of breast organoids toward 4-ABP. The HPLC method uses a chemically synthesized 4-ABP-N-Glucuronide (4-ABP-G) as a standard to determine the amount of glucuronide formed. The method was specific and sensitive. The calibration curve for the 4-ABP-G was linear from 25-500 pmol/200µl. The intra- and inter-day precision and accuracy for 4-ABP-G were 4% and 7% respectively. The lower detection limit was 10 pmol/200µl. The intra- and inter-day precision of the UDP-glucuronosyltransferase (UGT) activity in mice liver microsomes and expressed human UGT1A4 and UGT1A9 were less than 3 and 8 % respectively. The method proved to be very sensitive and it enabled us to determine the kinetics of UGTs without the need to use the radioactive [C^{14}]-UDPGA, which is expensive and difficult to handle. We used this method to determine the kinetics of recombinant human UGT1A4 and UGT 1A9 for 4-ABP. The Km and Vmax of UGT1A4 were 454µM and 396/min/mg protein, respectively and were 227µM and 31pmol/ min/mg protein respectively for UGT1A9.Therefore, this method is applicable to determine the glucuronidation status towards carcinogenic arylamines. The UGT reaction was optimized in terms of the amount of protein and incubation time as well as the optimal reagent and its concentration required to activate microsomes. Using this method, the UGT activity of male and female mice microsomes was determined. Also it will be used to determine the glucuronidation activity of human liver microsomes in order to study the species differences in bioactivation of arylamine carcinogens.

Poster

Peak Particulate Exposure and Heart Rate Variability

Brent Yeagy, Frank Rosenthal, Ph.D., Wie Zheng, Ph.D. - Purdue University

Peak occupational exposure to welding particulates may immediately affect autonomic heart regulation. These effects may be related to pathophysiological mechanisms linking cardiovascular mortality and welding particulate exposure. More than 400,000 Americans are employed in welding in the U.S., according to the Bureau of Labor Statistics, 2001. Welders have been shown to have an increased risk for cardiac morbidity and mortality. Sjogren et al. 2002, reviewed the Swedish National Census and identified welders employed within the times period 1970-1990. He found an SMR of 1.35 (95% CI 1.1-1.6).

There has been a growing recognition of the importance of the autonomic nervous system in cardiovascular health (Pope et al, 1999). Reduced heart rate variability (HRV) has been found to predict increased risk for cardiovascular mortality and morbidity (Tsuji et al, 1994 and 1996) and has led to the hypothesis that particulate exposure may influence cardiovascular risk in part through disturbance of autonomic function as reflected in changes in HRV (Gold et al, 1999, Samet et al. 2000; Schwartz 1997; Schwartz and Dockery 1992).

The mechanism responsible for increased risk of heart disease in welders is unknown; however, it may be related to their peak exposure to high levels of particulates inducing rapid changes in HRV. The acute pulmonary consequences of particulate exposure include changes in pulmonary function oxidative lung damage, inflammation, and release of cytokines; long term effects involve decreases in lung function (Pope et al 1991, Souza et al 1998). Magari 2001, identified this rapid effect when he found a statistically significant 2.76% decrease in HRV in a group of oily fly ash exposed boilermakers using a 1-hr averaging interval, but began seeing an effect on HRV at the 15 minute averaging interval. This indicates a relatively acute HRV response component.

This acute effect of particulate exposure on autonomic heart regulation could be a causal factor in the incidence of adverse cardiac events during workshifts. Additionally the current exposure standards for particulate exposure may not be protective for the long-term cardiac health of welders, other workers exposed to particulates, or the community at large. Therefore a need exists for additional knowledge about the effects of particulate exposure on autonomic heart regulation.

Specific Objectives:

1. Determine real time particulate exposure and heart variability data, during work shifts, for a population of continu ously and intermittently exposed welders.
2. Investigate the correlation between peak particulate exposure and changes in heart rate variability (HRV).
3. Investigate the effect of cumulative full shift particulate exposure on HRV.

We will perform real time aerosol sampling on a population of welders (N = 10) who are intermittently exposed to high levels of welding particulate (> 5 mgM3) and determine the effect on HRV. Continuous, personal particulate sampling will be conducted using a real time MIE pDR-1200 DataRAM aerosol photometer. Full shift real time HRV data will be gathered using a personal Polar RR Monitor. The potential association will be investigated using statistical models for both individual (within-subject) and aggregate (all subjects) response using multiple regression and time-series analyses.

The results of this study will further advance the understanding of how mixed exposures (welding fume) effects the autonomic regulation of the heart, which may aid in our understanding of the role particulates play in the cardiac health of occupationally exposed welders.

Poster

Postural Stability and Fatique among Residential Roofers

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Maintaining balance while performing construction work is an essential part of ensuring the health and safety of a building construction employee. Reduction in the ability of an employee to keep his/her balance may lead to falls resulting in injury or even death. Falls accounted for approximately 33 percent of the OSHA investigated fatalities in the construction industry averaging over 200 fatalities per year. The goal of this project is to determine postural stability of construction workers who work at elevations. This pilot study of approximately 9 construction workers will be to: 1) determine the effect of postural stability (using a portable balance platform) after heavy work is performed during construction tasks, 2) correlate changes in heart rate and peak heart rate (as a function of construction tasks), and 3) to use this information to develop recommendations to reduce fatigue and prevent falls during construction related activities.

Poster

Use of E-Beam Technology to Produce Silver-fabric Bactericidal Composites

Anthony R. Arment, Ph.D. - Central State University

Silver has a long historical use as a bactericidal metal. Silver salts have been used as disinfectants, in the treatment of infection, and on industrial surfaces and clothing to retard bacterial growth and odor. Silver exerts its antimicrobial effects oligodynamically. It functions as many of the other heavy metals do against microbes, effecting membrane stability, inhibiting DNA replication, and interacting with protein thiol groups to cause denaturation.

With the advent of e-beam technology, it is possible to move from beyond impregnating metal salts into fabrics for slow release to bonding the two substances together as a composite. Central State University (CSU) maintains collaborative research ties with Kent State University (KSU). KSU maintains a 150 kW, 5 MeV electron accelerator in partnership with Mercury Plastics, Inc. (MPI) as part of their joint Program on Electron Beam Technology (PEBT); the joint facility is the NEO Beam Alliance Ltd. This proposal marks the first project aimed at undergraduate research collaboration between institutions.

The primary goal of the project is to evaluate the usefulness of e-beam technology in creating bacteriostatic lab coats using silver as a means of bacterial control. Within this goal lie the following specific aims, to: 1) test different e-beam treated synthetic fabrics used in lab coats for effectiveness in retarding bacterial growth; 2) distinguish differences in resistance between different bacterial genera; 3) test the longevity of treated fabrics to withstand repeated exposure as measured by repeated washing; and 4) optimize e-beam treatment and silver concentrations for maximum effectiveness. This project impacts the NORA Research Agenda in two important areas: Emerging Technologies (e-beams) and Control Technology and Personal Protective Equipment.

Experimental focus will center on two commonly used synthetic fabrics in lab coats: polyester (non-disposable) and polyethylene (disposable). The fabrics will be irradiated with silver then tested via a modified Kirby-Bauer procedure to measure zones of inhibition to commonly encountered pathogenic genera. Following each round of data collection, the fabrics will be laundered and the process repeated to gauge the effectiveness of the fabrics to retard bacterial growth over extended wear. Once preliminary data has been gathered, the process will be evaluated as to its effectiveness and an alternate irradiation strategy performed prior to the repeat of the experiment.

Poster

Understanding the Work-family Consequences of Shiftwork

Linda Jean Whinghter and Steve M. Jex, PhD - Bowling Green State University

The antecedents and consequences of occupational health and safety problems associated with shiftwork are not domain-specific. As such, study of these issues as they relate to shift-workers should not be limited to the workplace. From NORA's report of its 21 priority areas of study (Sauter et al., 2002), two categories emerge as relating directly to the issues addressed by this study: Organization of work and Special populations at risk. This study will investigate the interaction between shift-workers' work and non-work lives in an effort to qualify and quantify the broad consequences linked to working alternate shifts. More comprehensive understanding of the antecedents and outcomes of alternate work schedules (a feature of work organization and design), should allow future researchers to better meet the needs of shift-workers, their organizations, and communities. It is anticipated that negative work and non-work factors will be positively related, such that increased WFC/FWC is associated with higher incidence of work stress and decreased job performance and vice versa.

The overarching goal of this study is to demonstrate how a more holistic approach to evaluating the effects of occupational stress can be applied in a field setting to produce meaningful information and results. This study contributes a great deal to the existing literature on shiftwork as it will consider multiple components of stress (e.g., psychological, physical and environmental factors), as well as multiple perspectives (e.g., the shiftworker and his/her significant other). This pilot study will serve as the foundation for future attempts to secure grant funding for a larger-scale study of the work and non-work lives of shiftworkers. The future study will be aimed at designing an intervention to facilitate reduction of the unique challenges faced by shiftworkers who balance uniquely difficult work and nonwork roles.

Poster

Obesity Effects on Lifting/Lowering Movement Pattern

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Obese workers represent a significant portion of the workforce in today's industry. Obesity may be a risk factor for work-related musculoskeletal disorders (WMSDs) from manual materials handling (MMH). Heavier body mass may subject obese workers to higher biomechanical stresses than non-obese workers. When performing a MMH task, obese workers may move differently than non-obese workers to compensate for heavier body mass and reduce biomechanical stresses in certain body areas.

Despite the prevalence of obesity and its potential importance as a risk factor for WMSDs, movement patterns of obese individuals during MMH have not been extensively studied. At present, it is largely unknown whether or not there exist significant differences between motion patterns of non-obese and obese individuals during MMH and how such potential differences would affect biomechanical stresses. This hampers our attempts to adequately protect the obese worker population. Thus, the purpose of the proposed research is to test differences between non-obese and obese individuals in their motion patterns during whole-body lifting and lowering, and understand how such differences affect biomechanical stresses in body areas. The hypothesis to be tested is: when adopted by obese individuals, lifting and lowering motion trajectories of non-obese individuals will create higher biomechanical stresses in the low back, the lower extremity, and the upper extremity joint areas than obese individuals' own self-selected motion trajectories.

A motion capture experiment will be conducted to accomplish the research goal. 10 non-obese ($18.5<BMI<25$) and 10 obese ($BMI>30$) individuals of similar stature (170cm - 175cm) will participate. Each subject will perform three lifting and three lowering tasks. Kinematic motion data of lifting and lowering will be recorded using a 12-camera VICON motion capture system. Biomechanical stresses that would be experienced by a hypothetical 'obese' individual in two distinct scenarios will be compared: when he adopts obese subjects' motion patterns (obese motion condition) and when he adopts non-obese subjects' motion patterns (non-obese motion condition). Biomechanical stress measures are: static and dynamic peak and average joint moments, peak and average joint muscle utilization ratios, and peak and average L5/S1 disc compressive

and shear forces. A 2 (Motion Type: obese and non-obese motion conditions) × 6 (Task) factorial design will be adopted. This design is a mixed factor (split-plot) design with the MotioType factor treated as a between-subjects factor, and the Task factor treated as a within-subjects factor. Each of thebiomechanical **stress measures will be subjected to a two-way** analysis of variance (ANOVA) based on the experimental design (α=0.05). This exploratory study will allow us to understand effects of obesity on lifting and lowering motion patterns and provide a basis for further investigation of obesity effects during manual exertion tasks.

Poster

Domestic Violence Screening & Treatment in the Workplace

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The purpose of this cross-sectional study is to survey members of the American Association of Occupational Health Nurses (AAOHN) regarding their beliefs about their ability to screen for and treat domestic violence (also called intimate partner violence) in the workplace. The specific research aims are: (1) Identify the educational training that Occupational Health Nurses receive about workplace screening for and treatment of domestic violence. (2) Describe the Occupational Health Nurses' beliefs about their ability to complete workplace screening for and treatment of domestic violence. (3) Identify the relationship between the educational training, demographics and work experiences of Occupational Health Nurses and their perceived ability to complete workplace screening and treatment of employees who experience domestic violence. A total of 1,000 randomly selected AAOHN members will be asked to anonymously complete the mailed instrument "Occupational Health Nurses' Survey on Screening for Domestic Violence in the Workplace." Four weeks after the first mailing if the return rate is less than 40%, a second mailing will occur. In this second mailing another 1,000 randomly selected AAOHN members will also be anonymously surveyed using the same procedure that was used for the first mailing. Subjects' names obtained from AAOHN for the first mailing list will not be included on the second mailing list. Data analysis will include descriptive analysis for specific aims one and two and bivariate analysis for specific aim number three. This study will provide baseline information about screening and treatment for domestic violence by Occupational Health Nurses in the workplace and will address a priority of both the NORA and AAOHN research agendas. Information from the study can be used to to increase awareness regarding the current state of workplace domestic violence screening and treatment and will serve as the foundation for future resource development and intervention research that benefits multiple stakeholders, including employees, employers, nurses and academicians.

Poster

Body type impact on whole body kinematics during manual handling

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Obesity is one of several factors that have been suspected of causing low back pain. It has been assumed that the cause of low back symptoms in obese people was due to a mechanical disadvantage in weight distribution. Fat distribution of obese people can be classified into three types (apple-shaped, pear-shaped, and tube-shaped), and each of these body types has the potential to influence the biomechanical response during typical manual material handling tasks because of excessive pressure on the discs and shifts of the center of gravity. Although previous studies have hypothesized about the relation between obesity and LBP, the actual biomechanical etiology has yet to be investigated scientifically, under controlled but realistic conditions. Therefore, the objective of this study is to investigate the whole body kinematic characteristics of individuals in each of three body type groups while performing traditional manual material handling tasks that are typical of industry and

daily living. For this, the joint motion of the major joints in the body (ankle, knee, hip, shoulder, elbow, neck, and wrist) will be measured. The data gathered in the proposed study will identify neuromuscular differences that result from different body types. The results of the current proposed study will serve as a foundation for a larger and expanded laboratory study that would include more intensive evaluation of the impact of different fat distribution during typical manual material handling tasks.

Poster

Customized Integrated Intervention for Injury Prevention

Setenay Tuncel, Richard Shell, PhD, Judy Jarrell, EdD - University of Cincinnati

Despite the several decades of extensive research, lower back disorders (LBD) remain to be a major occupational health problem. This has been mostly attributed to the myriad demands of work (physical and non- physical), individual, and non-work related factors impacting LBD. Because the etiology of LBD is complex, the interventions are advised to cover multiple causes of LBD simultaneously. In addition to the complex etiology, each workplace has its own needs. That is why, the extensive number of occupational risk factors for the specific workplace should be investigated in detail before identifying the intervention content.

This pilot study addresses parts of the gap in prior research; it integrates a large number of work-related risk factors impacting LBD and a smart computer algorithm customizing intervention elements (for example training of employees about safe lifting postures), and their priorities according to the site's needs which are defined by the individual workers. The hypothesis is that algorithm-identified intervention elements and their priorities to decrease LBD are not statistically different than those identified by the workers. There are three related specific aims: 1) To gather data about workers' evaluation about physical and non-physical risk factors of their work environment; 2) To identify intervention elements and their priorities to decrease LBD; 3) To validate algorithm-identified intervention elements and their priorities through participation of workers.

To achieve the specific aims, a cross-sectional study design with an exposure (production workers) and comparison (office workers) group from the same company is proposed. An algorithm will extract the data from the worker's evaluation of his/her profile of physical and non-physical work-related factors (independent variable) and identify the intervention matrix (dependent variable). The intervention matrix will reveal the relative priorities of different intervention elements. This matrix will be validated through workers' participation. Secondary validation will be employed by collecting musculoskeletal and stress symptoms. The DE-12 data collected from the comparison group will be used to test discriminate validity.

This study is the first step to develop an algorithm to identify priorities for intervention elements to reduce LBD. In a following prospective cohort study, effectiveness of this approach will be tested on the same work setting. Another future project is to use the same approach to define the priorities for injury and illness reduction as well as productivity and quality improvement.

Poster

Assessing the Predictive Validity of a Functional Capacity Protocol- A Retrospective Study

Trang Nguyen, M.D.and Kermit Davis, PhD, Asst. Professor

Study Objectives: The Osborne Functional Capacity Evaluation (FCE) protocol can be utilized to evaluate the physical capability of the injured worker and to provide a recommendation of the job category to which the worker can safely return-to-work.

Design: In this retrospective study, subjects were recruited with phone calls and mailed questionnaires. The Work History Questionnaire was self-administered by the participants. Pertinent data were abstracted from the OWLS database. Subjects were followed up for restricted or lost work days, modi-

fication of job duty or recurrent injuries of the lower back.

Setting and Participants: 75 low back pain subjects evaluated at HEALTHSOUTH Evaluation Center in Ft. Worth, Texas in 2003 were recruited.

Results: No significant differences found between the responders and non-responders with respect to age, gender, time since injury, and prior back surgery. When comparing the same factors among those who did and did not return to work, time elapsed since injury was significant. Of 35 responders, 26 subjects did not return to any level of work. Only one subject out of nine who did return to work was re-injured secondary to working at a heavier job demand than recommended.

Conclusions: There is some evidence that the Osborne FCE protocol can evaluate the physical capability of the injured worker and to provide a safe return to work job level recommendation. These findings should be confirmed with prospective cohort study, larger sample size and the duration of follow up time of at least 2 years.

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