NIOSH-Supported
Education and Research Center (ERC)

17th Annual

2016 Pilot Research Project (PRP) Symposium

October 13-14, 2016
Proctor Hall Auditorium, College of Nursing
University of Cincinnati
Thursday, October 13th 1:00 pm—5:00 pm
Friday, October 14th 8:00 am—12:00 pm

Keynote Speaker

Anita Schill , PhD, MPH, MA
Senior Science Advisor to the Director
Co-Manager, Total Worker Health® Program
National Institute for Occupational Safety and Health

Podium and Poster Presentations by PRP Awardees

Supported by NIOSH grant #T42-OH008432

UNIVERSITY OF Cincinnati

Pilot Research Training Program and Symposium

Welcome to the University of Cincinnati Education and Research Center's (ERC) **17th Annual Pilot Research Project (PRP) Symposium** on October 13-14 , 2016**,** held in the Auditorium of Proctor Hall, College of Nursing. 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 – Air Force Institute of Technology, Bowling Green State University, University of Toledo – Health Science Campus, Central State University, Purdue University, University of Kentucky, Western Kentucky University, Eastern Kentucky University, Murray State University, Ohio University and Kentucky State University.**

At this symposium, the 2015-16 awardees will be presenting the results of their research and the 2016-17 awardees will make poster presentations of their proposed work. The keynote speaker on Thursday, October 13, 2016 is **Anita Schill, PhD, MPH, MA, Senior Science Advisor to the Director and Co-Manager for the Total Worker Health® Program with the National Institute for Occupational Safety and Health (NIOSH), will deliver the keynote address on "Advancing Well-Being Through Total Worker Health."**

The University of Cincinnati's Education and Research Center is one of 18 such centers funded by the National Institute for Occupational Safety and Health (NIOSH) nationally. Dr. Tiina Reponen serves as the director of the ERC, which is based in the university's Department of Environmental Health within the College of Medicine. The purpose of the ERC 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 $1.3 million to support 222 pilot research projects. These projects have served as a catalyst in bringing over $34 million in additional research support to the region from sources independent of the PRP program, such as, the National Institute for Occupational Safety and Health (NIOSH), National Institutes of Health (NIH), United States Department of Agriculture (USDA), National Science Foundation (NSF), and the Centers for Disease Control and Prevention (CDC). Additionally, the PRP has brought 47 new investigators from other fields of expertise to the area of occupational safety and health research.

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Symposium attendees are eligible for:

- ◊ **ABIH (IH) CM Points; apply online at http://www.abih.org/**
- ◊ **Meets BCSP criteria for continuation of certification credit**
- ◊ **Approved contact hours: 1.0. Continuing education contact hours for nurses are approved by the Ohio Board of Nursing through the OBN Approver Unit at the University of Cincinnati College of Nursing, Continuing Education Program, (OBN-011-93). Contact hours are valid in most states. Program #161013-1**

The 17th Annual PRP Symposium is free and open to the public.

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

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PODIUM PRESENTATION SCHEDULE

Thursday, October 13, 2016			
	Moderator: Vijay Golla, PhD, MPH, MBBS		
Time	**Title**	**Speaker**	**Affiliation**
1:00—1:05 pm	**Welcome**	**Amit Bhattacharya, PhD, CPE, PRP Program Director**	**Environmental Health University of Cincinnati**
	Welcoming Remarks	**Donna S. Martsolf, PhD, RN, Associate Dean**	**College of Nursing University of Cincinnati**
1:05-1:15 pm	**Introduction of Education and Research Center (ERC)**	**Tiina Reponen, PhD, CIAQP, ERC Director**	**Environmental Health University of Cincinnati**
1:15—1:20 pm	**Introduction of Keynote Lecturer: Anita L. Schill, PhD, MPH, MA**	**Susan Reutman, PhD, BSN, MPH**	**College of Nursing University of Cincinnati**
1:20—2:10 pm	**Keynote Address: "Advancing Well-Being Through Total Worker Health"**	**Anita L. Schill, PhD, MPH, MA**	**Senior Science Advisor to the Director, Co-Manager, Total Worker Health® Program National Institute for Occupational Safety and Health**
2:10—2:20 pm	**Keynote Q & A**		
2:20—2:40 pm	**Antigen Profiling of Field Metalworking Fluids**	**Harish Chandra, PhD**	**Environmental Health, University of Cincinnati**
2:40—3:00 pm	**Application of a Novel Sensor for Traffic-Related Indoor Air Pollution**	**Jennie Cox**	**Environmental Health, University of Cincinnati**
3:00—4:00 pm	**Break (15 minutes) and Poster Session I**		
4:00—4:20 pm	**Lightweight, Low Energy Consumption Heaters for Winter Gears**	**Seyram Gbordzoe**	**Materials Engineering, University of Cincinnati**
4:20—4:40 pm	**Detecting, Localizing, and Tracking Wildfires Using an UAS**	**Sarthak Kukreti for Kelly Cohen, PhD**	**Aerospace Engineering & Engineering Mechanics, University of Cincinnati**
5:00 pm	**PRP Networking Picnic**		

PODIUM PRESENTATION SCHEDULE

Friday, October 14, 2016			
	Moderator: Diana Schwerha, PhD		
Time	**Title**	**Speaker**	**Affiliation**
8:00—8:10 am	**Opening Remarks**	**Amit Bhattacharya, PhD, CPE, PRP Program Director**	**Environmental Health, University of Cincinnati**
8:10—8:30 am	**Get ACTive! A Pilot Acceptance and Commitment Therapy Workshop**	**Jessica Borushok**	**Psychology, Bowling Green State University**
8:30—8:50 am	**A Test of the Work Stressor - Vulnerability Model of Alcohol Consumption**	**Kristin Horan**	**Psychology, Bowling Green State University**
8:50—9:10 am	**Oral Microbiome Perturbations and Associated Risks in Firefighters**	**Sukanta Bhattacharya, PhD**	**Environmental Health, University of Cincinnati**
9:10—10:25 am	**Break (15 minutes) and Poster Session II**		
10:25—11:15 am	**Panel Discussion of the Podium Presentation Topics**	**Lynne Haber, PhD (Moderator)**	**Associate Professor, Environmental Health, University of Cincinnati**
11:15—11:45 am	**Award Presentations**	**Diana Schwerha, PhD**	**Associate Professor, Industrial and Systems Engineering, Ohio University**
11:45—12:00 pm	**Closing Remarks and Program Evaluation**		

2016 PRP AWARDEE POSTERS

No	Title	Author	Affiliation
1	Inclined Surfaces - Impact on Postural Stability and Spine Loading	Noma Agbonifo CSP, MIIRSM, MSc	Environmental Health, University of Cincinnati
2	Industrial Hygiene Air Sampling/Analysis of Microcystin in Lake Erie Region	April Ames, PhD	Public Health and Preventative Medicine, University of Toledo
3	Intrinsic Factors that Influence Retention among Nursing Assistants	Megan Bennner, MPH	Health and Recreation Professions, University of Toledo
4	Black Carbon Validation of a Novel Sensor for Traffic-Related Indoor Air Pollution	Jennie Cox	Environmental Health, University of Cincinnati
5	Firefighter Physiological Health Assessment and Hazard Monitoring Device	Matthew Giovanetti	Electrical Engineering and Computing Systems, University of Cincinnati
6	Enhanced Capture of Microbeads for Water Treatment	Samuel Miller	Mechanical and Materials Engineering, University of Cincinnati
7	Post-retirement Employment among Nurses: A Case of Planned Behavior	Yisheng Peng	Psychology, Bowling Green State University
8	UAV Use in Reducing Hazards for Firefighters During Emergency Response	Michael Valigosky, PhD	Public Health and Preventative Medicine, University of Toledo
9	Ergonomics in Veterinary Care	Denny Yu, PhD	Industrial Engineering, Purdue University

INVITED STUDENT POSTERS

1	Performance of an N95 Filtering Facepiece Respirator and a Surgical Mask Used by Home Attending Health-Care Workers (A Pilot Study)	Yousef Elmashae PhD	Environmental Health, University of Cincinnati
2	Use of Physiologic Markers to Evaluate Firefighters' Reactions when Exposed to Stressors	Georganne L. Kincer, RN, BSN, COHN-S	College of Nursing, University of Cincinnati

Keynote Speaker, Thursday, October 13, 2016

Anita L. Schill, PhD, MPH, MA

Senior Science Advisor to the Director
Co-Manager, Total Worker Health® Program
National Institute for Occupational Safety and Health

Dr. Schill received her BS in Nursing from Russell Sage College, her MA in Occupational Safety and Health from New York University, and her MPH and PhD degrees from The Johns Hopkins University Bloomberg School of Public Health (formerly the School of Hygiene and Public Health). Her doctoral research explored the association of psychosocial risk factors and the occurrence of musculoskeletal disorders. As Co-Manager of the Total Worker Health® Program at NIOSH, Dr. Schill shares responsibilities for strategy development and leadership of the program. In her role as Senior Science Advsior, Dr. Schill contributes to institute-wide efforts related to strategic program direction.

2015-16 PRP Awardees
PODIUM PRESENTATION ABSTRACTS

Antigen Profiling of Field Metalworking Fluids

Harish Chandra[1] (PI), Ying Wai Lam[2], and Jagjit S Yadav[1]

[1]Department of Environmental Health, University of Cincinnati
[2]Vermont Genetics Network Proteomics Facility, University of Vermont

Purpose: Overall objective was to profile field samples of mycobacteria-contaminated in-use metalworking fluid (MWF) to identify antigens which may trigger hypersensitivity pneumonitis (HP) or machine operator's lung (MOL), asthma, or other respiratory symptoms in the exposed machine workers. Our working hypothesis is that the prevailing field conditions in industrial MWF operation can lead to induction and release of specific antigens from mycobacteria such as *Mycobacterium immunogenum* (MI) that are critical for HP etiology. The study is innovative is that such HP-associated causative T-cell antigens/epitopes are not yet defined.

Design: Two types of field MWF samples derived from the same MWF brand, one containing Mycobacteria (MI) and the other without mycobacteria, were identified and obtained through our industrial collaborator for identification of mycobacterial antigens. Proteins in the MWF supernatants were subjected to 2D immunoproteomic analysis followed by mass spectrometry-based identification of proteins. Mycobacteria-free contaminated MWF samples served as controls. Identified mycobacterial antigens were subjected to immunoinformatic analysis for T cell epitopes.

Methods: The study involved cutting edge techniques of molecular biology and immunoproteomics coupled with immunoinformatic analysis. Mycobacteria-positive and control MWF samples were compared. Total proteins were precipitated by TCA precipitation from the cell free supernatants. Protein samples were subjected to 2D- immunoproteomic analysis using anti-MI antibodies as well as human patient sera and the immunoreactive spots were subjected to mass spec identification of protein antigens.

Results: We isolated a novel *M. immunogenum* strain named as MJY-27 from the field MWF. Differential immunoproteomic analyses using rabbit anti-MI antibodies revealed ~ 15 immunoreactive spots in the mycobacteria-containing MWF. Use of HP patient sera as probe helped further identify HP-relevant antigens. Mass spectrometry analysis is underway to identify the HP causative antigens.

Conclusion: The current pilot study led to identification of several HP-specific mycobacteria antigens from field in-use metalworking fluids. This may provide a key to understanding the etiological aspects of the occupational HP disease development and facilitate development of immunodiagnostic and intervention strategies for HP patients in occupational settings.

Impact statement: Metal workers/machinists working with mycobacteria-contaminated MWF are at increased risk of developing MOL/HP and currently there is huge knowledge gap about the antigens triggering this occupational lung disease. At the same time there are no reliable immunodiagnostic methods currently available to assess disease status; hence cases of mycobacterial-HP remain unrecognized/under reported. The identified T-cell antigens will help in the development of new diagnostics for HP and biomonitoring tools to assess personal exposure risk in occupational settings.

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Application of a Novel Sensor for Traffic-related Indoor Air Pollution

Jennie Cox (PI), Sergey Grinshpun, and Seung-Hyun Cho

Department of Environmental Health, University of Cincinnati

Purpose: Exposure to traffic-related air particulates (TRAP) is linked with reduced respiratory health in both public and worker populations. It has been determined that TRAP penetrates homes and occupational settings, affecting the indoor air quality. Diesel exhaust is a highly complex mixture composed of vapors, gases, and fine particles emitted by diesel-fueled compression ignition engines. Due to the complexity, a surrogate was selected by NIOSH to help detect levels of diesel exhaust. Diesel particulate matter is predominantly (typically more than 80%) carbon, but organic carbon (OC) of diesel particulate matter is not a selective measure. Other sources of OC include asphalt fumes, combustion aerosols and cigarette smoke. Elemental carbon (EC or black (BC)), the carbon in the soot particle core, is a better surrogate to monitor because it is more selective of particulate diesel exhaust and constitutes a sizable fraction (30%–90%) of the particulate mass.

Design: This project employs two specific novel approaches: the speciation of carbon using a multiwavelength optical absorption to differentiate between environmental tobacco smoke and soot (black) carbon, and the new particulate matter monitoring technology, RTI's Micro Personal Exposure Monitor (MicroPEM). The determination of tobacco smoke and carbon with reasonable accuracy is possible using an integrating sphere radiometer and multiple wavelengths to provide specificity. This technique provides a low cost, non-destructive exposure assessment alternative to standard thermo-gravimetric elemental carbon evaluations on quartz filters. This new method also allows the same sample filter to be used for assessment of mass, carbon, and tobacco smoke without affecting the deposit. The MicroPEM provides both integrated exposure (filter based) and the patterns of exposure (real-time) data. This device is also usable for indoor air monitoring as it is quiet, takes up a small amount of space, provides relative humidity-adjusted measurement data and includes a size-selective impactor to sample TRAP. All nephelometry based instruments, in order to obtain accurate real-time data, must be corrected utilizing the filter-based measurements and the real-time data. One objective of this study was to determine the correction factor for the MicroPEM real-time data to be used for analysis of TRAP in the Cincinnati region.

Methods: In conjunction with an ongoing study funded by the U.S. Department of Housing and Urban Development (HUD) Healthy Homes Technical Studies (HHTS), sampling was performed for 2 days before and 2 days after establishing high efficiency particulate air (HEPA) filtration indoors. MicroPEM samples were also taken 2 days outdoors for each sampling event.

Results: Preliminary results, based on 5 homes, ranged from 0 µg/m3 to 6827 µg/m3 with an average of 7.9 µg/m3 for the direct reading instrument and 0.6 to 26.7 $\mu g/m^3$ with an average of 7.3 µg/m3 for the filter-based concentrations. These results indicate that the correction factor will be in the range between 0.2 and 3.1. The average correction factor for the first 5 homes was 1.1 with a standard deviation of 0.94 and coefficient of variation of 85%. The direct reading values for the outdoor monitor on days when the relative humidity exceeded 80% (due to cold weather condensation or rain) were highly variable due to weather impacting the instrument. The remainder of the homes are expected to yield more reliable values as sampling strategies were implemented to reduce weather impact on the monitor. The BC values ranged from 0.0 to 4.3 $\mu g/m^3$ with an average of 0.5 $\mu g/m^3$ and the environmental tobacco smoke (ETS) values ranged from 0.0 to 3.9 $\mu g/m^3$ with an average of 1.3 µg/m3. Utilizing regression analysis, the correction factor for the PM2.5 was independent of the amount of carbon species in the collected filter sample with a slope of -0.3%. We are waiting analysis for an additional 12 homes for a total of 60 samples.

Conclusion: It is expected that a correction factor for the MicroPEM determined for operation in Cincinnati, Ohio has CV < 20%, is close to the correction factors determined for other regions of the United States, and that the slope of the regression line between the correction factor and the BC/ETS-ratio will be within 20% from 0 (zero). ***Corresponding author:*** Jennie Cox at roejd@mail.uc.edu

Lightweight, Low Energy Consumption Heaters for Winter Gears

Seyram Gbordzoe[1] (PI), Robert Wolf[3], and Vesselin Shanov[1, 2]

[1]Department of Mechanical and Materials Science Engineering
[2]Department of Biomedical, Chemical, and Environmental Engineering
[3]Department of Electrical Engineering

University of Cincinnati

Purpose: The primary goal for this 1-year project is to obtain a proof-of-concept prototype of an energy efficient heating device that can be easily incorporated into clothing to be used by firefighters, first responders and low wage workers.

Design: Carbon nanotubes (CNT's) used in this research were manufactured using the chemical vapor deposition method. The vertically aligned CNT's are then drawn and collected on a roller to form sheets for CNT heaters.

Methods: Scanning electron microscope (SEM) is used to collect images on the morphology and cross-section of CNT sheets. A DC power source is used to supply power to the CNT heaters. An FLIR T640 IR camera is used to take infra-red images of the heaters and record temperatures.

Results: It is observed that an increase in the number of layers leads to a decrease in the CNT sheet resistance and this is also shown by SEM images. The resistivity of 100 and 200 layer sheets are calculated to be 1.08 × 10-2 Ω cm and 1.32 × 10-2 Ω cm respectively. CNT heaters have very fast heating times and this is shown by the temperature profile of the different layers. It takes about 20 s to reach an equilibrium temperature. Heaters made up of 100 and 200 CNT layers are incorporated into a glove. It can be seen that when the 100 CNT layer sheet is connected to a 9V battery the surface temperature of the glove reaches as high as 34.2 °C, whiles for a 200 CNT layer sheet it reaches 58.5 °C.

Conclusion: A simple and easy to practice approach for fabricating flexible, low voltage CNT heaters is demonstrated. The fast heating rate of the heaters make them attractive for manufacturing of body protection clothing used in cold weather and an example of that is demonstrated in this work.

Impact Statement: This project will break new ground in the studies related to development of improved, multi-functional personal protective equipment (PPE) for the well-being of firefighters and other employees who have to work during the cold seasons. CNT heated gloves will help keep the firefighters from cold stress while also maintaining comfort for the wearer.

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Detecting, Localizing, and Tracking Wildfires Using an Unnamed Aircraft System

Kelly Cohen[1] (PI), Manish Kumar[2], and Sarthak Kukreti[1]

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[2]Department of Mechanical Engineering
University of Cincinnati

Purpose: Recently, Unmanned Aerial Vehicles (UAVs) are being used for a wide variety of applications including detecting and tracking wildland fires. Using UAVs for fire-fighting purposes reduces the human involvement for this high risk job. Such a mission involves locating the wildland fire, tracking the direction of spread of the fire and searching for human presence in the region. This paper investigates algorithmic development for the use of UAV to detect and track wildland fires.

Design: One of the main reasons for the inability to suppress wildland fires before it spreads over a large is because of the delay in the fire crew reach the scene of the fire. This delay is caused by the lack of exact location of the fire in the wildland areas. We propose a mechanism to detect a fire using an Unmanned Aerial Vehicle (UAV) fitted with two cameras (visual and infrared cameras) and transmitting the geo-location of the fire by using intelligent estimation and data fusion techniques to relay critical information about the region to the fire crew on the ground.

Methods:

1) Geo-locating the fire using a UAV.
   - Using the pixel location of the target in an image, with measurements of UAV position and attitude, and camera pose angles, the target is localized in world coordinates.
   - The fuzzy logic based image processing algorithm will output the fire pixel locations helping us identify fire from the camera feed.

2) Tracking the fire.
   - Tracking the spread/growth of fire using the processed and time stamped video stream in the global coordinate frame. We obtain the coordinates and an estimated ground track of the fire.
   - We use the process image to find the depth of the fire pixel relative to the camera. Then, based on the GPS location of the UAV, the inertial sensor data of the UAV, camera angles and other camera parameters, the algorithm will be able to reproduce a ground track of the fire by using a constant stream of real time images.

Results: In the simulation, images are generated from true values of the relative positions between the quadrotor and the target. The localization and tracking algorithm is applied to obtain the relative position and yaw angle. For the stationary target localization, over 100 runs of the simulation are done and the mean value error for the runs was 1.5 m from the actual target location.

Conclusion: The report shows an acceptable performance of the UAV applying the control navigation schema proposed. Genetic fuzzy has been used to design a cascaded fuzzy system capable of detecting fire pixels from image. This has been shown to be very effective in distinguishing fire pixels from fire-like colored pixels. Based on the estimation algorithm a decent ground track could be developed for the target.

Impact Statement: Fire departments, especially in wild land areas, face a lot of challenges to keep the forests and surrounding areas safe from wild fires. The use of technology will help in mitigating any unnecessary risks that the fire crew might otherwise take. More importantly the ability to locate and track the fire will aid the fire crew in better understanding the nature of the fire and the parameters of influence. The project is applicable to the following NORA sectors of: 1) Healthcare and social assistance 2) Public safety 3) Agriculture, Forestry and Fishing.

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Get ACTive! A Pilot Acceptance and Commitment Therapy Workshop

Jessica Borushok (PI) and Robert Carels

Department of Psychology, Bowling Green State University

Purpose: The purpose of the current study was to develop and implement an Acceptance and Commitment Therapy (ACT) workshop to increase physical activity and general movement, as well as impact psychological and workplace factors that contribute to occupational stress and overall wellbeing. This pilot ACT workshop was compared to a traditional Education workshop for physical activity to assess whether the ACT workshop was comparable to current treatments.

Design: This pilot randomized control trial compared an ACT approach to a traditional Education approach. All participants (ACT: 17; Education: 19) completed a orientation session with one week baseline data collection, a four hour workshop, and a three month follow-up that included pedometer steps per day and 24 hour recall text messages regarding minutes of physical activity per day.

Method: Participants were full-time, physically inactive, sedentary workers in the Midwest (N= 36; 92% Female; 88% Caucasian; mean age: 48.5, SD: 11.8, range = 21-67). Participants were recruited through local newspaper advertisements, flyers, and emails through their place of employment. All eligible participants were randomized into treatment conditions and workshops via a random number generator prior to orientation session. Bowling Green State University's Institutional Review Board approved this study.

Results: The current study found that the ACT workshop was comparable to the Education workshop and that both approaches significantly impacted self-reported physical activity (minutes per week and days per week), satisfaction with life, feelings of depression, anxiety, and stress, job burnout, work role overload, ratings of their coworkers and opportunities for promotion, as well as psychological flexibility and mindfulness. The ACT workshop differed from the Education workshop in overall feelings towards their job, where participants in the ACT workshop increased their positive feelings toward their job in general, while the Education workshop participants maintained theirs. Additionally, analyses approaching significance suggest that both workshops demonstrated increases in minutes of exercise per day as well as an interaction effect where ACT participants increase their pedometer steps per day from baseline to follow-up while Education participants decreased their steps per day.

Conclusion: Overall, these preliminary findings support an Acceptance and Commitment Therapy approach for physical inactivity and sedentary behavior intervention.

Impact Statement: The current study piloted a four-hour workshop for increasing physical activity and decreasing sedentary behaviors with successful outcomes. While the pilot has room to grow, it is a step towards creating a practical solution to a global problem that impacts more than 58 million American workers in low-impact occupations (Brownson, Boehmer, & Luke, 2005). Given that physical inactivity is the fourth leading cause of death worldwide, if Americans became more active not only would the financial burden decline, but the prevalence of associated negative health conditions could also be reduced and in turn lead to increased productivity at work (Kohl et al., 2012; Pratt, Norris, Lobelo, Roux, & Wang, 2014). This line of research has the ability to impact health, finances, and productivity levels in America and the world through targeting physical activity and sedentary behaviors among sedentary physically inactive workers.

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A Test of the Work Stressor—Vulnerability Model of Alcohol Consumption

Kristin Horan (PI), Alison Bayne, Alexandra Henderson, Steve Jex, and Sara McKersie

Department of Psychology, Bowling Green State University

Purpose: This study aimed to adapt the general Stressor-Vulnerability Model of Alcohol Consumption to the workplace, which emphasizes the importance of accounting for both individual and organizational risk factors of alcohol consumption.

Design: This study utilized a daily diary method to assess between- and within-person effects in the relationship between work stress and alcohol consumption.

Methods: 53 participants in food service roles completed an initial survey measuring trait attitudes and beliefs regarding alcohol and 21 daily surveys measuring work stressors, alcohol craving, and alcohol consumption. Data were analyzed using hierarchical linear modeling.

Results: Main effect results revealed that daily work stress predicted alcohol craving, but not alcohol consumption. The majority of risk factors considered did not moderate the slope of the relationship between daily stress and alcohol outcomes, but did significantly impact the intercept.

Conclusion: Daily stress, individual risk factors, and organizational risk factors are important to consider when measuring the relationship between daily stress and alcohol outcomes. Results suggest that risk factors are important pieces for interventions designed to address alcohol consumption, but that other temporal and contextual variables should be considered as well.

Impact Statement: Despite its potential impact for employee health, research on stress and alcohol consumption is complex. The present study tested a model that informs both research and interventions related to employee alcohol consumption, which could ultimately increase employee productivity and decrease absenteeism and safety issues in the workplace.

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Oral Microbiome Perturbations and Associated Risks in Firefighters

Sukanta S. Bhattacharya[1] (PI), Scott M. Langevin[1], Jorge Santo Domingo[2], and Jagjit S. Yadav[1]

[1]Department of Environmental Health, University of Cincinnati College of Medicine
[2]Environmental Protection Agency, Cincinnati, Ohio

Purpose: Firefighters are at a greater risk for developing several health disorders and diseases such as different types of cancers including oral cancer, cardiovascular problems, respiratory diseases, diabetes, among others. One may relate these health problems to the fact that firefighters are regularly subjected to extreme stress involving exposure to fire-associated smoke and heat often resulting in inhalation of carcinogenic and proinflammatory chemicals such as PAHs and particulates. However the exact etiological mechanisms are unclear. We hypothesized that these occupational exposures have the potential to alter the oral microflora (microbiome) which in turn may regulate or modulate cellular events leading to adverse health outcomes in firefighters.

Design: Our working hypothesis is that smoke exposure causes perturbations in oral microbiome which in turn may interact with other prevailing physiological stress factors and modulate the associated health risk such as oral cancer in firefighters. To test this hypothesis, we proposed to evaluate oral microbiome samples from non-smoker controls, smokers, and former smokers and compare them to a Firefighters cohort. These changes will be correlated with the exposure data and other metadata available on the subjects.

Methods: The oral microbiome was studied using oral samples (sponges and rinse) from unexposed and exposed subjects to identify exposure-specific microbiome constituents. The protocols for microbiome DNA recovery from these sample matrices were standardized using modifications in Qiagen DNeasy Blood and Tissue kit. The microbiome analysis was performed based on V4 region of 16S rRNA gene using both in-house Denaturing Gradient Gel Electrophoresis (DGGE) analysis and nextgen sequencing (NGS) using Illumina's MiSeq platform. Data analyses were carried out using Gelcompar (for DGGE) and Mothur (for NGS).

Results: Oral microbiome from unexposed normal controls revealed a greater proportion of gamma-proteobacteria and beta-proteobacteria relative to other microbial groups including Saprospirae, Acidobacteria, Actinobacteria, Alphaproteobacteria, Clostridia, Bacteroidia, and Fusobacteria. The smokers and former smokers groups showed an altered oral microbiome as compared to the non-smoker group. Specifically, the smokers group showed increased proportion of bacterial families Vellonellaceae, Prevotellaceae, and Carnobacteriaceae (in current smokers) and a decrease in Nisseriaceae (in both current and former smokers) in their oral microbiome. Analysis of oral microbiome samples collected from the firefighters cohort (20 subjects) is in progress; the data obtained will be compared and contrasted with the smokers cohort data.

Conclusion: The study showed that smoke exposure causes specific perturbations in oral microbiome. Ongoing analysis is expected to specifically identify the components altered in the exposed firefighters.

Impact Statement: The observed specific oral microbiome changes associated with smoke exposure will help expand our understanding of the etiological factors and biomarkers for smoke-related health effects. Further studies will provide insights into the role of oral dysbiosis in predisposing firefighters to occupational health risks including cancer.

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2016-17 PRP Awardees
POSTER PRESENTATION ABSTRACTS

Inclined Surfaces – Impact on Postural Stability and Spine Loading

Noma Agbonifo[1] (PI), Kermit Davis[1], and Susan Kotowski[2]
[1]Department of Environmental Health
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Many work environments require workers to perform manual materials handling (MMH) tasks on surfaces that are not perfectly flat – sloped, slippery, or uneven surfaces in industries such as construction, agriculture, and maritime workplaces. Although these situations are common, there is little research focus on how working on these types of surfaces may impact the lifting strategies and techniques utilized by the worker and how this in turn affect the biomechanical loading of the spine as well as ability to maintain upright posture. According to the Bureau of Labor Statistics (BLS), falls in the workplace are a major cause of injuries and fatalities and 76% of fatalities in the roofing industry are attributed to falls. The cost of these falls in workers compensation is currently put at an average of $106,000 per fall. While falls from elevated and inclined surfaces account for many fatalities, performing MMH activities on these surfaces has the potential to impact many more workers by altering the loading of the spine and potentially increasing low back injuries. Biomechanically, these inclined surfaces require the body to maintain a stable posture by keeping the center of pressure (COP) within the base of support (BOS) when lifting. Theoretically, postural stability would have a direct impact on the biomechanics of the human system where more unstable inclinations would result in great muscle coactivation and spine loads during the handling of materials. However, little is known about the impact of inclined surfaces on spine loading. Furthermore, there is limited understanding of the potential mechanism between postural stability at the base of support and the corresponding impact on the low back system, which may be loaded at elevated levels, ultimately increasing the risk for low back injuries. This study will examine three novel hypotheses: 1) surface inclines will increase muscle coactivation and corresponding spine loading, 2) surface inclines will increase postural instability as determined by the COP moving closer to the BOS boundary, and 3) a strong relationship exists between postural stability and spine loads. These hypotheses will be tested by repeated-measures within subject experimental design. The specific aims will be to: 1) determine the impact of different work surfaces (flat versus inclined at 14o and 26o respectively) on spine loading during routine roofing activities involving manual materials handling, 2) measure deviations of the body's COP from the BOS associated with changes in the different work surfaces, and 3) compute the relationship between postural stability indices and spine loading variables from the different work surfaces. These aims will allow for independent evaluation of the three dimensional spine loads from peak normalized electromyography (EMG) activity of the 10 major trunk muscles and 8 major postural stability muscles, three dimensional trunk kinematics and kinetics, and the path lengths (PL) and sway area or elliptical area (EA) while working on these inclined surfaces. It is expected that the study outcomes will provide beneficial information on the link between postural stability and dynamic spinal loading, which will positively impact the reduction of low back musculoskeletal disorders and potential fall related incidents resulting from inclined working surfaces. This will also potentially result in significant reduction in overall workers compensation costs across affected industries including the current healthcare costs of over $90 billion spent annually on low back injuries/disorders in the United States. This study aligns with the National Occupational Research Agenda (NORA)'s mission of stimulating innovative research and improving workplace practices including musculoskeletal disorders and construction.

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Industrial Hygiene Air Sampling/Analysis of Microcystin in Lake Erie Region

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Symptoms and illnesses have been associated with recreational exposure to cyanobacteria with the most common reported including hay fever like symptoms, pruritic skin rash, and gastrointestinal symptoms. The pilot project will be the first step to explore these emerging issues, especially those related to occupationally exposed groups. Available reports have focused primarily on different geographic regions and smaller inland lakes. Little to no information is available on airborne microcystin on or near Lake Erie, which is an important source of drinking water and recreational use in Northwest Ohio. In order to evaluate the possible hazards of recreational, occupational, and community environments, this project aims to examine industrial hygiene monitoring methods to sample airborne microcystin in different lakeside environments. This project will employ novel concepts and methods to address unconventional industrial hygiene monitoring in uncommon locations. Air samples will be collected with a pump at 10.6 lpm using an IOM sampler during peak algal bloom occurrences in predetermined locations: on and off shore of Lake Erie; a commercial boat house; and a control location. Sampling will be repeated on at least three occasions. Water samples will also be collected. Air and water samples will be analyzed using the microcystins-ADDA ELISA test. This proposed project combines environmental and occupational health approaches that are both relevant and timely. By exploring sampling methodology for airborne microcystin, we will relay the available information to recreational and occupational users. It is expected that the public and workers who live and work around the lake will be more informed about the air quality on Lake Erie and its shores.

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Intrinsic Factors that Influence Retention among Nursing Assistants

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As the number of individuals 65 and older in the U.S. continues to rise, the need for nursing assistants within skilled nursing facilities will also increase. The increased need is complicated by high turnover and low retention rates. High turnover and low retention have negative impact on facilities, staff, and residents. For-profit skilled nursing facilities experience the highest rates of turnover when compared to their not-for-profit counterparts. Intrinsic (meaning, enjoyment, personal fulfillment) factors have been identified as contributors to retention of nursing assistants. The proposed research seeks to describe the relationships between multiple intrinsic factors and their influence on well-being of nursing assistants, and their intent to stay in their job. This research will utilize a combination of qualitative and quantitative methods to provided additional understanding of causal factors related to nursing assistant intent to stay in their positions. As a result of this research current retention efforts can be redesigned to better reflect the experiences of nursing assistants in order to sustain this integral direct care workforce.

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Black Carbon Validation of a Novel Sensor for Traffic-Related Indoor Air Pollution

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Exposure to traffic-related air particulates (TRAP) is linked with reduced respiratory health in both public and worker populations. It has been determined that TRAP penetrates homes and occupational settings, affecting the indoor air quality. Better methods are needed for fast and accurate assessment of efficiency of control methods. A novel MicroPEM™ (Personal Exposure Monitor) device was recently developed at Research Triangle Institute (RTI) International as a personal exposure monitoring device capable of direct reading measurement of PM2.5 with a simultaneous collection to a Teflon filter. Preliminary data, based on the Pilot Research Project 2015 grant, is focused on developing a correction factor for analysis of traffic-related airborne particles (TRAP) in the Cincinnati region. This study will build upon what we have learned. We proposed to use the unique opportunity to test another novel device, AethLabs microAeth Black Carbon (BC) sensor in an ongoing study that is funded by U.S. Department of Housing and Urban Development Healthy Homes Technical Studies (HHTS). We hypothesize that the microAeth data and the average and the MicroPEMs BC filter data will be statistically similar. In the first specific aim, we will determine the association between the microAeth BC sensor and the BC collected on each MicroPEM filter both indoors and outdoors in buildings close to highways. A multiwavelength optical absorption technique will be used to apportionment of environmental tobacco smoke and soot (black) carbon. The determination of tobacco smoke and carbon with reasonable accuracy is possible using an integrating sphere radiometer and multiple wavelengths to provide specificity. The second specific aim is to determine a correlation coefficient between the MicroPEM PM2.5 direct-reading data and the microAeth BC sensor direct reading data for the assessment of traffic-related indoor pollution. The tested sensors, once validated, will be easy and useful tools to determine occupational exposure to traffic-related indoor air pollution.

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Firefighter Physiological Health Assessment and Hazard Monitoring Device

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Firefighters are exposed to a multitude of different hazards when on the field. These hazards include overexertion, low oxygen environments, falls, contact with objects, impact from objects, burns, hyperthermia and dehydration. The proposed physiological health monitoring device would be able to help monitor and report back if on duty firefighters are at risk of these hazards.

The proposed device is a band-aid like device that would be attached to the firefighter's skin positioned on the upper arm. The device would monitor the firefighters physiological health including heart rate and blood oxygen level though the use of a pulse oximeter, physical activity by the use of an accelerometer, hyperthermia by measuring the skin temperature, and hydration by measuring the sweat conductivity. Not only will the proposed device monitor the firefighter's physiological health the device will also monitor and report back on the temperature and humidity inside the firefighter's suit for the hazard of burns, and monitor for impacts, falls, impact from objects or contact with objects using an accelerometer. The proposed device is a microcontroller interfaced with multiple sensor. The sensors include pulse oximeter, accelerometer, two temperature sensors, humidity sensor, and a sweat conductance sensor. The first step is to design a wireless rigid printed circuit board (PCB) interfacing all the sensors into an arm band like device. The second step is to transfer the design over to a wireless flexible PCB band aid like device. The third step is to explore communication methods such as Bluetooth and other commercial communication devices to transfer the data.

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Enhanced Capture of Microbeads for Water Treatment

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In micro total analysis systems, detection of pathogens and isolation of biomolecules by immunoassays is essential for point-of-care diagnostics. Magnetophoretic separation, which uses magnetic microbeads coated with specific epitopes to entrap target pathogens, is a common method used in microfluidic platforms. However, the difficulty with these platforms is efficient capture of microbeads.

The purpose of this study is to analyze a microfluidic device that utilizes electroosmotic flow and flow switching to increase capture efficiency in a portable chip device. Electroosmotic flow enables easy switching through the changing of voltage between two electrodes to increase the amount of time beads spend under the influence of the magnetic field, thereby increasing the capture effectiveness. This project will analyze the capture efficiency of the system using fluorescently tagged microbeads, as well as characterize the secondary capture of bacteria in a sample.

This device will be used to analyze water systems and determine the concentration of bacteria in a water system through the use of beads coated with epitopes targeted to specific bacteria. This technology is a unique platform that allows for rapid and accurate analysis in a portable device that can be used in on site, point of care situations.

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Post-retirement Employment among Nurses: A Case of Planned Behavior

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The nursing occupation has been struggling with labor shortage for a long time. What's worse, recent aging trend further exaggerated this problem. Post-retirement employment (PRE), which refers to labor force participation during retirement, is a promising strategy to be considered. Actually, PRE is becoming common among current retiree population and has important benefits for individual older workers, employers, and organizations.

Previous studies mainly focused on general demographic characteristics, job-related variables, and family-related variables. They failed to examine the roles played by specific factors that are particularly important in the context of an increasingly aging workforce. As people grow older, they will experience age-related changes in physical and cognitive functions, time perspective, as well as motivational strivings. Likewise, the aging workforce leads to new challenges for many organizations, such as designing better jobs for older workers, adjusting human resource practices for older workers' needs, promoting intergenerational communication, and preventing age discrimination. What are the influences of these age-related changes on older workers' intention to engage in PRE? Prior research has failed to systematically examine these age-related changes as potential antecedents of older workers' intention to engage in PRE. Additionally, aging-related changes in the family sphere, such as family caregiving issue and spousal expectations and support, are also important. A fuller examination of older workers' intention to engage in PRE must consider the effects of older workers' family-related variables.

Based on the above consideration, the present research will examine the effects of aging-relevant person-related (e.g., motivations), job-related (e.g., physical demands), organization-related (e.g., opportunities for generativity, age discrimination), and family-related factors (e.g., family caregiving demands, spousal expectation and support) on older nurses' intention to engage in PRE (e.g., bridge employment). Furthermore, nurse incivlity, as a specific nursing occupation-related factor, will also be examined. Findings of this research will provide implications for organizations and policy-makers to retain older, skilled nurses.

This study will survey consenting nurses above 50 years old by valid measures on antecedents and outcome variables. Proposed hypotheses will be tested through the quantitative data collected in this project.

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UAV use in Reducing Hazards for Firefighters during Emergency Response

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The utility of Unmanned Aerial Vehicles (UAVs) needs additional investigation. This pilot project will serve to initiate further research evaluating ambient concentrations of contaminants encountered by firefighters in emergency response to chemical releases. This use of UAVs to quickly collect air samples via Tedlar® bags in hazardous environments will allow for rapid monitoring of chemicals during response efforts. By utilizing instruments immediately available on firefighting equipment this will provide a greater level of safety and health for responders. This is the first step in the long term goal of the project to incorporate sensor technology and unmanned aerial vehicles (UAVs) in emergency response, including model development, to better characterize sites and protect workers.

Specifically, the study will examine the utility of UAVs in industrial hygiene sampling combined with a sample pump and Tedlar® bag. Emergency response drills and activities through the use of UAV mounted EO/infrared camera to identify missing or lost individuals in search and rescue scenarios will also be evaluated.

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Ergonomics in Veterinary Care

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An alarming number of veterinarians has self-reported experiencing musculoskeletal discomfort and injuries. Despite exposure to similar occupational and safety hazards as other healthcare providers, ergonomics and occupational health research in veterinary care is limited. The purpose of this proposed research is to quantify ergonomic risk factors in veterinary medicine that can impact veterinary clinicians', residents', and surgeons' musculoskeletal health, performance, and career longevity. The long-term goal of this research is to improve the occupational health and safety of veterinary medicine and animal care through an interdisciplinary veterinary medicine/industrial engineering approach, first by identifying risk factors in the operative environment in this proposed research work and quantifying workplace exposures in order to promote safer workplaces. The proposed work have potential to extend beyond surgical veterinary care to veterinary office and rural care environments and can lead to larger interdisciplinary collaborations between veterinary medicine, industrial hygienists, environmental health sciences, and engineering.

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INVITED STUDENT POSTER PRESENTATION ABSTRACTS

Use of Physiologic Markers to Evaluate Firefighters' Reactions when Exposed to Stressors

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Purpose: Elevated cardiovascular deaths among firefighters suggest the need for improved surveillance during stress of on-duty firefighting activities2. Vital sign alterations during firefighting activities may serve as early warning signs of cardiovascular and respiratory distress. Goals of early VS alteration detection: 1. Permit reduction of acute exposures prior to manifestation of adverse cardiovascular or respiratory health sequela; 2. Allow timely health interventions, and; 3. Identify firefighters not demonstrating acute distress as they perform essential job functions.

Background: This is a pilot research feasibility report based on evaluation of preliminary data from the University of Cincinnati Education and Research Center's Targeted Research Training (TRT) "Firefighter Study". TRT Aim 1, addresses firefighter responses to heat stress. This poster is being presented to inform development of the study entitled, "Use of physiologic markers to evaluate firefighters' reactions when exposed to stressors." This effort expands on previously completed TRT funded data collections to achieve a sufficient sample size to permit a focus on firefighters' vital signs outcomes.

Design: All subjects sign informed consents as per the approved IRB protocol. Data collection processes are designed around the firefighters' live-burn trainings. The trainings included 3 scenarios lasting approximately 10 minutes. Objective and subjective measures are gathered prior to the trainings (baseline) and post-scenario throughout the trainings. For control group data will be gathered at baseline and approximately one hour after end of live-burn training at the fire departments.

Methods: Heart rate is monitored continuously during the three training scenarios using a Zephyr Bioharness. Measures of blood pressure, heart rate, SpO2, tympanic temperature, perceived exertion, perceived respiratory distress, and height and weight will be obtained pre- and post-scenario.

Pilot Feasibility Results: Feasibility results for this expanded vital signs project were based on analysis of preliminary TRT vital signs data collection from three regional fire departments that agreed to take part to date during the TRT study. Approximately four firefighters per each live-burn training participated in the TRT study and 100% completed the data collection.

Conclusions:
Feasibility: Determined feasible to acquire previously collected vital signs data and replicate vital signs collection methods in expanded study. Total required sample size: projected for expanded firefighter study analysis (N = 94). An estimated total of 10 additional live-burn trainings at regional sites will be required to achieve a sufficient sample size for a vital signs analysis. Limitations: Majority of sample subjects in prior TRT effort have been urban, Caucasian men, and not all fire departments perform annual medical testing or provide stress tests for their firefighters providing fewer sample subjects that meet study eligibility criteria.

Acknowledgement: This study was supported by the National Institute for Occupational Safety and Health Targeted Research Training Program of the University of Cincinnati Education and Research Center Grant #T42/OH008432.

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Performance of an N95 Filtering Facepiece Respirator and a Surgical Mask Used by Home Attending Health-Care Workers (a Pilot Study)

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Purpose: This study aimed at determining the Workplace Protection Factor (WPF) for one model of N95 filtering facepiece respirator (FFR) and one model of surgical mask (SM) that are widely used by the home attending health-care workers to reduce their exposure to potentially hazardous agents during home visits, such as respiratory pathogens, aerosolized secretions originated during tracheal suctioning and nebulized medications.

Background: Home-attending health-care workers are often exposed to various airborne hazards during care activities. This exposure can put them at a health risk. They often enter the homes environments unprotected or at best use SMs or N95 FFRs. Using the personal respiratory protection equipment may mitigate the problem; however, there is no data that would allow assessing whether existing N95 FFRs and SMs can provide an adequate protection to health-care workers during home visits. Generally, workplace protection factor (WPF) is used to determine the protection provided by an N95 FFR and SM to a worker. The WPF is defined as a ratio of the concentration outside of the respirator (Cout) to the concentration inside the respirator while worn at a workplace (Cin).

Methods: Three home-attending health-care workers serving in the Cincinnati area were recruited as subjects. Prior to the field experiment, each subject was cleared using the OSHA respirator medical clearance questionnaire and subsequently was fit tested with the selected N95 FFR using the standard OSHA protocol. At the workplace, the aerosol Cout and Cin of the tested N95 FFR or SM were measured on a subject using two simultaneously operating P-Trak condensation particle counters (Model 8525, TSI Inc., Shoreview, MN) within the particle size range of 20 to > 1,000 nm. The WPF was determined from multiple samples (scans) ranging from 100 to 279, depending on health care procedure. The WPF was determined from multiple samples (scans) ranging from 100 to 279, depending on health care procedure.

Results: This pilot study demonstrated that the WPF of the N95 FFR consistently exceeded that of the tested SM (with the overall mean WPF values being 56 and 3 respectively). In all cases, the N95 FFR's WPF was above the OSHA' s assigned protection factor of 10 whereas the SM often provided little protection (the WPF ranged from 3 to 9). The protection levels provided by both devices were affected by the activity; e.g., for subject #1 wearing the N95 FFR, the activity-specific WPF was as high as 94 during normal activity and 48 during nebulizer treatment.

Conclusions: Wearing an N95-certified respirator significantly improves the respiratory protection of home-attending health-care workers (as compared to a SM). The WFP may depend on the activity or body movements or both.

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