The University of Cincinnati Education and Research Center Presents

18th Annual Pilot Research Project (PRP) Symposium

Thursday and Friday, October 5th-6th, 2017

University of Cincinnati

Medical Sciences Building, Kresge Auditorium

Thursday, October 5th, 1:00pm-5:00pm

Friday, October 6th, 8:00am-12:00pm

This event is free and open to the public, please sign in at the registration desk

Keynote Speaker

Carri Casteel, PhD

Associate Professor

Occupational & Environmental Health

College of Public Health
University of Iowa

Happy Anniversary!
Celebrating 40 years as a NIOSH Education and Research Center

Podium &
Poster Presentations
by PRP Awardees

University of Cincinnati
Education and Research Center

Supported by NIOSH grant #T42-OH008432

University of CINCINNATI

Pilot Research Project Training Program and Symposium

Welcome to the University of Cincinnati Education and Research Center's (ERC) **18th Annual Pilot Research Project (PRP) Symposium** on October 5-6, 2017, held in the Medical Sciences Building Kresge Auditorium. 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 by 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 2016-17 awardees will be presenting the results of their research and the 2017-18 awardees will make poster presentations of their proposed work. The keynote speaker on Thursday, October 5, 2017 is **Dr. Carri Casteel from the University of Iowa College of Public Health, presenting on "Public Health Approach to Workplace Violence Prevention in Small Businesses."**

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 230 pilot research projects. These projects have served as a catalyst in bringing over $39 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 51 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
- 4.3 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 #171005-1.

The 18th 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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40 Years as a NIOSH Education and Research Center (ERC)

History of the UC ERC

NIOSH is mandated to provide an adequate supply of qualified personnel to carry out the purposes of the Occupational Safety and Health Act (1970). The Education and Research Centers (ERCs) are one of the principal means for meeting this mandate. In 1976, Dr. Eula Bingham was in a NIOSH study section when the upcoming request for proposals for ERCs was announced. She immediately informed the then Director of the Department of Environmental Health, Dr. Raymond Suskind. He submitted a successful application, and UC was among the nine institutions who were awarded an ERC training grant in 1976. The others included Harvard University, Johns Hopkins, University of Texas Houston, University of Minnesota, University of North Carolina, University of Washington Seattle, University of Illinois Chicago and University of Arizona. Currently, there are 18 ERCs across the country.

ERCs are academic institutions that provide high-quality interdisciplinary graduate training, research training, continuing education, and outreach in occupational safety and health disciplines. Research and research training are integral components of ERCs, with ERC faculty and NIOSH trainees conducting research on issues related to the NIOSH National Occupational Research Agenda (NORA) and Healthy People 2020. The ERCs also serve as regional resources for industry, labor, government, and the public.

Currently, UC ERC includes four core disciplines: Environmental and Industrial Hygiene, Occupational Health Nursing, Occupational Medicine Residency and Occupational Safety Engineering as well as one allied program in Biomonitoring. Other main programs include Continuing Education, Targeted Research Training, and Evaluation core. The directors and the timeline of main program changes is summarized in Table 1.

UC ERC has been very successful in recruiting, training, and graduating high-quality practitioners and scientists who assumed leadership roles in government, industry, labor, and academia. The programmatic focus of this training is to help fill the ever-expanding shortage of environmental and occupational safety and health experts.

Table 1: Short History of the UC ERC

Director	Years	Main Programs
Raymond Suskind	1977-1985	Industrial Hygiene, Occupational Medicine, Occupational Health Nursing, Continuing education
Roy Albert	1985-1994	Occupational Safety and Health Engineering added in 1986 Hazardous Substances Academic Training Program added in 1994
Scott Clark	1994-2008	Pilot Research Project Programs added in 1999 Biomonitoring added in 1996
Carol Rice	2008-2012	Targeted Research Training added in 2011 Hazardous Substances Academic Training Program ended in 2012
Tiina Reponen	2012-current	Evaluation core added in 2016

Occupational Health and Safety Impact Awards

This year the ERC is giving out special awards to celebrate 40 years and recognize significant impacts on health, safety, and wellbeing outcomes among workers. The UC ERC Academic Cores seek to honor professionals who have had an exceptional impact on worker health and safety in the areas of Mechanical Engineering, Industrial Hygiene, Occupational Health Nursing, Research to Practice, Service, Continuing Education, and Overall Impact. Please see the next 4 pages listing the award winners and excerpts from their nomination letters.

Occupational Health Nursing Award
Dr. Gordon Gillespie

Dr. Gillespie's commitment to the prevention of workplace violence has received global and national recognition. Dr. Gillespie's work emphasizes preventing workplace violence and bullying in healthcare fields. His research has contributed to evidence that supports effective prevention and response strategies. Dr. Gillespie was invited by NIOSH to develop an educational program regarding workplace bullying and he consulted on the development of two national online learning modules. NIOSH (2017) reports that 15,980 workers in private industry experienced trauma from nonfatal workplace violence, based on 2014 data from the Bureau of Labor Statistics, and 69% of those victims worked in the healthcare and social assistance industries. The penetrance of Researcher Gillespie's work extends to the organizational and social cultures of healthcare institutions and organizations, which benefit from NIOSH educational programs and professional occupational safety and health journal articles, authored or co-authored by Dr. Gillespie. By exposing the reality of workplace bullying and violence, Gordon Gillespie's numerous research studies have promoted the occupational health and safety of underserved or under-recognized workers who have experienced workplace bullying and/or violence but did not feel empowered to illuminate others regarding their workplace bullying and workplace violence experiences.

Service Award
Mr. John Morawetz

John Morawetz has a distinguished record of service in occupational health. Much of his impact has been in ensuring that workers have the requisite knowledge and skills to identify and avoid workplace risks. This impact is highlighted via his leadership in worker training. John works as Director of the ICWUC Training Center which trains 7,000 participants each year from industrial unions and organizations in Industrial, Hospital and School Chemical Emergency Response, Hazardous Waste, and Disaster Preparedness. John has also provided service to the UC ERC graduate and continuing education programs as an advisory board member and hosting EIH students for hazardous waste worker training events. John has made a national impact in helping derive protective chemical standards. He served on the NAS panel to review acute emergency guideline levels and also has been a contributor and commenter on other emergency value derivation efforts – such as the NIOSH IDLH program. These types of activities provide national standards of practice to inform decisions during chemical emergency response. Thus, the impacts of this effort are direct and take effect during chemical emergencies that can affect communities on a large scale.

Industrial Hygiene Award
Dr. Lauralynn McKernan

Dr. McKernan has made significant impacts in industrial hygiene practice that go far beyond the Cincinnati region. Lauralynn has been instrumental in moving the science forward for ensuring that industrial hygiene professionals have health-based exposure benchmarks for chemical hazards in the workplace. She was the lead of a complex assessment effort for diacetyl. While developing guidance on this chemical is itself an important impact on thousands of workers, her efforts in this area also helped to set in motion preventive strategies for looking at food manufacturing risks in the broader sense. She was assigned to the leadership of the NIOSH Occupational Exposure Banding (OEB) team and guided the team through its formative period. This innovative effort is providing a tool for industrial hygienists to assess potential health-based exposure limit (OEL) ranges for the thousands of chemicals with no current guidance. Dr. McKernan is viewed as a go to resource on mentoring, management, and leadership. This shows in her career track and even more so in the number of people that seek her input. She has served as a leader, advisor, or mentor for national industrial hygiene associations, been instrumental in planning technical conferences, and mentored numerous young professionals and students. She has also supported the IH program at UC by presenting seminars, hosting students, and serving on advisory committees.

Mechanical Engineering Award
Mr. Andy Park

Mr. Park is a Vice President and Partner at Centric Consulting, a Business Consulting and Technology Solutions Firm with over 20 years of Consulting experience. Mr. Park co-leads Centric's National Enterprise Applications and Solutions ("EAS") Business, a practice focused on business transformation that leverages solutions such as Oracle Cloud and Microsoft Dynamics 365 among other ERP and CRM enterprise solutions. Mr. Park is also a serial entrepreneur and a philanthropist. He has launched several profitable businesses, and continues to feed his passion for start-ups and social enterprise through his leadership in Flywheel Social Enterprise Hub and Rathskeller Labs, a start-up MVP accelerator. He serves on Advisory Boards including the University of Cincinnati's (ERC) National Advisory Committee, UC's OSHE engineering program, UC's OBAIS program at the Lindner College of Business, The Circuit, and a regional Smart City Initiative. Mr. Park has been a strong supporter of the ERC's Occupational safety and Health Engineering program for over 20 years and has been the longest serving member of the External Advisory Board for the program for 15 years.

Research to Practice Award
Dr. Scott Hutton

Dr. Hutton began working as a nurse where he first became interested in addressing the problem of workplace violence (WV). He studied in Occupational Health Nursing and upon graduation, began work at the Cincinnati Veterans Health Administration (VHA) Hospital where he translated research into practice. Dr. Hutton developed a three-pronged research-based WV practice model of training, threat mitigation, and reporting. The model is unique for its comprehensive nature, including education, multidisciplinary threat assessment teams, mitigation plans, and facilitative reporting structures of disruptive behaviors. Systems improvement techniques and informatics technology/methodology were used to address reporting barriers and standardize reporting. Through his unwavering leadership, the model was successfully implemented at the Cincinnati VHA. Outcomes were unquestionably favorable, showing substantial decreases in WV incidents (51%), injuries (32%), and severity (29%), as well as higher nursing staff satisfaction. Following success within the Ohio VHA network, a grass roots effort emerged among VHAs nationwide to build on, customize, and implement the model. In 2016, as part of a nationwide multidisciplinary implementation effort, Dr. Hutton was appointed as WV Prevention Program Clinical Manager, the highest-ranking WV prevention nurse within the VHA. His leadership of national level multiple disciplinary teams resulted in system-wide improvements. The model has been deployed to 142 hospital settings and all the associated satellite clinics.

Continuing Education Award
Dr. Judy Jarrell

During her time as Continuing Education Director for the UC ERC, Dr. Jarrell interacted extensively with local, state, and federal regulating agencies as the CE courses were driven by regulation. Dr. Jarrell often presented at national levels and organized special activities for the ERC such as a trip to the International Conference on Biomechanics and Ergonomics in Cairo, Egypt and an International Conference on Nanotechnology hosted in Cincinnati. Working with the University of Minnesota, Dr. Jarrell assisted in the formation of the Great Lakes OSHA Regional Education Center. This Center underwent a competitive renewal in 2002-03 and was awarded a five-year renewal in a new configuration which included the University of Cincinnati as the lead center, the Eastern Michigan University, and the United Auto Workers. Dr. Jarrell took over as the Executive Director of the Great Lakes Regional OTI Education Center at that time. She continues to serve the UC ERC as Evaluations Director.

Overall Impact on Research Award
Dr. James Lockey

For 35 years, Dr. Lockey has been involved with occupational studies and adverse pulmonary health of workers in a variety of industries. Over the last 30 years he has been the PI of the longest on-going occupational pulmonary morbidity and mortality study within the US that studies the longitudinal exposure of workers to refractory ceramic fibers (RCF). These study results have informed RCF occupational exposure guidelines both within the US and Europe (REACH) demonstrating global influence. In collaboration with the Mechanical, Industrial and Nuclear Engineering Department he was instrumental in the development of technology for a personal ultra fine particle sensor (<1.0 micron) that represents a paradigm shift from any previous monitoring device that is currently being used by the USAF, UC, and CCHMC investigators among others. A patent was issued for this technology and licensed by UC to Environmental Monitoring Technology of which he is the CEO. He and his collaborators have done research on firefighters that has had far reaching influence in the US and globally to establish compensation due to exposures to multiple carcinogens. He is currently a member of the National Academy of Sciences National Research Council's committee on Toxicology.

Overall Impact on Policy Award
Dr. Eula Bingham

Dr. Bingham is an internationally known toxicologist and former head of the Occupational Health and Safety Administration (OSHA). She began working with the UC Department of Environmental Health (DEH) on immunology studies then progressed as a biologist focusing on complex mixtures and cancer among workers exposed to chemicals on the job. Eventually, Dr. Bingham took over the carcinogenesis group at DEH and built a relationship with NCI and NIEHS. In the early 1970s she collaborated with NIOSH and served on OSHA's carcinogen advisory committee and the Labor Department's commission on coke oven emissions. Dr. Bingham began focusing on worker training for safety and health in the workplace. In 1977 she became OSHA's Assistant Secretary of Labor during President Jimmy Carter's Administration, the first to serve a full four year term. During this time, her main priorities were 1) an all-out effort to combat occupational illness and disease, 2) to "make life safer for employees, not to make life harder for employers" by increasing assistance to small businesses, and 3) to simplify safety rules. During her time at OSHA, Dr. Bingham instituted the New Directions Health and Safety Training program, used millions of dollars to educate workers, distributed funds to unions and university training efforts, and helped build strong programs. In 1982 she became the Vice President of Research and Graduate Studies at UC and returned to her research and won an agreement with the EPA and another with NIOSH, funding the Center to Protect Workers' Rights.

Keynote Speaker, Thursday, October 5th, 2017

Carri Casteel, MPH, PhD

"Public Health Approach to Workplace Violence Prevention in Small Businesses"

Associate Professor

Occupational & Environmental Health

College of Public Health

University of Iowa

Carri Casteel, MPH, PhD is an Associate Professor of Occupational and Environmental Health at the University of Iowa (UI). She is also the Associate Director for the UI Injury Prevention Research Center and Director for the Occupational Injury Prevention Program of the Heartland Center for Occupational Health and Safety. Dr. Casteel's primary areas of research include workplace violence prevention in the retail and healthcare industries, methods for reaching small businesses with occupational safety and health programs, older adult falls prevention and prevention of prescription opioid abuse and overdose. She is the past President for the national professional association, Society for the Advancement of Violence and Injury Research.

Day 1, October 5th, Schedule

Introductions	
1:00pm	**Welcoming Remarks and Introductions** Amit Bhattacharya, PhD, CPE, PRP Program Director *University of Cincinnati, Environmental Health* Shuk-Mei Ho, PhD, Department Chair *University of Cincinnati, Environmental Health* President Neville Pinto, PhD *University of Cincinnati* **Introduction of Education and Research Center & 40th Anniversary Celebration** Tiina Reponen, PhD, CIAQP, ERC Director *University of Cincinnati, Environmental Health*
1:20pm	**Introduction of Geoff Daniels** Kermit Davis, PhD
1:25pm	**Proclamation from Senator Sherrod Brown's Office** Read by Geoff Daniels on behalf of Senator Brown
1:30pm	**Introduction of Keynote Lecturer** Gordon Gillespie, PhD, DNP, RN, PRP Deputy Director *University of Cincinnati, Nursing*
Keynote Address & Q&A	
1:30pm-2:10pm	**Public Health Approach to Workplace Violence Prevention in Small Businesses** Carri Casteel, PhD *University of Iowa, Occupational and Environmental Health*
Presenters (Moderator: Joe Abulhassan)	
2:10pm-2:30pm	**Inclined Surfaces - Impact on Postural Stability and Spine Loading** Kermit Davis, PhD presenting on behalf of Noma Agbonifo *University of Cincinnati, Environmental Health*
2:30pm-2:50pm	**Industrial Hygiene Air Sampling/Analysis of Microcystin in Lake Erie Region** Cathy Ross presenting on behalf of April Ames, PhD, CIH *University of Toledo, Population Health*
Break	
3:10pm-3:30pm	**Intrinsic Factors that Influence Retention among Nursing Assistants** Megan Benner *University of Toledo, Health and Recreation Professions*
3:30pm-3:50pm	**Black Carbon Validation of a Novel Sensor for Traffic-Related Indoor Air Pollution** Jennie Cox *University of Cincinnati, Environmental Health*
3:50pm-4:10pm	**Ergonomics in Veterinary Care** Denny Yu, PhD *Purdue University, Industrial Engineering*
4:10pm-5pm	**Occupational Health and Safety Impact Awards** Presenter: Susan Reutman, PhD, MPH, RN *University of Cincinnati, Nursing*
PRP Networking Picnic, Procter Hall 3rd Floor Atrium	

Day 2, October 6th, Schedule

Introduction and Speakers	
8:00am-8:10am	**Welcoming Remarks** Gordon Gillespie, PhD, DNP, RN, PRP Deputy Director *University of Cincinnati, Nursing*
Presenters (Moderator: Susan Reutman)	
8:10am-8:30am	**Firefighter Physiological Health Assessment and Hazard Monitoring Device** Matthew Giovanetti *University of Cincinnati, Electrical Engineering and Computing Systems*
8:30am-8:50am	**Enhanced Capture of Microbeads for Water Treatment** Samuel Miller *University of Cincinnati, Mechanical and Materials Engineering*
8:50am-9:10am	**Post-retirement Employment among Nurses: A Case of Planned Behavior** Hanyi Min presenting on behalf of Yisheng Peng *Bowling Green State University, Psychology*
9:10am-9:30am	**UAV Use in Reducing Hazards for Firefighters During Emergency Response** Michael Valigosky, PhD, CIH, CSP, RBP *University of Toledo, Population Health*
Poster Session with Q&A	
9:30am-10:00am	**Poster Session (Hallway E799 Outside Auditorium)** 2017-18 PRP Awardees will present their posters – listed on page 3 *Poster authors MUST be by their posters during the entire session*
10:00am-10:40am	**Poster Presenter Q&A** Moderator: Gordon Gillespie, PhD, DNP, RN *University of Cincinnati, Nursing*
Panel Discussion, Awards, and Closing	
10:40am-11:30am	**Panel Discussion of the Podium Presentation Topics** Moderator: Susan Reutman *Panelists: Tiina Reponen, Alexander Sergeev, Jagjit Yadav, Nancy Johnson*
11:30am-11:55am	**BEST Award Presentations** Diana Schwerha, PhD *Ohio University, Industrial and Systems Engineering*
11:55am-12:00pm	**Closing Remarks and Program Evaluation**

2017 PRP Awardee Posters

Title	Presenter	Program
Lightweight, Wearable Energy Storage Devices for Fire Fighters and First Responders	Paa Kwasi Adusei	*University of Cincinnati, Mechanical and Materials Engineering*
Microbiome Changes as Markers of Exposure and Stress in Firefighters	Harish Chandra, PhD	*University of Cincinnati, Environmental Health*
Assessment of Diesel Particulates in Fire Departments Using Different Exposure Metrics	Jooyeon Hwang, PhD	*Western Kentucky University, Public Health*
Fabric Integrated Gas Sensors for First Responders and Miners	Sathya Narayan Kanakaraj	*University of Cincinnati, Mechanical and Materials Engineering*
Negative Responses to Workplace Incivility in Home Care Workers	Hanyi Min	*Bowling Green State University, Industrial Organizational Psychology*
Comparing Health Status and Exposure Risk in Career vs. Voluntary Firefighters	Cody Morris, PhD	*Western Kentucky University, Exercise Science*
Nanofabric to Protect Firefighters and First Responders from Toxins and Particles	Vianessa Ng	*University of Cincinnati, Mechanical and Materials Engineering*
Immunotoxicity of PFCs (Perfluoroalkyl Compounds) Found in Fire-Fighting Foams	Alison Pecquet	*University of Cincinnati, Environmental Health*
Well-Being of Youth Caregivers and its Effect on Pursuing a Career in Geriatrics	Jennifer Perion	*University of Toledo, Population Health*
Establishment of Aerosol Sampling Protocols Using Scanning Electron Microscopy (SEM) and Passive Air Sampler (PAS)	Jurate Virkutyte, PhD	*University of Cincinnati, Environmental Health*

Invited Posters

Title	Presenter	Program
Occupational Exposure to Aerosolized Drugs in Residential Environments: Physical Characterization (Simulation Study)	Yousef Elmashae	*University of Cincinnati, Environmental Health*
Proposal of a Comprehensive Mode-of-Action Model to Aid in Occupational Health and Safety Assessments of Airway Irritants	Evan Frank, PhD	*University of Cincinnati, Environmental Health*
Virtual Reality Applications in Education and Research	Eric Phillips	*University of Cincinnati, Mechanical Engineering*
An examination of the Musculoskeletal Impact of Residential Solar Panel Installation	Vince Guinsler	*Ohio University, Ergonomics and Occupational Safety*

2016-17 PRP Awardee Podium Abstracts

Inclined Surfaces - Impact on Postural Stability and Spine Loading

Noma Agbonifo (PI) and Kermit Davis
University of Cincinnati, Environmental Health

Purpose: The primary purpose is to understand the relationship between postural stability and spine loading during manual material lifting under various conditions including inclined surfaces, task asymmetry, and handling method.

Design: Repeated measures within-subject experimental design to collect electromyography (EMG), lumbar motion monitor (LMM) measurements, and center of pressure (COP) data on 10 healthy male participants.

Methods: Participants performed repeated sagittal and asymmetric (90^{o} right and 90^{o} left) lifts of an 8 kg box from three different shelf locations to waist height while standing on three surface inclines (0^{o}, 14^{o}, and 26^{o}). Data was analyzed using an EMG-assisted biomechanical model, using repeated-measures analysis of variance (ANOVA) and Tukey Studentized t-test.

Results: The main effect of surface inclination angle significantly impacted the three-dimensional (3D) spine loads [lateral shear ($p < .0001$), anterior-posterior (A-P) shear ($p < .0001$), and compression ($p < .0001$)] as well as the COP sway area ($p = 0.0006$) and path length ($p = 0.007$). Task asymmetry also significantly impacted compression ($p = 0.04$) and A-P shear ($p = 0.03$) forces, COP sway area ($p < .0001$) and path length ($p = 0.003$). The handling method only significantly impacted the 3D spine loads. Also, the interaction between asymmetry and handling method significantly impacted the compression and A-P shear forces. Participants' ratings of perceived exertion was significantly impacted by surface inclination angle ($p < .0001$).

Conclusion: Overall, the results of this study show that workers exposed to incline working surface such as the one evaluated in this study are potentially exposed to spine loading well above the acceptable tolerance limits and postural instability, which could potentially trigger the development of neuromuscular disorder or fall related fatalities/injuries.

Impact Statement: This study provides understanding on the potential link between postural stability and spine loading from MMH tasks on inclined surfaces. This understanding may potentially spur intervention strategies to mitigate potential exposures/injuries for workers daily exposed to inclined surfaces.

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

April Ames (PI) and Cathy Ross

University of Toledo, Population Health

Purpose: Little to no information is available on the airborne toxin microcystin (MC) on or near Lake Erie, which is an important issue for Northwest Ohio. To date, aerosol concentrations of microcystin have only been evaluated on smaller inland US lakes (Backer 2008; Backer et al., 2010; Murby and Haney, 2015) and there is a need to evaluate larger bodies of water like Lake Erie's western basin. The primary purpose of this study was to evaluate the application of an industrial hygiene (IH) sampling/analysis method in the detection of airborne microcystin in the Lake Erie region.

Design: The project included 1) a laboratory study evaluating filter extraction methods in order to determine the method with the highest extraction efficiency for use in the study; and 2) a field study examining the application of the IH sampling method on lakes with MC present.

Methods: First we evaluated different filter extraction methods by spiking known concentrations of MC to filters and applying extraction techniques with elements similar to those developed by Cheng et al. (2007), Enviro Team Building Diagnostics & IAQ North America (2016), and Giølme, N., & Utkilen, H. (1994). Airborne microcystin was then evaluated over two events on a Harmful Algal Bloom (HAB) impacted lake and one event on Lake Erie during an algal bloom. Air samples were collected using Whatman 41 filter paper loaded in an IOM sampler and connected to a battery operated sampling pump. A sampling flow rate of 9.0 L/min was used and verified through calibration. Filters were analyzed for microcystin by enzyme-linked immunosorbent assay (ELISA).

Results: The extraction efficiencies for extraction by filtration were overall much lower and three out of the six test concentrations had extraction efficiencies less than 100%. The 1.5 µg/L test concentration had the best extraction efficiency of 94.8%. In the field study, MC-RR was detected on all filters from the HAB impacted lake with a range of 0.07 ng/m^3 to 0.47 ng/m^3. All filters from Lake Erie during an algal bloom had detectable levels of airborne MC, ranging from 0.03 ng/m^3 to 0.06 ng/m^3.

Conclusion: The sampling method evaluated was successful in detecting airborne MC on Lake Erie during an algal bloom.

Impact Statement: The results from this study provide information on the suitability on an industrial hygiene method/analysis for use in monitoring microcystin in air. Currently, there is no standard filter extraction method from filters for airborne microcystin. This project evaluated different filter extraction methods for MC and identified extraction by filtration as the method with the best extraction efficiencies. The limited studies on airborne microcystin have been performed on smaller, inland lakes. This project was the first to sample and confirm the presence of airborne microcystin on the western basin of Lake Erie, a larger, shallow lake. Harmful algal blooms are on the increase in Lake Erie. While many lakes are impacted with HABs, regionally, Lake Erie is unique in part due to the large fishing industry. Further research may lead to models predicting MC levels for lake users.

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Intrinsic Factors that Influence Retention among Nursing Assistants

Megan Benner (PI) and Victoria Steiner

University of Toledo, Health and Recreation Professions

Purpose: The purpose of the research was to preliminarily test a new conceptual framework to determine the salience of factors related to intent to stay among Nusing Assistants (NA) prior to finalizing and testing the new model in a larger sample.
Design: This research occurred in two phases. **Phase I** was qualitative and included interviewing State Tested Nursing Assistants (STNAs) to explore their workplace experiences and establish and identify factors salient to intent to stay in their position. **Phase II** was quantitative and consisted of model development and finalization, as well as Structural Equation Modeling with MPlus in order to identify if the model designed was representative of STNA workplace experiences that predicate STNAs' decisions to stay in their positions at for profit SNFs.
Methods: **Phase I**. A random sample of STNAs employed at for-profit SNFs in the Midwestern United States participated in face-to-face interviews. The semi-structured interview covered 3 domains: basic psychological needs; physical and psychosocial well-being; and organizational commitment. Interview transcripts were analyzed and coded by the research team to identify broad concepts, recurrent themes, and quotes. In the final stage, the coding framework was applied to all data. Based on **Phase I** of the research a conceptual model was finalized and a series of validated and reliable measures were combined to create an STNA workplace experiences survey. In **Phase II** of this research, a random sample of 7150 Ohio STNAs from the Ohio Nurse Aide Registry were sent a postcard detailing how to access an online survey about their job experiences, and an additional 100 post cards were distributed at for-profit facilities in northwest Ohio. The STNA workplace experiences survey included a series of demographic questions and the following valid and reliable measures: Basic Psychological Needs at Work Scale (Baard, Deci, & Ryan, 2001), Rosenberg Self-Esteem Scale (Rosenberg et al., 1965) , Affective Commitment Scale (Allen & Meyer, 1990), Organizational Citizenship Behavior Checklist (Robinson & Morrison, 1995), and a measure of Intent to Stay (Price & Kim, 1995).
Results: The preliminary findings from **Phase I** provided a more comprehensive explanation of STNA's intent to stay. Findings from interviews with nine STNAs (1 Male, 8 Female) revealed five themes supportive of STNA intentions to stay in their positions including: (1) Work related self-confidence, (2) Knowledge and professional development, (3) The caring relationship (4) Workplace appreciation, and (5) Willingness to go above and beyond. In addition, four themes emerged that threatened STNA intentions to stay including: (1) Career advancement, (2) Disappointment with poor resident relationships (3) Indifference among supervisors, and (4) Frustration with limited teamwork. In addition, **Phase I** results supported the proposed conceptual model. The salient factors from each domain of the proposed model identified from prior research and the element of Organizational Citizenship Behavior, previously not included, were incorporated into the finalized conceptual model and survey for **Phase II**. **Phase II** descriptive statistics find the sample of STNAs in this study demographically similar to previously collected national data on nursing assistants (Centers for Disease Control and Prevention: National Nursing Assistant Survey, 2004). The STNAs (n=42) in **Phase II** were primarily female (n=25, 75.8%), white (n=26, 81.3%), non-Hispanic or Latino (n= 26, 81.3%), and between the ages of 25 and 54 years (n=23, 69.7%). Job tenure among the STNAs was also reflective of national data with the majority of respondents indicating that they had worked as an STNA for two years or greater (n= 26, 81.4%). An analysis of the total scores from each measure indicate moderate levels of basic psychological need fulfillment, organizational citizenship behavior, and affective commitment. Respondents had lower total scores on the measures of self esteem and intent to stay. Structural Equation Model analyses using MPlus are currently underway.
Conclusion: Phase I of the research identified that basic psychological need fulfillment was experienced among the STNAs through caring relationships with residents and social relationships with coworkers. In addition, occupational injury and protective protocols were their most important physical health concerns; and psychosocial health was impacted by job and personal stress. Experiences of workplace support and recognition for achievements influenced organizational commitment among the participants in **Phase I.** These findings indicate a need for responsive strategies at the facility level to address and reduce contributors to psychosocial stress among STNAs. Further, results indicate that facilities should focus on providing patient centered care to their residents by enabling STNAs to develop caring relationships with patients, which has been shown to be a primary driver of job satisfaction and retention behavior among STNAs. The results of Phase II should help guide retention efforts by guiding administrators and supervisors in the implementation of interventions and training to address the factors contributing to intent to stay among STNAs.
Impact Statement: This research provides insight to the struggles and detriments to STNA intention to stay and will help to create responsive and effective strategies to increase retention behavior among this integral direct care staff. The results also contribute to the body of research investigating the workplace experiences of STNAs and provide a unique perspective by examining STNAs at specifically for-profit facilities. This research corroborates previous research indicating the preponderance of emotional and physical stressors experienced by STNAs in the workplace and the impact of these stressors on the overall well-being of STNAs, facilities, and residents. Moving forward, future research can utilize the findings to examine the intent to stay in a larger sample of STNAs from different facility types, Long-Term Care providers, and/or geographic areas.
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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 to 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. Appropriate methods are needed for rapid and accurate assessment of the efficiency of control measures. 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 particulate matter <2.5 µm (PM2.5) with a simultaneous collection to a Teflon filter. This was a follow-up study built upon the data obtained in the Pilot Research Project 2015 grant, which focused on developing a correction factor for analysis of traffic-related airborne particles (TRAP) in the Cincinnati region. The study objective was to test another novel device, AethLabs microAeth® Black Carbon (BC) sensor. This effort benefited from an ongoing investigation funded by U.S. Department of Housing and Urban Development (HUD) Healthy Homes Technical Studies (HHTS). The HUD HHTS study was independently collecting PM2.5 and BC utilizing a SKC Impactor collocated with the MicroPEM™ and microAeth® devices. We hypothesized that the averaged microAeth® data, the MicroPEM™ BC filter data and the SKC BC filter data would be statistically similar. In the first specific aim, we determined the association between the microAeth® BC sensor, the BC collected on each MicroPEM™ filter, and the BC collected on each SKC filter in homes close to highways. A multiwavelength optical absorption technique was used to determine BC values for both the MicroPEM™ and SKC filters. The second specific aim was 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.

In conjunction with an ongoing HUD HHTS investigation, sampling was performed for 2 days for a total of 30 sampling events before any treatments occurred in the home, either a high efficiency particulate air (HEPA) filtration or a placebo HEPA. Preliminary results demonstrated the MicroPEM™ PM2.5 direct reading averaged data ranged from 2.1 to 77.2 µg/m3 with an overall average of 14.6 µg/m3 and the MicroPEM™ filter-based PM2.5 concentrations ranged from 0.4 to 45.6 µg/m3 with an average of 14.7 µg/m3. Due to the small flow rate the MicroPEM™ uses, most of the filters were lightly loaded and have larger detection limit-related bias. While we have not received data for 9 of the SKC samples, preliminary data showed the SKC filter-based PM2.5 ranged from 1.8 to 46.9 µg/m3 with an average of 11.6 µg/m3. The ratio between filter-based PM concentration and direct reading average PM concentration was examined for MicroPEM™ and SKC filters as correction factor. The results indicate that the correction factor utilizing MicroPEM™ was in the range between 0.5 and 10.1 with an average of 1.5 having a standard deviation of 1.9 and coefficient of variation (CV) of 127%. The correction factor utilizing SKC PM2.5 was in the range between 0.2 and 1.7 with an average of 0.96 having a standard deviation of 0.4 and CV=37%. This substantial variability in the MicroPEM™ correction factor and differences in CV between MicroPEM™ filters and SKC filters were largely due to the bias caused by small mass loading of MicroPEM™ filters.

The MicroPEM™ filter-based BC values ranged from 0.0 to 14.9 µg/m3 with an average of 1.1 µg/m3, the SKC filter-based BC values ranged from 0.1 to 4.3 µg/m3 with an average of 0.85 µg/m3, and the microAeth® BC sensor averaged values ranged from 0.9 to 7.9 µg/m3 with an overall average of 0.8 µg/m3. To evaluate the SKC filter-based BC data, the MicroPEM™ filter-based BC data and the microAeth® direct reading BC sensor, Wilcoxon signed-rank test and Spearman correlation coefficient were utilized. The microAeth® direct reading BC sensor was validated with the SKC filter-based BC sample with a correlation coefficient of 26% from 1. In addition, the MicroPEM™ black carbon data was also not correlated significantly with the SKC filter-based or microAeth® direct reading black carbon values. Variables, such as distance to highway, distance to interstate, season, number of trucks, household activities, and TRAP land use regression values were considered to see if there was any correlation with black carbon. TRAP land use regression value was the only variable significantly correlated ($r=0.56$, $p<0.01$).

The MicroPEM™ direct reading and microAeth® direct reading data for each sample was evaluated in a pair-wise comparison. While Wilcoxon analysis revealed there was a strong significant difference ($p<0.001$) between the two sets of data for all 30 samples, the Spearman correlation coefficient demonstrated that 20 out of the 30 pairs were significantly correlated. In addition, the direct reading data demonstrated visual trends that both PM2.5 and BC tend to spike around 6:00-7:00am, 7:00-8:00pm and 9:00-10:00pm.

Once all of the data is obtained, data analysis will be repeated for the correction factor of the direct reading MicroPEM™ data for operation in Cincinnati, Ohio. The microAeth® direct reading BC sensor was validated with the SKC filter-based BC values and once all of the data is obtained, further data analysis will be performed. The direct reading data collected from both the MicroPEM™ PM2.5 and the microAeth® BC sensor showed significant correlations with each other, and trends during higher traffic times of day. While the correlation coefficient was not 20% from 1, the intent of the specific aim to demonstrate a relationship with these two sensors was achieved. These sensors, once validated, will provide easy and useful tools to determine occupational exposure to traffic-related indoor air pollution. By ensuring that these new exposure monitors are capable of detecting diesel particles successfully, researchers and industrial hygienists will be armed with a user-friendly tool to monitor indoor air quality. ***Corresponding author:*** *Jennie Cox at roejd@mail.uc.edu*

Ergonomics in Veterinary Care

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Purpose: Studies have observed injuries and musculoskeletal discomforts among surgeons in human medicine. It is likely that veterinary surgeons endure similar musculoskeletal injuries; however, limited work has been done in this domain. Therefore, this research aims to identify occupational risk factors affecting the upper extremities of leading and assisting surgeons in orthopedic and soft tissue small animal surgeries. As a result, we aim to reduce surgeon injuries by assessing the surgical environment in veterinary care.

Design: A prospective observational study was conducted in the operating room during live veterinary surgery to determine self-reported musculoskeletal symptoms and objectively measure ergonomic risk factors with video and wearable physiological sensors.

Methods: To collect objective metrics, inertial measurement units (IMUs), heart rate monitors, and electromyography (EMG) sensors are used. In addition, surveys are used to evaluate perceived pain before and after surgery and the workload of the task. In total, 5 participants were studied over 26 surgeries.

Results: Postoperatively, neck discomfort was most commonly recorded. Neck discomfort was reported in two-thirds of the cases by the orthopedic surgeons and over one-third of the soft tissue surgeries. Average perceived workload was reported higher in orthopedic surgeries compared to soft tissue surgeries. When measuring the deltoid and trapezius muscle activities, orthopedic surgeons exerted about 21% of their maximum muscle force across the two muscle groups and soft tissue surgeons exerted 12%.

Conclusion: These results provide insight to surgeons' perceived workload and physical efforts associated with performing surgery, and further applications of this work may translate to modifications to surgical environments or additional surgeon education to reduce physical strains.

Impact Statement: The proposed study advances occupational health and safety innovation by a) being one of the first studies to quantify whole-body biomechanics in the operating room in veterinary medicine and developing detailed ergonomic exposures to musculoskeletal risk factors, and B) identifying potential user-centered interventions for reducing musculoskeletal fatigue and injuries in the workplace.

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Firefighter Physiological Health Assessment and Hazard Monitoring Device

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Based on data from a 2012 publication, firefighters experienced 61 deaths in 2011 [1]. Similarly, based on injury reporting for 2010 firefighters experienced 71,875 injuries due to the multitude of risk and hazards that they experienced in the profession when on active duty [2]. The purpose of this project is to create a novel device that is specifically designed to monitor the physiological status of active duty firefighters and report back with status updates, warnings, and hazard alerts encountered. Deeper exploration into the injuries and death statistics shows that active duty firefighters are highly vulnerable to hazards such as overexertion, low oxygen environments, falls, contact with objects, impact from objects, burns, hyperthermia, and carbon monoxide poisoning. The device developed in this research effort was designed to monitor exposure to these hazards through the use of five sensors including: pulse oximeter, pulse CO oximeter, accelerometer, skin temperature sensor, and suit humidity and temperature sensor. The device uses Bluetooth to transmit the information to a nearby computer. The method used to verify that the device is functioning properly involves use of commercially available devices to test the accuracy of the project device. The results show that the hardware of the device is functioning correctly. Further, the current rigid circuit board prototype is being adapted from a rigid arm band to a flexible patch design. While the software is capable of recording and processing the data from most of the sensors, further development is required for designing a risk and warning system for the processed data. In conclusion the device requires more work, with the software for the SpCO sensor and warning threat holds, and testing the device as a flexible patch. The completion of this device will have an impact because Firefighter's are at risk for both injury and death when on active duty from mainly overexertion and sudden events such as slips, falls, contact with objects, or impact from objects. The device developed through this research project will allow monitoring of the firefighter's physiological health and sudden events allowing the device to contact the supervisor to reduce the number of injuries and death from overexertion and to request immediate assistance for the sudden events. The project device shows the possibility to combine basic health assessment devices into a smaller wearable platform that can be used a warning system in the workplace.

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Enhanced Capture of Microbeads for Water Treatment

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Efficient detection of pathogens is essential to the development of a reliable point-of-care diagnostic device. Magnetophoretic separation, a technique used in microfluidic platforms, utilizes magnetic microbeads coated with specific antigens to bind and remove targeted biomolecules using an external magnetic field. In order to assure reliability and accuracy in the device, the efficient capture of these magnetic microbeads is extremely important. The purpose of this study was to analyze a microfluidic device that utilizes electroosmotic flow (EOF) and flow switching to increase capture efficiency in a portable chip device and then analyze bacteria capture in this 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. The capture efficiency was analyzed at two different bead concentrations using magnetic microbeads bound to a fluorescent tag, with the total fluorescence compared for captured versus uncaptured beads. The beads were then targeted to fluorescent bacteria to determine the capture of bacteria in water samples. The results showed a drastic increase in the capture of magnetic microbeads using the flow switching system. Under the steady-state flow protocol, capture efficiency was determined to range from 31% to 42%, while the switching flow protocol exhibited a capture efficiency of 71% to 85%, showing a relative increase of around 2 times the capture efficiency for the switching protocol. Bacteria tests are still ongoing, but have shown positive results in the tagging with microbeads and capture in the channel. These two outcomes highlight the potential of our microfluidic EOF device as a water analysis tool in a point-of-care setting. This device will be able to assist health workers in identifying hazardous water sources so that appropriate precautions can be taken to isolate the danger from the workers and the public.

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

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Purpose: Leveraging the theory of planned behavior (TPB; Ajzen, 1991; 2011), this study examined individuals' attitudinal and cognitive antecedents of older nurses' intentions to engage in Post-Retirement Employment (PRE) and actual planning for PRE.

Design: A cross-sectional survey design was used. Nurses from Ohio who are 45 years of age or older were recruited as the target sample for the current study.

Methods: The sample consists of 469 nurses from a variety of work settings. Participants were asked to complete an online survey containing various self-reports on their attitude toward, perceived control over, subjective norm about, intentions to engage in, and actual planning for post-retirement employment. Each participant received a monetary incentive for participation.

Results: Attitude and subjective norm but perceived control were significantly and positively related to older nurses' PRE intentions. Furthermore, attitude, perceived control, and subjective norm were significantly and positively related to actual planning for PRE. PRE intentions fully mediated the effect of attitude on older nurses' actual planning for PRE and partially mediated the effect of subjective norm on older nurses' actual planning for PRE. Finally, perceived control enhanced the positive effect of PRE intentions on older nurses' actual planning for PRE.

Conclusion: Overall, these findings contribute to the literature on post-retirement employment by testing the TPB framework, further increasing our understandings of why certain individual attitudinal and cognitive characteristics are particularly important to older nurses' post-retirement employment issues. Considering the great labor shortage in nursing, this study is very timely and provides several practical implications. Future interventions aiming to promote older nurses' PRE could focus on these three TPB components.

Impact statement: Theoretically, results of the present research contribute to existing literature of post-retirement employment by providing insights regarding the roles of individuals' attitude, perceived control, and subjective norm in the PRE process. Practically, this study provides implications to encourage post-retirement employment among nurses. The research also has implications for career counselors and human resource managers to consider nurses' attitude, control beliefs, and subjective norm regarding PRE in the career counseling process.

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UAV Use in Reducing Hazards for Firefighters During Emergency Response

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Purpose: Firefighters are potentially exposed to variety of hazards, both physical and chemical, when responding to emergency situations. The goal of this pilot research project was to determine the utility of Unmanned Aerial Vehicles (UAVs) in reducing these hazards to firefighters during emergency scenarios.

Design: A field evaluation was performed to 1) evaluate emergency scenarios through the use of commercially available UAVs equipped with high definition (HD) and infrared cameras for intelligence gathering and 2) the applicability of an air sampling apparatus on a drone for collection of gases and vapors.

Methods: Initially, the UAVs were evaluated for payload and the effect of environmental variables on flight time. Under a scenario completed with Toledo Fire a HD camera was used to evaluate firefighter's high ropes training exercises. During the exercise, multiple firefighters rappelled off of a 300 foot tower and practiced lowering a victim in a Stokes basket to the ground. The drone was deployed over the exercise and was used to evaluate the technique and procedures for instructional purposes. Under a separate exercise, a SKC Touch Pocket Pump and sample bag were attached to the underside of an UAV to collect grab air samples. A sample probe was extended approximately 18" perpendicular from the UAV to pull air ahead of the drone. The pump was programmed to run at 500 ml/min for 5 minutes and test runs performed.

Results: Over the course of the high ropes scenario, video and photos were collected from the drone. Subsequent to the drill, Toledo Fire used media for their debriefing to review the exercise and improve procedures. The best design for attaching a sampling bag to a drone and pulling a sample was determined and air samples were successfully collected from the UAV device.

Conclusion: UAVs were determined to be a useful tool that can be deployed by firefighters prior to a variety of emergency operations for scene evaluation, sample collection and visual identification of hazards prior to scene entry. Further investigation into the beneficial uses of UAV in the field of firefighting is needed.

Impact Statement: The use of UAVs is still in its infancy in the field of occupational safety and health and technology is continuing to evolve. Locally, the interest in collaboration is very strong and we will continue to investigate the value of UAVs in this field. The initial applications of air sample collection and evaluation of techniques are promising and will have a definite benefit of providing situational awareness and in protecting firefighters in the future.

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2017-18 PRP Awardee Poster Abstracts

Lightweight, Wearable Energy Storage Devices for Fire Fighters and First Responders

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Flexible and wearable electronics have become popular in this day and age and a lot of applications have been proposed for these. Wearable energy storage systems have applications that could provide power to a wide range of applications such as for medical bio-monitoring devices, military equipment, safety and construction gear like illuminated vests and for other devices used by first responders and low wage workers.

This proposal focuses on developing and providing energy storage devices (supercapacitors) made of nanomaterials (CNT and its composites) that are suitable and simple to incorporate into fabrics. Specifically in the fabrication of supercapacitors, CNTs have been found to be very effective and efficient. They have a relatively large surface area, high electrical conductivity, high mesoporosity, and high electrolyte accessibility which make them excellent materials to be used especially in the fabrication of supercapacitors. CNTs can also be drawn into fibers which makes it easier to incorporate into materials and to be used structurally.

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Microbiome Changes as Markers of Exposure and Stress in Firefighters

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Firefighters have been identified to be at a higher occupational risk for several health disorders such as cancers, cardiovascular problems, respiratory disorders, diabetes etc. Firefighters are regularly exposed to smoke and heat involving inhalation of toxic chemicals such as PAHs and particulates as well as stressful work environment. All these factors have the potential to alter the consortium of human microflora (microbiome). In this investigation, we hypothesize that fire-associated exposure may cause stress and gut microbiome perturbations in firefighters which may interact with other prevailing physiological stress factors thereby increasing the risk for occupational diseases. We propose to compare the gut microbiome of firefighters from their fecal samples using 16S rRNA gene-based nextgen sequencing and identify the microbiome constituents associated with occupational PAH exposure. We will further correlate the microbiome changes with the exposure data and other metadata collected using a study questionnaire. Completion of the study is expected to identify specific gut microbiome constituents and changes associated with the firefighters. Further analysis will provide insights into role of microbiome dysbiosis in predisposing firefighters to occupational health risks.

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Assessment of Diesel Particulates in Fire Departments Using Different Exposure Metrics

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Firefighters are exposed to many known carcinogens including diesel particulate matter (DPM). The International Agency for Research on Cancer has linked diesel engine exhaust to cancer sites in humans (IARC, 2013). Firefighters in small, rural fire departments in particular spend more time at the fire department, as they are likely to have a lower number of calls (runs). Also, air monitoring systems in those fire departments tend to receive less maintenance due to budget constraints. Due to the length of exposure to DPM and less frequently maintained air monitoring systems, firefighters may be at greater risk for cancer development.

The goal of this study is to improve the health of firefighters by assessing health-relevant carcinogenic exposures. Airborne samples of DPM based on elemental and organic carbon mass concentrations (integrated) and particle number and mass concentrations (direct-reading) will be collected in fire stations in northwestern Kentucky. A comparison of different areas in the fire station, such as the vehicle bay, kitchen/dining area, dorm area, and training room/office, will provide more in-depth knowledge on DPM exposure through the industrial hygiene observations. The concentration levels of DPM in fire departments can be used by the scientific community to better understand firefighter cancer studies. The knowledge gained from this study will provide firefighters with information critical for implementing needed guidelines for monitoring air systems in vehicle bays, storing turnout gear, and running apparatus or equipment, especially in small, rural fire departments.

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Negative Responses to Workplace Incivility in Home Care Workers

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Home care is an occupation where employees work inside client's home and workplace mistreatment can be very detrimental because the workers lack the necessary social support after experiencing incivility (Barling, Rogers, & Kelloway, 2001). Retention of home care workers is a major challenge for this field given its high and growing market demand (Bercovitz et al, 2011). As a type of mistreatment, incivility is defined as "low-intensity deviant behavior with ambiguous intent to harm the target, in violation of workplace norms for mutual respect. Uncivil behaviors are characteristically rude and discourteous, displaying a lack of regard for others" (Anderson & Pearson, 1999; p.457). The nature of low-intensity and ambiguous intent makes incivility occur frequently in workplace yet usually neglected by organizations. However, incivility can escalate into more severe forms of mistreatment with obvious intention to harm others.

Our study aims to study home care workers' negative emotional and behavioral responses to workplace incivility. Different from previous studies, we categorize negative emotions into approach-related and avoidant-related emotions by their associations with the motivational system (Bauer & Spector, 2015) and negative behaviors (i.e., counterproductive work behavior) into active versus passive forms of CWBs.

Another unique contribution of our study is that we will examine group differences between minorities and majorities. An overwhelming majority of home care workers were non-Hispanic (90.2%) and female (95.0%)" (Bercovitz et al, 2011; p. 3). Previous research (e.g., Kern & Grandey, 2009) examined race differences in the relationship between incivility and emotional exhaustion. Our study will extend prior research by examining the relationship between incivility and home care employees' emotional and behavioral responses. Another limitation of previous research is that the work context was not taken into consideration. Our study will overcome this limitation by asking participants to report their demographic information and the gender/race ratio among their organizations and work teams.

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Comparing Health Status and Exposure Risk in Career vs. Voluntary Firefighters

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The wearing of protective turnout gear and personal protective equipment (PPE) can pose a substantial challenge in addition to the tasks necessary for firefighting. The elevated heart rate response combined with the rise in core temperature places a considerable challenge on the body. Even firefighters who are considered experts in their field can experience a severe physiological challenge based on unpredictable environmental conditions, especially if they lack an adequate level of fitness. Further work needs to be conducted on the effects exercise or physical exertion has on the body in regards to reaction time (RT), while also looking at task complexity and physiological stressors the body can have to respond to while making a crucial decision. The purpose of this study will be to evaluate potential differences in health and physical fitness status between members of a volunteer firefighting department vs. members of a professional firefighting department. An additional purpose will be to evaluate if firefighters will exhibit an increase in markers of physiological stress during a simulated fire suppression work circuit while wearing full turnout gear compared to when performing the simulated fire suppression work circuit in standard athletic attire. The research protocol will consist of three testing days, with the first dedicated to a health and physical fitness assessment and the second and third dedicated to a physiological evaluation during a simulated fire suppression work circuit. The health and physical fitness assessment will involve testing the 5 components of health-related fitness (body composition, cardiovascular fitness, muscular strength, muscular endurance, and flexibility) using previously published and accepted protocols. The physiological evaluation during the simulated tactical occupation workload will consist of evaluating and monitoring firefighters while completing a 6-min simulated fire stair climb in measuring the following variables: reaction time, core temperature, physiological strain index, blood lactate, and salivary cortisol. This study will attempt to fill a key gap in the literature in that no study has directly evaluated many of the previously mentioned variables in firefighters simultaneously during a simulated fire suppression task. In addition, none to-date have directly compared the physical fitness or health status of firefighters from professional departments versus those firefighters who are members of a volunteer department. This will be a key research question to answer as it could have potential workplace safety and policy-altering ramifications.

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Nanofabric to Protect Firefighters and First Responders from Toxins and Particles

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First responders (i.e. law enforcement, fire, emergency medical personnel) work in a dangerous profession and are subjected to a multitude of health and safety threats. They are the first to deal with any type of crisis: from pubic health threats such as contamination, to fires, bomb threats, to a terrorist attack. First responders face heat stress and heat exhaustion in their work which will decrease their performance and increase their risk for injury or death. Current garments are made of a nylon fiber composite material, which includes Dupont's Kevlar and/or Nomex used to protect the wearer from outside environment (i.e. bullets, puncture, fire, chemicals). However, these materials, if exposed to chlorine or other chemicals break down. Washing also causes deterioration, and tumble drying above 160F causes the material to shrink and wrinkle [Int.'l Fabricare Institute Bulletin's Fabrics and Fashion's FF-394 "Nomex and Kevlar" (1991)]. Deterioration of the garment can cause long-term lung damage to the wearer from airborne fibrils [Dupont's "Nomex Brand Fiber" MSDS (1999)]. Therefore, the firefighter must wear a respirator to minimize respiratory injury from particles released from the garment, and from the toxic chemicals and particles produced by the fire. We propose to supplement these existing materials with a novel nanofabric made of carbon hybrid nanomaterial. CNT sheets have no significant adverse health effects, and are pliable and light weight with high mechanical, electrical, and thermal properties, high heat dissipation, and fire resistance. Firefighter nanofabric can be strong, tough, and will wick perspiration to increase evaporation and cool the skin due to high thermal conductivity, low specific heat, and large surface area. Moreover, UC has recently developed a method (patent pending) to hybridize the CNT sheet by incorporating nanoparticles within the synthesis process to add functional properties to the sheet. Particles such as granular activated carbon, titanium dioxide, silver can provide protection from certain toxic chemicals and biological materials. In this project, CNT nanofabric will be synthesized and characterized for quality, thermal, mechanical and electrical properties, and chemical and particle filtering. Fabric samples will also be provided to industry for evaluation.

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Immunotoxicity of PFCs (Perfluoroalkyl Compounds) Found in Fire-Fighting Foams

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The overall objective of this project is to investigate the immunotoxicity from perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) in highly exposed occupational populations. PFOA and PFOS are used in fire-fighting foams, and exposures of fire fighters occur during foam application, or from the burning and breakdown of various consumer products that contain PFOA/PFOS during a fire. Firefighters have high body burdens of PFOA and PFOS in the serum, alongside other occupations such as PFC manufacturing. Increased risk estimates were found in firefighters for the immune-cell related cancers multiple myeloma and non-Hodgkin lymphoma. PFOA and PFOS are "presumed to be an immune hazard to humans" by the National Toxicology Program based on multiple alterations to the immune system in both experimental animals and humans. Mechanisms related to PFOS-induced cytokine inhibition were related to disruption of cell signaling (NF-kB) activation pathways. PFOA induced aspects of cellular immune responses related to inflammatory pathways (IL-1β, NF-kB, MyD88), which have been implemented in disease development.

However, these responses were conflicted in the literature, suggesting further research is needed to identify the impacts of pathway perturbation at doses relevant to human exposures. The complexities of dose-response behavior may reflect competing roles of different regulators of receptor pathways, as shown for estrogenic chemicals. A potential modifier of this response could be through receptor activation (peroxisome proliferator-activated receptor - PPAR), as PFOA and PFOS are known PPAR ligands and modulate inflammatory immune pathways. **We hypothesize** that competing pathways are modulating the initial innate inflammatory response from PFOA/PFOS exposure in a dose- and chemical-dependent manner. The role of each pathway in modulating the innate immune response will be tested and dose-response data will be generated in two specific aims:

1. Expose human cell lines to PFOA and PFOS at a range of doses of human-relevance and identify significant alterations in pro-inflammatory gene expression (IL-1β, NF-kB, MyD88), including the role of PPAR in modulating the immune response.
2. In cells exposed as part of Aim 1, we will investigate PFOA- and PFOS-induced global gene perturbation using RNASeq and identify any novel immune-gene pathways that are altered from exposure.

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Well-Being of Youth Caregivers and its Effect on Pursuing a Career in Geriatrics

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The United States (U.S.) health care system lacks a sufficient geriatrics health care workforce, and is ill prepared to meet the needs of an aging population. Family caregivers, considered a "shadow workforce", fill the gap by performing tasks that often fall under the realm of professional health care services such as wound care or administering intravenous medications. Most research related to family caregivers has focused on adult children or spouses and has overlooked the 1.3 to 1.4 million adolescents 8 to 18 years of age providing significant support and care for family members, who are most commonly individuals with dementia. The purpose of this research study is to improve the scientific understanding of the experiences of adolescents who enter the unpaid healthcare workforce, providing care for a family member with dementia, and how this role affects their psychological health and well-being. The findings will contribute to the development of strategies that enable adolescents in the care of older adults with dementia. Future NIH funding will be used to develop an innovative approach that combines support and education tailored to adolescent caregivers while addressing the shortage of geriatrics health care workers through the recruitment of these experienced caregivers into a career in aging.

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Fabric Integrated Gas Sensors for First Responders and Miners

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The critical factor for death in fires is not burns but smoke inhalation. It used to be that our households and workplaces were furnished with either glass, ceramics, wood or metals. But with the advent of polymer chemistry, they have become a cheap alternative and fill every nook and cranny of our living and working space. These pose a new set of even deadlier threats. As a fire grows it often consumes a major portion of available oxygen, leading to incomplete combustion of synthetic materials. This results in the release of toxic gases. This project proposes to design a lightweight and highly accurate gas sensing material into fabric that can be worn safely. There currently exists bulky sensors that have latencies in detection and short life times. Carbon Nanotubes and Graphene prove to be a better alternative for these heavy, metal- based sensors. They have a much higher surface area and functionality for sensing usage. Carbon monoxide, Methane and Dihydrogen sulphide will be focused upon.

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Establishment of Aerosol Sampling Protocols Using Scanning Electron Microscopy (SEM) and Passive Air Sampler (PAS)

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Aerosol exposure assessment is important for the overall assessment of health risks to various work populations, including health care workers (HCW). Inhalation or skin contact with aerosols generated during cleaning procedures in health care environments, particularly from disinfectants and cleaning agents have been linked to a variety of health effects. While studies have been conducted to address exposure of HCWs to airborne particulate hazards, there is a need for developing a reliable sampling protocol, which would adequately account for the environmental factors and the workplace specifics of health care settings. A new protocol utilizing the scanning electron microscopy (SEM) and the passive air sampler (PAS) will be developed in the proposed pilot study. A sampling setup will include an SEM stub with Formvar sticky carbon for passive sampling of aerosol particles. It will be placed in a temperature and humidity controlled chamber. Saline, one of the most widely used solutions in the health care settings will be aerosolized in the chamber and collected by the PAC. The samples will be analyzed by environmental SEM under low-vac conditions for the particle distribution, their size and shape and composition. To confirm that the sampling protocol is adequate, the control samples with 0.1 M NaCl concentrations dispersed on the stubs will be analyzed on environmental SEM for particle distribution, size, shape and composition and compared to the aerosolized sample. Upon validation of the new protocol, it will be used for a grant application on the field assessment of exposure of HCWs to chemical and biological aerosol hazards. The proposed effort combining a novel approach (using SEM stubs as PAS with a proven particle morphology determination (SEM/EDS), will lead to the development of aerosol sampling protocol for HCWs. It will be further utilized for field exposure assessment of HCWs in hospitals and home health care environments.

The overall goal of this project is to develop reliable aerosol sampling protocol that is transferrable to other aerosols relevant to the health care by focusing on the use of SEM stubs as PAS and environmental SEM.

Hypothesis: PAS and experimental setup provides adequate data to develop reliable aerosol sampling protocol.

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Invited Poster Presentation Abstracts

Occupational Exposure to Aerosolized Drugs in Residential Environments: Physical Characterization (Simulation Study)

Yousef Elmashae[1], Sergey A. Grinshpun[1,] Tiina Reponen[1], Michael Yermakov[1], Evan Frank[1], Michael Benjamin[1], Andrew Maier[1], Nicholas Newman[2]

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Purpose: This study aimed at assessing the inhalation aerosol exposure of a home healthcare worker (HCW) treating a patient with aerosolized drugs using a nebulizer. The secondary goal was to determine whether NaCl can serve as a surrogate of aerosolized drugs to be used in future field studies.

Background: Home-attending HCWs may be exposed to a wide range of hazardous aerosols, including pharmaceuticals that they administer to patients. For example, a nebulizer treatment can cause a greater exposure risk as compared to giving the same medication orally or intravenously. Inhalation exposure of home HCWs has not been quantified, and it is not clear if this exposure is significant.

Methods: A two-manikin set-up was designed and built for this study with one manikin simulating a patient and the other simulating a HCW administering a medical nebulizer treatment. Four aerosolized drugs (Ipratropium Bromide, Budesonide, Albuterol Sulfate, and NaCl) were evaluated in individual trials. Each treatment was aerosolized from liquid suspension using a commercially available nebulizer-based aerosol delivery system in a small chamber housed inside a Biosafety Cabinet. Deionized water was used as a control. The aerosol concentration and particle size distribution were measured using an Electrical Low Pressure Impactor at three locations of the HCW-simulating manikin relative to the aerosol source.

Results: The aerosol concentrations were significantly (up to four orders of magnitude, depending on the particle size) higher for each of the four medications compared to deionized water. The total aerosol concentration in the breathing zone exceeded 1 g/m^3 in some cases suggesting a potential inhalation exposure risk to a HCW providing the treatment. There were no significant differences between the total mass concentrations of the three selected medications versus NaCl; therefore, NaCl could serve as a surrogate of common nebulizer-administered aerosolized drugs.

Conclusions: The findings of this pilot study suggest that exposure of a HCW to aerosolized drugs may be significant and that NaCl can be used as a surrogate for medications administered by nebulization in future experiments.

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Proposal of a Comprehensive Mode-of-Action Model to Aid in Occupational Health and Safety Assessments of Airway Irritants

Evan Frank, Mary Beth Genter, Lynne Haber, Andy Maier
University of Cincinnati, Environmental Health

Airway disease related to exposure to chemical irritants is the most common manifestation of occupational illness and respiratory tract irritation is frequently used as a critical effect in setting airborne occupational exposure limit values. This process currently involves testing in animal models and human subjects, both of which are expensive and time-consuming methods. The biological basis of irritant-induced occupational airway conditions, which include chronic cough, non-allergic rhinitis, and irritant asthma, is complex and a comprehensive understanding of mechanisms enables more efficient and accurate hazard assessment. This review proposes a mode-of-action pathway model that integrates diverse irritant classes into a mechanistic framework to support development of low-cost alternatives to animal and human testing. We propose a pathway model where signaling cross-talk between chemosensation in nociceptive nerves and inflammation in airway epithelium mediates long -lived adverse outcomes, therefore toxic initiating events that cause signaling input into these pathways may cause or influence the potential for airway disease. Toxic initiating events include engagement of transient receptor potential (TRP) channels, oxidation of organelles, and initiation of inflammatory signaling in epithelial and immune cells. The overall hypothesis of this project is that assessment of a toxicant's activity through these mechanisms using low-cost in vitro tests can help predict in vivo airway irritancy and risk of adverse outcomes in humans. A low-cost, easily reproducible system validating this hypothesis will be of high value in screening, prioritization, and estimation of relative potency among chemical irritants and data-poor occupational toxicants.

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An examination of the Musculoskeletal Impact of Residential Solar Panel Installation

Vince Guinsler

Ohio University, Ergonomics and Occupational Safety

Purpose: The purpose of this study is to identify the musculoskeletal risks posed by residential solar panel installation to workers.

Design: My study utilizes the ergonomic modeling software 3DSSPP to analyze the physical impact of a residential solar installation on the installer.

Method: This is done by identifying the key postures utilized by installers during the installation process and utilizing the modelling software to assess those postures.

Results: The results are still being gathered.

Conclusion: A conclusion will be made based on the data gathered as to which postures are risks to installer safety, with suggestions for mediations on how to minimize those risks.

Impact statement: This project aims to give workers in the rapidly growing field of residential solar installation the information needed to work more safely. The relative modernity and rapid growth of the industry has led to a gap in the safety information available to installers, especially regarding the postures and positions that are most hazardous to workers while installing solar panels. The results of this study will illuminate the postures that pose a health and safety risk to installers as well as the interventions that can be applied to mediate these risks.

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Virtual Reality Applications in Education and Research

Eric Phillips
University of Cincinnati, Mechanical Engineering

Virtual Reality (VR) is an emerging technology, and has many potential applications. This research project looked at some of the potential uses of VR in education. Specifically, it examined how VR could be used in undergraduate level mechanical engineering classes. This research project was performed as a self-designed undergraduate research experience for the University of Cincinnati Honors Program.

The heart of this project was the creation of two VR applications which could be used as a tool to explore different integrations of VR in a classroom. The first application is more advanced and extremely interactive experience. It provides the user with a collection of building blocks in a playground environment. The user can use these in any way they wish. For example, a student could use this to reconstruct textbook problems and interact with them dynamically, watching all the physics play out in the virtual world.

The second application is a much less interactive experience, and is better suited for people who are new to VR. It is primarily a model visualization tool, with some extra fun interactions thrown in. Within the app, the user can pick up different machines and place them on a holographic scanner. The scanner then projects an interactive view of the internals of the machine out into space. On the scanner console, are numerous controls, which allow the user to change how the machine is projected. These include everything from the transparency level to false coloring to the speed at which the machine is running (some of the models are fully animated). This app allows a student to easily understand how a mechanism works, and could be adapted to include specific machines which a professor might choose to talk about in class.

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We are especially grateful to the AIHA Ohio Valley Section for their generous support of the Annual PRP Symposium.

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