

# 2023 ERC REGIONAL SYMPOSIUM

April 14th, 2023

Ann Arbor, MI

---

## POSTER SESSION

South Lounge

---

Sponsored by the NIOSH Education &  
Research Centers at the University of  
Cincinnati, University of Illinois at Chicago &  
University of Michigan

# RYAN BELLACOV

University of Cincinnati

---

## Measuring Hazardous Pollutant Levels in Fire Stations

**Background:** This study aims to investigate the risk factor of diesel exhaust from fire engines, focusing on the living quarters of a fire station environment. Firefighters often work in unpredictable environments involving a variety of hazards such as fire, mental and physical stress, chemicals, and air pollutants. Another potential hazard for firefighters is long-term exposure to diesel emissions from diesel combustion because diesel exhaust may enter not only the engine bay but also the firefighters' living quarters. With lengthier shifts than many other careers, firefighters can be exposed to diesel exhaust for a significant portion of their shifts while at their fire station.

**Objective:** Multiple air quality monitoring sensors were deployed to determine whether pollutants within fire stations are influenced by the activity of fire engines and the distance from fire engines.

**Results:** Air quality monitoring results show a correlation between some pollutants with the distance from the fire engine and the number of fire engine activities completed per day.

**Conclusion:** As part of their everyday duties, firefighters, while rescuing people, put their well-being at risk with possible injuries and death. While not all of the pollutants examined were found to have escaped into the living and working quarters within the fire stations, it is clear work needs to progress to further minimize the pollutants dispersing throughout the buildings. In the future, more studies are needed to address how to minimize pollutants within the living quarters of a fire station.

# SHELBY BRAND

## University of Illinois Chicago

---

### **Self-Perception among College Graduates with and without Disabilities when Entering the Job Market**

It is well-known that persons with a disability are less likely to be in the labor force than persons without a disability. Most literature focuses on barriers to employment, neglecting the job search and application process. The purpose of this study is to examine the experiences, abilities, and self-efficacy of students and recent graduates, with and without disabilities, when applying for jobs and entering the job market.

At the time of submission, we analyzed data from 157 respondents. Eligible study participants are English-speaking adults (18+) who plan to graduate technical school, college, or university between May 2023 - December 2023 or graduated between December 2021 - December 2022. All recruitment was done electronically, and the survey took place through Qualtrics.

This study is a one-time, cross-sectional survey design. The 14-item Job Search Efficacy (JES) Factor (scale 0-9; 0 very little, 9 very much) of the Career Search Efficacy Scale addressed self-efficacy. Questions about the application, work goals, and disability disclosure were shaped from reoccurring themes in the literature.

Overall JES looked at the mean score for all 14 questions. Although not statistically significant, persons with a disability had a lower mean score of 6, compared to persons without a disability, who had 6.3. Five of the fourteen questions were statistically significant. When analyzing the relationship between JES and if a job application hindered an applicant's ability to apply for a job, I found that the odds of having low job search efficacy are 4 times greater among people who are hindered by the job application process than those who did not report being hindered by the job application process.

This research will benefit job seekers with disabilities because it will identify if barriers exist when preparing to apply for jobs and within the job application itself. This data will allow us to guide universities and employers on system changes that need to be made to provide equal employment opportunities for persons with and without a disability.

# AFTON ERBE

University of Cincinnati

---

## **Mental Health and Suicide Risk Among Veterinarians: An Integrative Review**

**Introduction:** Veterinarians are at increased risk of mental health issues and suicide in comparison to the general public. These individuals are exposed to a number of occupational hazards and often report increased rates of stress and higher rates of burnout in comparison to their physician counterparts. The aim of this integrative review is to explore the major salient factors contributing to mental health issues and suicide among veterinarians.

**Method:** This integrative review was completed using the five-step methodological approach as described by Whittemore and Knafl: problem identification, literature search, data evaluation, data synthesis, and presentation.

**Findings:** There were five main themes identified throughout the literature: (1) occupational stress and burnout, (2) increased risk of mental health issues and suicide, (3) risk factors for development of mental health issues and suicide, (4) stigma, and (5) euthanasia.

**Discussion:** A better understanding of mental health and suicide risk among veterinarians will allow for future development of prevention strategies and interventions to improve resilience, mental health outcomes, and reduce the number of suicides in this population.

**Conclusion:** Occupational health providers can provide a unique perspective when it comes to management of occupational hazards among the veterinary industry. In addition, they can contribute to future research and development of interdisciplinary treatment interventions to address psychological distress, suicidal ideations, and suicidal behaviors among veterinarians.

# MARCOS GONZALEZ

University of Illinois Chicago

---

## **Occupational Assessment of Air Quality in Metal Sculptors' Studios**

Metal sculptors are those who shape, form, and expose the hidden nature of metals: an inanimate object is brought to life using tools of creation such as forging, grinding, and welding. The art piece is subject to all forms of manipulation to reach its achieved state; metal processes include grinding for polish, chemical exposure and etching for patinas, smashing and milling for shapes, abrading for texture, and heating to conjoin or deconstruct pieces. These techniques and processes generate metal dust, fine particles, and fumes detrimental to human health. Little research has been conducted on artists' exposure to such environments. To address this gap, we conducted indoor air monitoring in three Chicagoland metal sculptor studios. Indoor air quality (IAQ) and particulate matter (PM 2.5 , PM 4 , and PM 10 ) concentrations were monitored real-time; particle diameter and size were also characterized. Our IAQ data showed a range of daily averages of 0 ppm, 563 - 776 ppm, 13.0 - 15.7 °C, and 22.3 -31.3% for carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), temperature (°C) and relative humidity (%) respectively. PMs had a daily mean exposure range from 12 - 65 µg/m<sup>3</sup> for PM 2.5 , 13 - 73 µg/m<sup>3</sup> for PM 4, and 17-114 µg/m<sup>3</sup> for PM 10 . 76-96% of the particle sizes were bound in the range 0.3 - 0.579 µm. All locations were owned by independent workers, with only one using local exhaust ventilation and the other two utilizing dilution ventilation. Findings suggest that sculptors are at risk of heavy metal intoxication due to the materials and processes they use. Artist studios are unregulated and understudied, often not considered workplaces with occupational/environmental health hazards. Further studies of private metal sculpting studios are needed to determine which practices pose the greatest risk.

# FLORENCE JOHNSON

University of Michigan

---

## **Examining How Community Support Services Impact the Mental Health of Black Family Caregivers of People living with Dementia in the Community**

**Background:** Family caregiving is a highly stressful commitment with poor health outcomes for caregivers, especially Black caregivers of persons living with dementia. Black family caregivers are seldom prepared for the challenges of dementia care for a loved one. These caregivers carry a higher burden of care and may experience more isolation, loneliness, hardship, and diminished quality of life than other caregivers. Stress can affect caregiver health by elevating blood pressure, causing weight change, headaches, and other symptoms. Chronic depression, anxiety, and isolation are also widespread among family caregivers but may be minimized by support services such as support groups, dementia training, friends to talk to, and respite, which may reduce stress. This study examines the relationship between Black caregiver depression and community-based support services.

**Method:** We linked nationally representative cross-sectional data from the 2015 round 5 of the National Health and Aging Trends Study and round II of the National Study of Caregiving to give us the most significant sample of older adults and caregivers. The subset of dementia classification data of care recipients with dementia (N = 1,027) and their unpaid family caregivers (N = 1,046) was used to examine depression in family caregivers. Logistic regression stratified by race was used to examine the correlation between support service use and depression.

**Results:** Sample size: 65% White female, 69% Black female; 33% were male, and 67% were female. 24% of White caregivers reported being depressed compared to 17.5% of Black caregivers. 323 caregivers reported working for pay. Black caregivers to people with probable dementia, 22% reported being depressed and 31% of White caregivers. In the possible dementia category, 23% of Black caregivers reported being depressed and 29% of White caregivers reported depression.

**Conclusions:** The results emphasize that caregivers of people with probable dementia are likely to be older and less educated than caregivers of those with possible or non-possible dementia. Poor caregiver mental health outcomes remain a concern given the documented heavier care burden carried by Black family caregivers. These findings may inform policies and interventions to support caregivers of people with dementia.

# AURORA LE

University of Michigan

---

## **Evaluating Occupational Biohazards, Stress, and Readiness for Uptake of Total Worker Health Interventions in U.S. Waste Workers**

Waste workers experience occupational hazards daily. Particularly, solid waste workers are exposed to bioaerosols, bloodborne pathogens, and human and animal excrements in the process of collecting, sorting, and disposing waste. Together, the constant chronic biological occupational exposures can result in elevated stress. Occupational stress, in turn, can result in increased injury and illness rates among workers. Significant research, both in and outside of the United States, has been conducted on waste workers regarding their chemical and ergonomic occupational exposures. However, information about the biological exposures of U.S. waste workers and their associated workplace stress is limited despite comparable risks to biohazards as healthcare workers. Evidence suggests that Total Worker Health (TWH) approaches are efficacious in addressing both the physical and psychosocial stressors of the workplace, but to our knowledge, this has not been explored among U.S. waste workers.

We proposed a comprehensive assessment of a sample of U.S. solid waste workers to determine occupational biohazard exposures and knowledge and training to mitigate these hazards. Additionally, perceived occupational stress and readiness for uptake of TWH interventions will be measured using existing validated assessment tools. Perceived self-reported stress will be compared to the worker's physiological stress via collection of saliva samples to analyze cortisol levels. The proposed study generated pilot data that can be used for the future development of TWH interventions, as well as bolstered biohazard training and education to improve the health, safety, and wellbeing of this overlooked yet vulnerable population of solid waste workers.

# YIFAN LI

University of Michigan

---

## **Total Remote Worker Health: Developing a Remote Assessment Instrument of Physical, Emotional, and Musculoskeletal Health for Individuals who Work From Home**

**Background:** The shift to remote work in 2020 presented a wide-scale novel work environment while introducing new cognitive and physical challenges. Remote work at scale prompted a need for an assessment tool that a worker could administer autonomously to determine the risk of musculoskeletal disorders (MSD) and worker health, which is the primary issue this project aims to address.

**Method:** The method for developing this tool involved a review of the existing ergonomic tools commonly used by trained ergonomic professionals (RULA, REBA, SI, OWAS, OCRA, QEC, ACGIH TLV for HAL, and Body Discomfort Maps were evaluated) to identify which aspects could be implemented autonomously by an untrained remote or hybrid worker in their environment. Key elements of the existing tools measuring duration of a task, frequency, posture, duty cycle, workspace layout, and individual factors were used as input for assessing worker health.

**Results:** The most suitable tools for adaptation to remote ergonomic assessment were RULA & ROSA for spatial components. OCRA, ACGIH TLV and Strain index for temporal aspects of movement patterns. BORG and QEC are additional tools to be used to quantify force exertions.

**Conclusion & Discussion:** Future work needs to test the validity of the proposed remote ergonomic tool in both lab and remote office settings. The development of a valid remote ergonomic assessment will allow businesses to extend their wellness programs to incorporate and address the needs of remote workers. Developing ergonomic tools specifically tailored to worker environments should reduce risk of job-related injury and promote worker well-being, job satisfaction, and retention.



# GIANN MUNAR

University of Illinois Chicago

---

## **Occupational Exposures to Volatile Organic Compounds among Healthcare Workers in a Pathology Department**

Chemical exposures among healthcare workers are a serious occupational hazard that may cause various health problems and could lead to both acute and chronic health issues. Pathology departments commonly use volatile organic compounds (VOCs) for autopsy rooms, or as a dehydrating agent during staining, tissue processing or mixture processing. This study aims to assess whether the presence of formaldehyde, methanol and xylene within the pathology department exceeds occupational exposure levels set by occupational health and safety agencies, and inform how the department could control these chemical exposures through occupational control recommendations. Both personal and area sampling were conducted within a pathology department in a Chicago hospital through passive VOC samplers. A total of 21 samples were collected during this investigation. The range of time-weighted average (ranging from 42 to 240 mins) concentrations were 0.25-65 ppm for xylene and 5-80 ppm for methanol, all of which were below their occupational limits. For formaldehyde, the range of time-weighted average (TWA) concentrations was 0.02 to 0.42 ppm, and one out of 9 samples exceeded the ACGIH threshold limit value for full-shift exposure and one out of 3 samples exceeded the ACGIH threshold limit value for short-term exposure. According to the AIHA Exposure Control Categories, xylene has an exposure rating of 0 with formaldehyde having an exposure rating of 2. Current ventilation and work practices (such as wearing personal protective equipment, fume hoods to control vapor exposure) can keep inhalation exposure below threshold values. Other occupational recommendations include implementing other engineering controls such as absorbent pads under chemical containers and rubber toppers to plug sink. Further studies include conducting a health risk assessment through respiratory health evaluation among workers and further surveillance of volatile organic compounds.

### **Fit testing of N95 Respirators fitted with an ear loop strap system and the Novel Face Seal**

Respiratory protection protocols adopted worldwide during the COVID-19 pandemic made it mandatory to wear facemasks and National Institute for Occupational Safety and Health (NIOSH)-approved N95 filtering facepiece respirators (FFRs). Workers using facemasks and FFRs in various occupational environments, as well as the general population prefer to utilize an ear loop straps system (ELSS). Respiratory protective devices equipped with ELSS are claimed to be easier to wear than the conventional FFRs, which use two headbands, one on the head and one behind the neck. Some users convert the universal strap system to the ELSS. The first objective of this study was to evaluate how the conversion impacts the fit of N95 FFRs. Additionally, a novel face seal (NFS) technology was deployed to modify the ELSS-converted N95 FFRs. The NFS was designed around the critical zones in human facial anatomy that are most likely to leak and has been previously demonstrated to enhance the fit of N95 FFRs. The second objective was to evaluate the effect of ELSS plus NFS on the N95 respirator fit.

The Occupational Safety and Health Administration (OSHA)-approved quantitative fit testing (QNFT) was performed on 16 human subjects exposed to sodium chloride (NaCl) challenge aerosol. Three models of cup-shaped N95 FFRs were tested in three versions: the standard version with universal strap system, the ELSS-converted, and the ELSS-converted version modified by adding the NFS. We found that the FFR model and the strap system version are significant factors impacting the respirator fit factor (FF) and fit testing pass rate ( $FF \geq 100$ ). The QNFT demonstrated that the conversion to ELSS decreases the respirator fit. However, the data reveal a significant improvement in the overall FF as well as in the fit testing pass rate resulting from adding the NFS to the ELSS-converted respirator. The study findings suggest that the designs of ELSS combined with NFS has a potential for developing a “universally-fitting” FFR that can be used by the public in case of future disease outbreaks.

# LAURA RIDGE

Funding by University of Michigan 2022  
University of Cincinnati

---

## **Needlestick Injury, Incidence, and risk factors among healthcare workers in Liberia and Ghana**

**Background:** Needlestick, or sharps, injuries are an important occupational hazard for healthcare workers worldwide that can transmit HIV and Hepatitis B and C. There has been highly limited research on sharps injuries among healthcare workers in West Africa, despite the prevalence of HIV and HBV in that region. Ghana and Liberia, two countries in West Africa, are collectively home to 36 million people. One prior study in Ghana, from a tertiary care facility, indicated many sharps injuries might be concentrated among a relatively small group of workers. Purpose: The purpose of this research was to establish the frequency, risk factors, and management patterns, of sharps injuries among healthcare workers throughout Liberia and Ghana.

**Methods:** A 50-item Qualtrics survey was developed and validated by researchers and subject matter experts with experience in Liberia and Ghana. The survey was sent to healthcare workers in both countries via professional association membership lists. Informed consent was obtained prior to beginning survey. Descriptive and analytic statistics were used to calculate frequency of needlesticks and identify risk factors associated with injury, particularly frequent injury (three or more injuries in the last twelve months).

**Findings:** There were a total of 847 respondents; 80 in Liberia and 767 in Ghana. The average number of reported needlestick injuries in the survey was 1.06 in Ghana and 1.75 in Liberia. Midwives had the largest percentage of frequently injured workers (17.8%), and physician assistants had the smallest percentage (12.9%). In Ghana, frequently-injured workers had statistically significantly lower scores ( $p < 0.01$ ) on a sharps handling knowledge scale than other workers. No statistically significant relationship was observed between the workers' responses to the CDC's Stop Sticks Scale (Ghana  $p = 0.07$ , Liberia  $p = 0.17$ ) and whether or not the workers were frequently injured.

**Discussion:** This data indicates sharps injuries are a major occupational hazard among healthcare in Liberia and Ghana. It also indicates there is a subpopulation of frequently injured workers in both Liberia and Ghana who might benefit from an educational intervention focused on safe sharps handling. Further research into what form such an intervention could take to be most effective would likely benefit these workers.

# ABAS SHKEMBI

University of Michigan

---

## **Assessing the State of Occupational Justice in MI**

Workplaces present a tremendous variety of hazards (e.g., physical, chemical, psychosocial). While exposures to environmental hazards such as air pollution can be considerable, occupational exposures are often orders of magnitude greater than environmental exposures and present concordantly higher disease risk to communities. Of particular susceptibility to these higher risks are low-wage and racial/ethnic minority workers, who are more likely to work in hazardous workplaces. As such, occupational exposures should not be discounted in assessments of environmental justice. This descriptive study sought to examine the state of occupational justice in Michigan, collectively with environmental justice. Six novel occupational indicators for each census tract in Michigan were constructed: one chemical hazard (exposure to contaminants); three physical hazards (exposure to hazardous equipment, hazardous conditions, and noise exposure); and two biological hazards (exposure to disease/infections and physical proximity to other workers). Frequency of exposure was assessed via the Department of Labor's O\*NET and combined with Census tract-level data of total employment count by major occupational groups to create a weighted frequency score for each Michigan tract. This data was combined with metrics of environmental hazards and vulnerable population characteristics from the EPA EJScreen. Results showed that the percentage of racial/ethnic minorities and low-income individuals across Michigan is positively associated with higher frequency of exposure to hazardous occupational exposures. A cumulative "OEJ" index score which incorporates measures of occupational hazards alongside environmental exposures and vulnerable population characteristics was developed to identify the most vulnerable communities in Michigan. This index highlights that occupational exposures should be considered in assessments of environmental justice in Michigan, that EJ screening tools such as should consider incorporating such measures, and reaffirms the 8th principle of environmental justice of all workers' right "to a safe and healthy work environment without being forced to choose between an unsafe livelihood and unemployment.

# TOLU SOLOMAN

University of Illinois Chicago

---

## **Physical Ergonomic Intervention to Address Lower Back Musculoskeletal Pains Among Environmental Health and Safety Technicians - A Participatory Ergonomic Intervention**

**Background:** Many musculoskeletal disorders (MSDs) are workplace posture-related, and regions including the back, shoulders, elbows, neck, and wrists are commonly affected by postural problems. MSDs can often affect muscles, tendons, cartilage, nerves, joints, and spinal disks (Katie, 2014). The two categories of MSDs are cumulative trauma and strains/sprains, and both categories are significantly impacted by posture.

**Methods:** This study was an implementation of a small-scale organization ergonomic intervention. Radiation technicians were observed while they performed their tasks. A survey was given to ascertain how much lower back, neck, and shoulder pain subjects have experienced in the last week, the last 12 months, and their lifetime. A physical intervention was then implemented for two weeks. After the implementation, the participants were again observed to evaluate the success of the intervention. For this research, a one-arm pre-post study design was employed to assess the effect of the intervention after implementation.

**Results:** During this task, four technicians were observed, and attention was paid to regions like the elbow, neck, lower and upper back, wrist, and shoulders to determine whether they were in a neutral or non-neutral position and how often it occurred. The currently used instrument for radiation assessment (Pancake) was substituted for an alternative instrument (End window).

After the intervention, data shows that the alternative instrument enabled technicians to maintain a more neutral position while they performed their tasks due to the location of the reading window on the instrument. In contrast to prior intervention, all four participants confirmed decreased tension in their lower back, neck, and shoulders when asked.

**Conclusion:** This intervention showed the efficacy of a physical ergonomic intervention, which aligns with the study performed by Hoe et al. (2018). The implication of this study could lead to institutional policy change to help workers in this department experience fewer MSDs going forward.

# KAMOLNAT TABATTANON

University of Michigan

---

## **Environmental Interventions to Support Motor Planning in Older Workers who use Manual Wheelchairs**

Environmental interventions provide a promising opportunity to support inclusive mobility in our rapidly changing society and workforce. Trends for aging into mobility disability, working into older age, and burdens of unpaid caregiving are on the rise. Equitable mobility is an urgent need, but current evaluation methods are biased. This pilot investigation compares older adults 50+ years who use manual wheelchair (MWC) with aged-matched simulated impairment (SI) participants to illustrate population bias using our proposed novel intervention evaluation methods assessments.

Novel methods improve on traditional measures. We propose that understanding how internal representations of tasks from user perception can:

- Inform effective task-environment interactions
- Reduce bias in HF/E evaluations
- Aid visibility of workers with disability

# BROCK WILLETT

University of Michigan

---

## **Impact of Nurse Wellness Initiatives on Burnout**

**Background:** Promoting wellness within nursing is crucial to decreasing burnout. In nursing, there are many factors impacting the quality of health. With burnout on the rise, healthcare systems are seeking ways to combat burnout. The purpose of this DNP project explores the impact of a wellness program on burnout using Michigan Medicine nursing staff in the Medial Short Stay Unit during four-weeks.

**Methods:** The Ottawa Model of Research Use evaluated the interventions and allowed for continuous improvement measures. For evaluation, the Oldenburg Burnout Inventory (OLBI) was used to give a composite burnout score. This baseline assessment of burnout helps examine the impact of wellness program. Participants were given pre-OLBI and participated in a fourweek wellness initiative centered on stress first-aid, cognitive behavior, body scanning and breathing techniques. A post-OLBI was administered to examine the impact of the wellness program.

**Results:** TBD.

**Conclusion:** Nursing staff buy in of the wellness program is crucial to sustainability moving forward. Once staff can conceptualize the importance and impact that wellness programs have on burnout, they are more likely to advocate for its growth. These interventions act as baseline knowledge for continued efforts supporting the wellbeing of healthcare employees.

### **Compositional Variations in Metal Nanoparticle Components of Welding Fumes Impact Lung Epithelial Cell Toxicity**

Welding is an essential modern manufacturing technology, with more than a million estimated full time welders employed worldwide. Welding fumes are generated during the process which contain harmful metal components and gas by-products. There exists an occupational risk associated with welding fume exposures consisting of lung dysfunction, asthma, bronchitis, and lung cancer. Two of the most prominent particulate metal components in welding fumes include nano-sized iron (Fe) and manganese (Mn) which can deposit within the lung including oxidative stress and inflammation resulting in pulmonary injury and contributing to disease development. Toxicity resulting from welding fume exposure is likely variable based on alterations in metal nanoparticle (NP) components. To examine toxicity associated with the NP components of welding fumes, a system was constructed for the controlled and continuous generation of NPs from commercial welding rods and customized electrodes which varied based on their proportions of Fe and Mn. Aerosols generated from the system were found to consist of particles with a mean diameter within the nanosize range while also being compositionally consistent with the percentage of metals of their electrode. Human alveolar epithelial cells were exposed to freshly generated NP mixtures at a target concentration of 50  $\mu\text{g}/\text{m}^3$  for 6 h and then harvested for assessment of cytotoxicity, generation of reactive oxygen species (ROS), and alterations in expression of genes and proteins involved in metal transport, metal storage, inflammatory responses, and oxidative stress. Exposure to all aerosols decreased cell viability and induced ROS production. Assessment of gene expression demonstrated up-regulation in cellular mechanisms related to metal transport and storage, inflammation and oxidative stress that were variable between aerosols due to distinct metal compositions of the aerosols produced from the electrodes. Specifically, interleukin-8 was determined to be the primary cytokine mediating inflammatory responses in alveolar epithelial cells following NP mixture exposures. Overall, this study demonstrated variations in cellular responses to aerosolized metal NPs suggesting compositional variations in NP content within welding fumes may influence inhalation toxicity.



# JING YANG

Purdue University

---

## **Design of Computer-vision Based System for Multi-person Ergonomics Assessment in Veterinary Practice**

Compared with other occupations, veterinary medicine, and animal care (VMAC) has the 2nd highest incidence rate for nonfatal occupational injuries and illnesses<sup>1</sup>. However, limited work has been done to understand and address the unique contributors to injuries in VMAC. Despite the availability of observer-based checklists and sensor-based techniques, they may not be the best approaches for ergonomic risk factors assessment due to their interference with workflow. To have an easy-to-use and accurate ergonomic risk assessment in real-world operational environments, several research gaps need to be addressed: specifically, non-intrusive techniques for continuous work ergonomics assessment. To fill the gap in this field, we propose a novel ergonomic risk management tool using computer vision that performs an automatic ergonomic assessment for multiple veterinary practitioners, either individually or collectively, under challenging acquisition conditions without the need for wearables.

# RACHEL ZEILER

University of Cincinnati

---

## Effects of Chronic Heat Stress and Shift Work on Postural Stability in Firefighters: a Pilot Study

**Problem:** Firefighters are routinely subjected to extended work shifts (24-hours), disrupted sleep during the night, and external and metabolic heat. Acute exposure to such hazards has been associated with many adverse health effects conditions including, fatigue and postural instability. However, the long-term effects of the combination of extended shifts and heat stress are less studied. The purpose of this study was to understand how chronic exposure to heat stress and extended shifts impacts postural stability and functional stability.

**Methods:** Exposure to heat stress and shift work were quantified using self-reported work history: average hours worked/week, average EMS runs/week, average heavy smoke/fire runs/week, and job tenure. Force platform technology was used to measure slight changes in the center of pressure (COP) and quantify static postural balance. Four test conditions were used to test the sensory afferents: A-baseline, standing on two feet, eyes open; B-two feet, eyes closed; L-one foot, eyes open; M-one foot, eyes closed. Dynamic postural balance was assessed using an instrumented-timed-up-and-go (iTUG) test. Sensors measured linear acceleration and angular velocity during the test to quantify Gait outcomes. A dual task test (subtraction by three) was used to test the subject's motor function while performing a mentally stimulating task. Multivariate linear regressions were used to understand the relationship between exposure variables (heat stress and shiftwork) and balance metrics. Additionally, a two-sample t-test was used to determine if there were significant differences between gait outcomes in single and dual task tests.

**Findings:** Greater fire run and EMS runs/week were associated with poorer static balance when visual pathways were limited ( $p < 0.05$ ). When vision and proprioception were limited, age and hours worked/week were associated with poorer static balance ( $p < 0.05$ ).

Cadence (pace), turn velocity, stride mean, and range of motion at the hip were significantly worse during dual task compared to single-task gait ( $p < 0.05$ ). Longer job tenure was associated with slower turns and taking more steps (less stability) during single and dual task. More EMS runs/week were associated with taking more steps during single task, but not dual task.

**Conclusions:** Increasing age and exposure to shiftwork and heat stress detrimentally affect postural balance. Performing mentally stimulating tasks disrupt motor function and may put firefighters at a greater risk for falls during job tasks.

# ANUM ZIA

University of Michigan

---

## **The association between gender and occupational stress level on the medical staff in a Maternity Hospital for a low-income population in Pakistan**

**Background and Objectives:** Medical staff can experience acute or chronic stress depending on their workplace setting. They work long, rough hours in hectic environments and care for multiple patients. Patients belonging to impoverished areas have added problems. Hence, they are more challenging to handle. Medical staff dealing with maternity patients with low socioeconomic status have a more difficult time as stress is a conducive factor to organizational inefficiency. The outcomes of stress can be significant as it has both short-term and long-term effects on mental and physical health. Developing countries around the globe have lower health advantages than affluent countries. Very little work is done for medical staff working in different occupational settings, especially in underdeveloped nations. This project was conducted at Janki Devi Hospital, a hospital in an impoverished area of Pakistan, to assess the effect of occupational stress levels on the male and female medical staff with respect to socioeconomic and health confounders.

**Approach:** Data was collected from a convenience sample of 51 medical staff consisting of nurses, doctors, and ward boys through an anonymous health-based survey, which was given out to all staff members. The survey questions were derived using a previous literature review considering occupational stressors in a medical setting. The occupational stress level was evaluated through a Perceived Stress Scale (PSS) with a score ranging from (0 - never to 10 - Extremely High). R Studio is being used for data analysis. The association between different parameters is being analyzed using regression analysis, Chi-squared test and summary statistics. The socioeconomic and health confounders are also identified.

**Outcomes:** The sample consisted of 25% males and 75% females. Majority of the participants fall between 41-50 years. Females had higher stress levels in comparison to males. Low pay ( $p$  value=0.0006) was a significant confounder, but weather conditions, no pensions, and night shifts didn't affect the association between Gender and Rate of stress. According to Pearson's Chi-squared test, there is a strong association ( $p$ -value = 0.00013) between gender and muscle pain. Observational analysis and survey helped to assess multiple occupational stressors in the work setting. Some observations highlighted how gender roles affected stress levels, like women with children highlighted it as a significant stressor. Similarly, men had more coordinated work ethics. Due to the limited nature of the study, the results are still being refined. Data analysis is ongoing.

**Conclusions:** The findings can help to devise an intervention to improve hospital management structure to reduce occupational stress levels. The major limitation was the sample size and lack of generalizability. Future studies should opt for a bigger cohort size and a more gender-balanced population.