

2024 Research Day Symposium

Abstracts and Authors

Table of Contents

Platform Presentation Authors

1. [Channing Bice](#)
2. [Colton Castro](#)
3. [Ana de Oliveira Pereira](#)
4. [Rachel Perpich](#)
5. [Nick Stoll](#)
6. [Megan Zaiger](#)
7. [Tony Zbysinski](#)

Climate Change Poster Authors

1. [Erin Bammann](#)
2. [Miranda Daly](#)
3. [Karely Villarreal Hernandez](#)
4. [Yessica Martinez](#)
5. [Jacob Smoot](#)

Ergonomics & Safety

1. [Denali Sanders](#)
2. [Amanda Skidmore](#)

Health Physics

1. [Raissa Chunko](#)
2. [Michaela Harris](#)
3. [Rebecca Mueller](#)
4. [Sarah Sublett](#)
5. [Paige Witter](#)

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1. [Rachel Ain](#)
2. [Matthew Russell](#)

Occupational Health Psychology

1. [Kinjal Chheda](#)
2. [Asia Cutforth & Pari Thibodeau](#)
3. [Shelby Davis](#)
4. [Ryan Lizerbram](#)
5. [Brittany Lynner](#)
6. [Katie McMahon](#)
7. [Rosalyn Stoa](#)
8. [Danielle West](#)

Total Worker Health

1. [Amy Dye-Robinson](#)
2. [Cedra Goldman](#)
3. [Sarah Levine](#)
4. [Julia Pangalangan](#)

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Navigating the Breeze: Lessons from the Air Aware Campaign in Shaping Outdoor Workers' Behaviors

Author: Channing Bice

Abstract: Outdoor workers are among the most vulnerable to climate change-related health harm, particularly those from poor air quality exposure. Recognizing this population's vulnerability and the need for health-related organizational communication research, researchers collaborated with local government organizations to develop the Air Aware social marketing campaign, which was implemented from June to September 2023. Campaign messaging encouraged workers to take four health-protective actions in response to periods of poor air quality: choosing low-intensity activities (CLIA), rescheduling high-intensity activities (RHIA), taking more breaks (TMB), and wearing an N95 mask (WNM). The goal of this study, guided by the Theory of Planned Behavior (TPB), is to determine how the campaign affected behavioral intention through changes in attitudes, subjective norms, and perceived behavioral control. The study utilized a quasi-experimental design to collect post-intervention data from the control and treatment groups to assess campaign efficacy. Preliminary results revealed that the campaign alone did not significantly impact the intention to adopt one of the four health-protective actions promoted in the campaign. However, there was a significant indirect effect of campaign exposure on CLIA intentions attributable to changes in attitude ($ab1 = .09 [.01, .23]$) and TMB intentions through changes in subjective norms ($ab2 = .13 [.01, .30]$). These results offer insights into the complex psychosocial, environmental, and workplace factors that influence outdoor workers' adoption of specific health-protective actions during periods of poor air quality. More detailed findings as well as theoretical and practical implications will be discussed further on Research Day.

Funding: This work was supported under Assistance Agreement No. 84036301-0 awarded by the U.S. Environmental Protection Agency and CDC/NIOSH T42 OH009229 Mountain and Plains Education and Research Center.

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Direct-On-Filter Analysis and Limitations of Amorphous Silica Analysis Amongst Sugarcane Cutters

Author: Colton Castro

Abstract: In the last 30 years, chronic kidney disease of unknown origin (CKDu) has been widely recognized as an epidemic in Latin America. Specifically, in agricultural communities, sugarcane cutters are experiencing a high burden of disease. Several hypotheses exist as to the cause of the unknown disease (i.e., dehydration and thermal stress). Our research group is focused on exposure to particulate matter (PM) and associated constituents (e.g., amorphous silica), which have nephrotoxic potential. Sugarcane workers resuspend high concentrations of PM (and likely amorphous silica) when cutting and harvesting the cane. Therefore, quantitating amorphous silica and determining if it can play a role in kidney injury has become a priority in our research. We aimed to develop a predictive model using Fourier-Transformed-Infrared Spectroscopy (FTIR) to analyze amorphous silica. FTIR is a non-destructive method that can analyze samples in a rapid and cost-effective manner as compared to using X-ray diffraction. The model was created, and initial concentrations of amorphous silica were determined based on methods previously described. The work described here will focus on determining the limit of detection (LOD) of amorphous silica when using direct-on-filter FTIR. The LOD was determined by using FTIR to analyze lab-collected air samples of known concentrations of amorphous silica by aerosolizing diatomaceous earth in an exposure chamber. After aerosolization, air samples were collected using a cyclone sampler and pump that sampled across different durations to yield a range of diatomaceous earth amounts collected. Results will be presented at the MAP ERC Research Day. The results of this study will enable researchers to determine if the model is feasible to continue using in the research being conducted on sugarcane cutters and CKDu. Additionally, the results will be compared to current LOD values for the FTIR methods employed by NIOSH for their silica analysis tool.


Funding: This research was funded with support from the CDC/NIOSH Mountain and Plains Education and Research Center (MAP ERC) and the National Institute of Environmental Health Sciences (NIEHS; 1R01ES031585)

Pantaleon supported the research being conducted during the field campaigns in Guatemala. Support included local office and lab spaces, transportation to the site, and access to their workforce, and also included housing.

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Strategies in Return to Work in Work-Related Concussions

Author: Ana de Oliveira Pereira

Abstract: Concussions or mild traumatic brain injuries (mTBIs) are the most common types of traumatic brain injuries. Concussions occur secondary to external forces on the head that may lead to temporary or permanent memory and cognitive and functional impairments. Concussions tend to be underreported by patients and underrecognized by healthcare professionals. About 10% of concussions in the United States are work-related. Although the overall incidence of concussions has been declining, work-related concussions have been on the rise, reflecting a failure of preventive interventions in the workplace. The majority of cases recover in the first month post mTBIs. However, a subset of patients with risk factors such as previous concussions, history of migraines, and associated traumatic injuries, among others, may have a prolonged recovery, incurring significant medical expenses and wages and job losses. We reviewed the most current literature on work-related concussions and their guidelines for systematic return to work for workers in safety-sensitive and non-safety-sensitive jobs, aiming to update occupational healthcare providers in the diagnosis and management of workers with mild traumatic brain injuries.

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Perceptions of Supportive Organizational Practices and Well-being among LGBQ+ Employees

Author: Rachel Perpich

Abstract: Given the growing recognition for the importance and benefits of diversity, equity, and inclusion (DEI) initiatives, it is necessary to understand how organizational efforts to support and retain the rising population of sexual minority workers are perceived by these employees. The purpose of the current study is to examine the relationships between perceptions of supportive organizational practices, perceived organizational support, and worker well-being among LGBQ+ employees. Participants included 352 LGBQ+ individuals recruited via Prolific who completed online surveys at two time points. I hypothesized that LGBQ+ employees who reported their organization having supportive organizational practices would perceive more support from their organization and have more favorable reports of well-being. Additionally, I expected sexual orientation identity centrality to moderate the relationship between perceptions of LGBQ+ supportive practices and general perceptions of organizational support. Results show support for all hypothesized relationships besides those including anxiety symptoms. Specifically, LGBQ+ employees who reported more favorable (i.e., higher) perceptions of LGBQ+ supportive practices also perceived more general support from their organization, which ultimately served as a mechanism for higher reports of job satisfaction and work-life balance and lower reports of depressive symptoms. Additionally, the relationship between perceptions of LGBQ+ supportive organizational practices and perceptions of general organizational support was stronger for employees who identified their sexual orientation as more central to their identity. The present study contributes to a growing body of literature on sexual orientation and work by providing empirical support for the relationship between LGBQ+ employees' perceptions of workplace practices, perceptions of support, and important well-being indicators, including job satisfaction, mental health, and work-life balance.

Funding: This research was supported by the Mountains and Plains Education and Research Center, Grant T42OH009229, funded by the U.S. Centers for Disease Control and Prevention National Institute for Occupational Safety and Health. Additional funding was provided by the CSU Industrial-Organizational Psychology doctoral program Kraiger Research Award.

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An Agriculture Worker Wellbeing Assessment from a Total Worker Health® Perspective

Author: Nick Stoll

Introduction: The agriculture industry has been historically known for its hazardous conditions. With worker morbidity and mortality rates often higher than other hazardous industries, health practitioners need to understand the current state of this populations health. While occupational risk factors have been readily identified in the agriculture industry, the health status and needs of agriculture workers vary due to industry sectors and other local context. Because of this, the literature on agriculture worker health and wellness ranges in the breadth of its coverage, and agreeance in health status. Using a Total Worker Health® framework, we developed a wellbeing assessment for agriculture workers in the San Luis Valley, Colorado.

Methods: A Total Worker Health® approach was used to develop an assessment survey. Using portions of the NIOSH WellBQ; GAD-7; and CES-D, we quantify worker wellbeing (psychosocial and physical health indicators), anxiety, and depression. A needs assessment guided by a community advisory panel allowed Ag workers to identify the top stressors for their wellbeing, while individual and organizational social network mapping provided contexts for sources of social support and community resources.

Results: Approximately 118 participants responded to our survey with a completion rate adequate for analysis. This presentation will describe worker wellbeing through measures of job satisfaction, coworker support, work affect, work fatigue, overall health status, chronic health conditions, individual stress, general mental health status, substance use, work injury, social support, anxiety, and depression.

Conclusion: This work will aid in addressing a behavioral health deficit within the agriculture workforce – a disproportionately impacted and underserved population, and introduce a wellbeing assessment for agriculture workers through a work-centric perspective.

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Investigation of Detonation Nanodiamond Adsorption Rates for Radioactive Cesium in Water Samples

Author: Megan Zaiger


Abstract: The accident at the Fukushima Nuclear Power Plant in 2011 resulted in the generation of radioactively contaminated water which had to be stored on site for long periods of time. To deal with this waste, the reactor operator TEPCO has begun to release the water into the ocean after most of the radioactivity has been removed by the Advanced Liquid Processing System (ALPS) process. To ensure that all radioisotopes of concern have been removed from the water, it is necessary to quantify ultra-low levels of radiocesium. The currently available techniques for this measurement are very labor and time intensive. The need for efficient, rapid, and reliable methods for the determination of radiocesium in ocean water represents a critical gap that this work seeks to address. A new technique using Prussian blue coated detonation nanodiamonds (DND) to adsorb radioactive cesium from water samples is currently being studied in the Sudowe Lab. Adsorption to coated nanodiamonds was found to be very effective for drinking water samples. The current study focuses on the effect of varying pH, temperature, competing ions, and low amounts of stable cesium on the adsorption behavior. A High Purity Germanium (HPGe) detector was used to measure the amount of Cs-137 remaining in solution after contact with the DND. The data was then used to calculate the percent adsorption based on the initial amount of Cs-137 present. The compared data was used to calculate adsorption rates and put into a scatter plot for analysis.

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Ionizing Radiation and Mortality: Unraveling Neurocognitive Risks in a Worker Cohort

Author: Tony Zbysinski

Abstract: Current radiation safety regulations are based on data and results from populations exposed to acute high dose radiation, with lack of strong evidence for low dose IR health effects. This study investigates ionizing radiation's (IR) impact on neurocognitive-related mortality risk among occupationally exposed workers, aiming to help bridge this specific gap with respect to chronic low dose IR research. The study will leverage data from the Fernald cohort of the U.S. Million Person Study (MPS), which has a population of workers who processed uranium and were exposed to chronic low dose IR and other chemical hazards. We will explore potential amplification of risk by chemical co-exposures and analyze mortality by job category. The following co-exposures will be assessed for effect modification: NO₂/HNO₃, machining fluids, vehicle exhaust, welding fumes, TCE, asbestos dust, silica dust, coal dust, uranium dust, and tributyl phosphate and kerosene. Multivariable regression that considers time to mortality, Cox Proportional Hazards regression, will be used to examine mortality risk for neurocognitive outcomes. It is anticipated that co-exposure to chemicals already strongly associated with neurocognitive outcomes, such as vehicle exhaust or welding fumes, will further increase the risk of neurocognitive mortality. Results of this research will better our understanding of low dose IR and its effects on neurocognitive health outcomes and aid in guiding radiation safety policy. Furthermore, mortality by specific job category results will assist in directing future investigations and safety implementation. In these contexts where both IR and chemical co-exposures are present, work design interventions are of high value due to the nature of the work being completed.

Funding: This work is supported by the Mountain and Plains Education and Research Center, a NIOSH education and research center for occupational and environmental health and safety.

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Heat Related Illness and Considerations for Adverse Long-Term Effects in Firefighters: A Case of Acute Kidney Injury in a 30-year-old Male Firefighter Recruit with Acquired Solitary Kidney

Author: Erin Bammann

Abstract: A 30-year-old male firefighter recruit with a history of acquired solitary kidney, peptic ulcer disease secondary to H. Pylori complicated by GI bleed, and recent gastroenteritis presented to workers' compensation clinic for evaluation after having an approximately 10-second-long syncopal episode the day prior while doing tower laps in full gear for training. Upon further work-up he was found to also have an acute kidney injury (AKI) and his syncopal episode was attributed to heat related illness (HRI). HRI refers to hyperthermia accompanied by end-organ damage but without significant neurological manifestations. Global temperatures and frequency of heat waves are increasing as a result of climate change, which has led to higher burden of disease from HRI. Firefighters frequently experience HRI in their training and work due to hypovolemia and hyperthermia. Contributing factors to HRI risk include high outdoor temperatures, long hours, personal protective equipment, and individual vulnerability to heat. In addition to the harmful effects of acute HRI, it is important to consider the long-term effects of repeated incidences, particularly given HRI is often underreported and many short-term effects, such as AKI, may consequently go unnoticed. There are many risk factors for AKI and chronic kidney disease (CKD) among which solitary kidney is considered an independent risk factor for developing CKD. Moreover, repeated AKI is associated with long-term health consequences such as development and progression of CKD, adverse cardiovascular events, and mortality. Therefore, firefighters and recruits should be screened for risk factors contributing to AKI and CKD and counseled appropriately on risks in the clinical setting.

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Set When the Sun Rises, Rise When the Sun Sets: Climate Change Adaptive Strategies and Related Needs of Small Holder Farmers in Vietnam


Author: Dr. Miranda Daly Ph.D.

Vietnam is one of the countries most at risk for experiencing climate change. Agricultural production is one of the biggest contributors to Vietnam's economy. Recently research has explored how climate change will impact agriculture in Vietnam. However, the impact of climate change to the health, safety, and wellbeing of Vietnamese farmers is often overlooked. In this study we conducted five focus groups with 44 farmers representing three provinces of Vietnam. We used a combination of qualitative data collection techniques including listing, pile sorting, and qualitative vignettes to assess how farmers in Vietnam experience climate change related hazards, determine how farmers associate these hazards with impacts to their health, safety, and wellbeing, and assess any gender differences. Multidimensional scaling and thematic analysis of our data indicated farmers perceive both direct and indirect impacts of climate change to their health, safety, and wellbeing. Direct impacts of climate change included physical health effects such as heat-stress. Indirect impacts included mental health stressors due to productivity demands. Gaps in available health and safety trainings for farmers were also identified. Differences in perceptions by gender were not observed. This project demonstrates the need to co-develop safety and health trainings with farmers. Trainings related to preventing and responding to heat-stress should be prioritized. The local governments, cooperatives, Women's Unions, and Farmers' Unions are trusted sources of information that could implement and disseminate these trainings.

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The CHAP I Study: Characterizing Workday Core Body Temperature, Heat Exposure, and Heat Strain in Guatemalan Sugarcane Workers

Author: Karely Villarreal Hernandez

Background: Agricultural workers are at high risk for heat related illnesses when performing heavy labor in hot and humid conditions. Occupational heat strain, the physiological response to heat stress, is believed to be common in this worker population but has rarely been measured objectively, through core body temperature (T_c). **Methods:** In the “CKDu Heat and Air Pollution Study” (CHAP I), we characterized T_c via an ingestible pill across the workday to understand the incidence of occupational heat strain among 69 male Guatemalan sugarcane workers. We examined environmental temperature and humidity collected simultaneously using data loggers which workers wore externally during their workday.

Results: Trajectories of workday heat/humidity exposure and response (T_c) data will be presented. We found heat strain (T_c > 38° C) to be common among workers (41%), and that T_c continued to rise during the workday despite rest breaks.


Discussion/Conclusions: These data provide initial insights to the daily physiologic response to heat stress experienced by sugarcane workers during their workday and will help to inform future intervention research to mitigate the health risks associated with occupational heat exposure.

Funding: NIEHS R01 ES031585

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"The Most Important Thing is to Know What to Wear When Working in the Sun": Crop Workers Perspectives on Workwear.

Author: Yessica Martinez

Background. Crop workers face increasingly hot working conditions. Wearing light-colored, breathable clothing and wide-brimmed hats, on top of having water, rest, and shade, can reduce the risk of heat illness among crop workers. Clothing preferences and limited access may prevent crop workers from wearing optimal work apparel. However, little is known about crop workers' clothing preferences and their experiences in acquiring work clothing.

Objective. This qualitative study aimed to learn Spanish-speaking crop workers' ideal work clothes and identify primary barriers to wearing clothes that reduce heat-related illness risks.

Methods. Four focus groups were conducted in Spanish on vegetable farms in Colorado during August and September 2023. Two researchers thematically analyzed detailed focus group notes.

Results. Fifty-four Spanish-speaking crop workers participated in focus groups during August and September 2023. Findings show that participants know which work clothing options protect from heat-related illnesses. Participants described purchasing their work clothes at second-hand stores. They preferred clothes made of light but durable materials and complete pieces that cover the head, neck and trunk with long sleeves and pants that facilitate movement. Barriers to wearing ideal clothing described include costs and the difficulty in finding sizes adapted to Hispanic anthropometry among the Anglo-Saxon market. Participants described an interest in partnering with employers to purchase ideal clothing for heat illness prevention.

Conclusions. Spanish-speaking crop workers have a clear understanding of ideal work clothing and the link between clothing and heat illnesses prevention. However, cost and access to appropriately sized clothing are the biggest barriers. Future strategies should focus on facilitating access to appropriate clothing potentially involving employers as access bridges and promoting worker safety as a core aspect of agricultural companies.

Funding: CDC/NIOSH Grant No. U54OH008085



Modeling the Effects of an Emerging Toxicant, Wildfire Smoke, on Reproductive Toxicity Using *Caenorhabditis elegans*

Author: Jacob Smoot

Abstract: Intensifying wildfires, driven by hotter and drier climates, subject us to increased smoke exposures year over year. While a large body of literature detailing cardiopulmonary effects of these inhaled toxicants exists, new evidence suggests that the reach of these pollutants extends to the reproductive system. This poses significant public health burdens, specifically on pregnant persons, whose offspring may suffer from lower birth weight, preterm birth, and birth defects due to smoke exposure. By screening for reproductive toxicity using the *C. elegans* model, we can begin to understand the reproductive risks associated with exposure to wildfire smoke (WFS). Simulated WFS from Douglas Fir needles were generated in a combustion chamber at smoldering temperatures and collected onto PTFE filters, then extracted into a solution for experimentation. *C. elegans* at L4 stage were exposed to control medium, 200 ug/ml WFS, or 1000 ug/ml WFS to assess general toxicity and the impacts of WFS upon progeny and their viability. The total number of eggs were counted at 24, 48, and 72 hours after exposure. The adult worms were transferred to new plates each day and assessed for germ cell apoptosis using fluorescent acridine orange (AO) dye at 96 hours. Exposure to 1000 and 200 ug/ml WFS decreased the mean number of eggs laid over 72 hours compared to control ($p = 0.0468$, 0.0050 , respectively) Interestingly, adult worms exposed to 200 ug/ml laid significantly more eggs compared to controls during their daily counts at 96 hours ($p = 0.0002$). A harsh touch test assay of offspring of exposed adults did not reveal significant differences from controls. Representative images of the AO-stained parents indicated an increase in apoptotic cells compared to controls. Our studies thus far demonstrate that exposure to WFS results in reproductive toxicity in *C. elegans*, possibly through a germ cell apoptotic pathway.

Funding: This project has been funded by the MAP ERC funding grant #T42OH009229.

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Stooped Postures in Agricultural Workers: Characterizing the Task

Author: Denali Sanders

Abstract: Agricultural field workers worldwide are often exposed to stooped postures during their working tasks. Stooped postures constitute a significant risk factor for the development of musculoskeletal disorders, specifically low back pathologies causing pain. Chronic low back pain is a devastating disorder that can lead to depression, decreased mobility, lower quality of life, absenteeism from work, and decreased work productivity. Unfortunately, few studies have quantified stooped postures among agricultural workers, which makes it difficult to develop targeted work design improvements. This study aims to quantify stooped postures among workers performing several common agricultural tasks. Agricultural workers (N=72) will be recruited from multiple Colorado farms and will represent eleven distinct work tasks. Participants will wear a physiologic sensor (Zephyr BioHarness) on their chest to record and log trunk motion and heart rate for approximately two hours during work tasks. Data recorded on the sensor module will be downloaded and analyzed in a customized RStudio program to determine the percentage of time spent in three posture categories. We will also assess task cycle time, frequency of stooping, average and maximum trunk flexion during stooping, and heart rate during the tasks. For this study, stooped posture was defined as a trunk flexion greater than 60 degrees. Each harvesting task will be characterized to assess the percentage of time spent in each of three posture categories ($<0^\circ$ to 30° , 30° to 60° , $>60^\circ$). We hypothesize that there will be significant differences in the magnitude and percent time spent in stooped postures (as well as cardiovascular loads) when comparing across agricultural tasks. The results of this study will provide quantitative data that can help inform the development of targeted interventions aimed at reducing stooped postures in agricultural workers. Additionally, the methods developed in this study may assist the Colorado Department of Agriculture and farm owners with policies established in the Colorado Senate Bill (SB, 21-087), which limits stooped postures during agricultural tasks that involve thinning and weeding during crop production.

Funding: The MAP ERC grant funds my research.

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Feel the Change: Improving Surgeons' Adherence to Ergonomic Recommendations Through Kinesthetic Training

Author: Amanda Skidmore

Background: A majority of surgeons suffer from work-related musculoskeletal pain (WRMP), which usually begins during their residency. Actionable strategies to reduce WRMP are limited, and ergonomic education for surgeons is one of the most significant tools currently available. Ergonomic education within surgical training programs remains elusive, and surgeons of all experience levels profess a limited understanding of current ergonomic recommendations and how to apply them in the OR.

Aim: To train participants in an ergonomic protocol that combines lectures on current ergonomic recommendations with individual coaching to improve participants' kinesthetic awareness and ability to translate ergonomic recommendations into practice, which can be integrated into current surgical time-outs.

Design: The project will be run as a single-arm pre-post study, with participants drawn from residents in the UC School of Medicine Urology Residency Training Program (max: 15). Participant photos will be utilized to analyze postural patterns and to provide feedback to improve kinesthetic awareness. Pre- and post-intervention photos will be analyzed and compared utilizing the validated Rapid Entire Body Assessment (REBA). Participants will complete a questionnaire to assess pain, cognitive load, and burnout levels, utilizing questions from the NMSQ, SURG-TLX, and Maslach Burnout Inventory. Both questionnaire and photos will be repeated three times: pre-intervention; directly post-intervention; and 3 months post-intervention.

Anticipated Results: Training protocol will improve participants' abilities to accurately modify surgical environment; will result in decreased muscle fatigue and burnout; and will not increase operative time.

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Funding: We are currently working to obtain funding to pilot the program and anticipate launching the intervention in Fall 2024. The authors report no conflicts of interest.

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Effects of Trace Metals Found in Asphalt on Plutonium Uptake on Extraction Chromatography Resins


Author: Raissa Chunko

Abstract: In case of a nuclear incident, standard radioanalytical techniques must be available to analyze radionuclides in unusual matrices. Radiochemical analysis of samples in standard matrices of soil, water, and air are very well established; however, much less research has been conducted on the effect of unusual matrices such as steel, concrete, glass, and asphalt. In the event of a detonation of an improvised nuclear device (IND) in an urban environment, the standard separation techniques used for plutonium separations from asphalt samples originating from roadways and roofing shingles must rigorously be tested to provide useful insight on the characteristics of the special nuclear material. Batch studies were used to determine the changes in uptake of plutonium on extraction chromatography resins in the presence of trace metal components found in asphalt including aluminum, iron, and manganese at possible ranges found in asphalt samples. In these studies, selected cations with a +3-oxidation state had some interesting effects on the uptake of plutonium on the extraction chromatography resins. Aluminum increased the sorption of plutonium only on DGA and TRU resins especially at rising concentrations. Iron very unexpectedly increased the sorption of plutonium on all resins particularly at high concentrations. Additionally, metals found in the +3 oxidation state were shown to interfere with the recovery of plutonium from column studies conducted due to the synergistic effects. From this data, the contaminants found in asphalt with a +3-oxidation state may either compete with plutonium or give rise to a “salting out” effect that increases the sorption on the extraction chromatography resins and will need to be considered during the development of a rapid separation technique for plutonium from asphalt samples.

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Molten Salt Reactor: The Worker's Choice

Authors: Michaella Harris^{1,2}, Kyle Makovsky², Ralf Sudowe¹

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Abstract: The next generation of nuclear reactors boasts cleaner energy, robust safety features, and better working conditions when compared to the currently operating light water reactors (LWR). Chosen for being the safest of the generation four reactors, developers of molten salt reactors (MSR) strive to support a healthy and safe work environment for employees. The thermophysical properties are crucial for the successful operation of a MSR, as well as ensuring worker health and safety when handling reactor materials. Three methodologies have been developed to better characterize the thermophysical properties. Residual gas analysis mass spectrometry (RGA-MS) has been used to determine potential off-gas during operation. Current results show mass loss of salt and chlorine gas, both of which can affect the mass required to sustain the reactor. Calorimetry is used to determine heat capacity and enthalpy which will assist in the design of the heat transfer system. A benchtop pycnometry method has shown a decrease in density with increasing temperatures. This change in density could cause a change in fluidic behavior that disrupts the operating parameters. A better understanding of density, enthalpy, heat capacity, and volatility will support engineering control design to keep doses to workers as low as reasonably achievable. Using evidence-based information, reactor designers are better positioned to be well-informed, ensuring the safest environment for employees.

Funding: This research was supported by the grant 5T42OH009229-17, funded by the National Institute of Occupational Safety and Health in the Centers for Disease Control and Prevention.

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Characterization of a Cesium-137 Gamma Irradiator Using Fricke Dosimetry

Author: Rebecca Mueller

Abstract: Due to the nature of radioactive decay, as a radioactive source ages, the activity of that radioisotope decreases. A 6000 Curie cesium-137 source was installed in room 470 of the Molecular and Radiological BioSciences Building in 1989. This work aims to characterize the dose rate that the source currently delivers to allow for its future use in experiments to study the effect of radiation damage on chromatographic materials. This is confounded by the fact that the half-life of cesium-137 is 30.05 years. Thus, more than half of the activity inclement to this source has decayed away. This work uses Fricke dosimetry as described in ASTM standard 1026-04 for the dose measurement. Samples are placed in batches of 8 in a rotating sample carousel which rotates at 0.2 Hz. Additive manufacturing was used to create the holders for the samples to best match planned irradiation geometries for further work. A dose response curve was constructed as the samples were irradiated over a variety of times (3 minutes to 18 minutes). The saturation point of Fricke dosimetry (400 Gy) was reached during longer irradiations (60 minutes). As the source was installed in the late 1980s, some details about it are difficult to determine from a proprietary point of view. Thus, the height of the source when deployed from the shielding was also triangulated and calculated during the course of this work. Lower irradiation times were used to determine the source's position as, at higher doses, the two layers of the sample carousel see more similar dose rates due to the scattering within the irradiation chamber.

Funding: Funding for this project comes from the Mountains and Plains Education Resource Center.

The authors have no conflicts of interest to disclose.

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Characteristics of Gamma Radiation Fields in Subterranean Structures for Radiation Protection and Decision-Making

Author: Sublett, SM, US Army/Colorado State University, Parker, AR, US Army, Brandl, AW, Colorado State University

Abstract: Due to the unique physical environment, the subterranean environment poses unique challenges for emergency planners and decision-makers when planning and training to respond to a CBRN attack or accident. Subterranean environments, like mass transit tunnels, warrant investigation due to the potential use of a radiological exposure device (RED) using a gamma-ray source to expose the unsuspecting. The radiation fields of significant gamma-ray sources, such as those emitted from Cs-137 or Co-60, behave differently in the well-shielded and confined space of the subterranean environment due to increased scattering than in free air or open space geometries. A better understanding of exactly how these fields act in this environment is crucial to the safety of first responders and render safe teams responding to a CBRN attack or accident. SpaceClaim, Attila4MC, and MCNP were used in this project to model the subterranean environment with various tunnel materials, tunnel geometries, and gamma sources. The scenarios were modeled after the Zentrum am Berg training facility in Eisenerz, Austria, in collaboration with the IRON NIKE research group. In subterranean environments with high scattering potential or shielding, the inverse square law may not be as precise as it is in open air. The dose rate inside the well-shielded tunnel drops off very quickly as the high scatter angle photons greatly increase the dose rate near the source but are not directed down the length of the tunnel. Understanding this unique behavior of radiation fields can optimize movement and protective actions necessary to allow optimal response time and reduce radiation dose.

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Development of an Alanine Neutron Dosimetry System at Colorado State University

Author: Paige Witter

Abstract: Growing use and production of neutron radiation is leading to additional areas where neutron spectrometry and dosimetry is desired. Occupationally exposed workers in fields from high-energy physics research to space radiation, to medical therapies may utilize or be exposed to neutron radiation in their daily work. Passive, stable dosimetry for co-exposure in long-exposure neutron experiments is also desired. An accurate, inexpensive, robust dosimetry system is required to evaluate the doses to experiments and the health and safety risks and exposures for workers. A project at Colorado State University (CSU) is underway to formulate a passive dosimetry system that could be used in a variety of neutron energy fields to evaluate radiation doses more efficiently. L- α -alanine (“alanine”) is an amino acid that develops stable unpaired electrons when exposed to ionizing radiation. The number of unpaired electrons, measured via electron paramagnetic resonance (EPR), is proportional to the absorbed dose in tissue. The photon energy dependence of the EPR signal is well characterized and essentially flat above 100 keV. The EPR signal dependence on neutrons across different spectra, especially in specific moderated experimental conditions, is less well characterized. Alanine was exposed to multiple gamma and neutron sources and doses to develop calibration curves for future use of alanine in neutron dosimetry. Thermal-neutron sensitive filters were added to alanine dosimeters to investigate the resulting signal response and to increase the thermal-neutron sensitivity of alanine. A comparison of the bare- versus filtered signal response in known neutron fields was carried out.

Funding: This project is funded by the MAP ERC Pilot Projects grant. The authors have no conflicts of interest.

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Community Noise Exposure from Nearby Oil and Gas Extraction Sites

Author: Philip Stepherson

Abstract: Due to an increase in oil drilling and hydraulic fracturing (fracking) sites in Colorado near residential areas, many community residents may be at a higher risk of harmful noise exposure. The Colorado Oil and Gas Conservation Commission (COGCC) has identified multiple sources of high-volume sound associated with oil and gas site preparation, drilling and fracking including engines, mud pumps, rig top drives, and ancillary equipment. There is currently very limited data on the extent of community noise exposure as a result of proximity to oil and gas extraction operations and no published research directly comparing community noise exposure data to the COGCC regulatory standards. However, it is suggested in current literature that there is a substantially higher risk of exposure to low-frequency sound which is characteristic of the equipment used at oil and gas sites and also extremely difficult to control. Exposure to low-frequency sound has been found to cause adverse health effects such as sleep disturbance, discomfort, and irritability. To assess community noise exposure, a comprehensive environmental noise survey was performed at a new extraction site in Northern Colorado during the drilling phase of operations. The following measurements were recorded: Sound pressure levels (SPL) at 1-second intervals 1/3 octave band measurements Triggered audio recordings for sounds exceeding certain decibel thresholds Using the collected noise data and additional environmental information, researchers seek to complete the following: Characterize noise produced as a result of drilling activities. Determine potential noise-related health effects for future residents living near oil and gas extraction sites due to drilling activities. Data is currently being analyzed and results are expected by Research Day 2024.

Funding: Funding is provided by University of Colorado Denver, Anschutz Campus.

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Rural vs. Urban Injury

Author: Rachel Ain

Abstract: Injuries at work happen in all settings, however, do all populations get equal access to care based on location? Access to level 2 providers in the state of Colorado varies by location. Urban settings have higher numbers of level 2 providers compared to rural settings, as can be seen on the map. However, the question remains - does that affect access to care? This research project examined worker comp claims with one insurer focusing specifically on low back injuries and shoulder injuries in rural vs. urban settings.

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Carbon Monoxide Exposure: A Case Presentation and Review

Author: Matthew Russell

Abstract: Carbon Monoxide (CO) is a highly toxic and common workplace hazard. It is colorless, odorless, and tasteless- all of which make its recognition even more difficult. CO is produced via the incomplete combustion of carbon-containing material and binds to hemoglobin, which then displaces oxygen in the blood. This leads to tissue hypoxia, oxidative stress, and subsequent organ damage. Symptoms often are non-specific, which can make the diagnosis challenging. Cases with suspicion for CO exposure or poisoning can be confirmed via blood co-oximetry. Confirmed cases are treated with 100% oxygen by way of a nonrebreather mask. Occupations at risk are such as, but not limited to: welders, garage mechanics, firefighters, and forklift operators. Employers should implement preventive measures, for example: effective ventilation systems, maintaining equipment properly, and educating employees about CO hazards. Prompt recognition and treatment are paramount to prevent morbidity and mortality.





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Effects of Workload on Creativity: The Moderating Role of Trait Mindfulness

Author: Kinjal Chheda

Abstract: According to the transactional theory of stress (Lazarus & Folkman, 1984) aspects of both person and the environment are likely playing a role in the extent to which outcomes may be adverse or propitious through the coping process. The coping process is dependent on several factors including (a) environmental stressors, (b) individual resources to meet those demands, and (c) primary and secondary appraisal processes that are contingent upon (a) and (b) factors (Dvořáková et al., 2018). Stress researchers have typically focused on the adverse outcomes of work demands, however, there is growing indication that work demands could also result in positive outcomes. More specifically, workload is a major job stressor (Casper et al., 2017) that has been linked to both negative (e.g., strain, impaired well-being; Alarcon, 2011; Nixon et al., 2011) and positive outcomes (e.g., vigor, task performance; Hon et al., 2013; LePine et al., 2005). This study focuses on the relationship between workload (stressor) and creativity (outcome) and examine the moderating effects of trait mindfulness in this relationship.

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Examining Workplace Trauma and Moral Injury Amongst Healthcare Social Workers

Author: Asia Cutforth, BA; Colorado School of Public Health 2. Pari Thibodeau, PhD, LCSW, University of Colorado, Department of Psychiatry

Introduction: Healthcare social workers (HSWs) are integral parts of the medical workforce, yet the limited research on the well-being of HSWs signals an undervaluing of HSWs. HSW provide critical psychosocial and clinical care; however, there are serious emotional and physical consequences of this work. The care HSWs are able to provide is diminished when they are experiencing moral injury and trauma. This study aims to better understand how moral injury and trauma are related amongst HSWs.

Materials & Methods: A mixed methods secondary data analysis was conducted using 24 semi-structured interviews and 158 cross-sectional survey responses from The Moral Injury Amongst Healthcare Social Workers Study. Qualitative analysis was conducted using a rapid analysis approach by two coders. Quantitative analysis of survey data included descriptive, bivariate, and multiple regression analyses. The mixed methods analysis collated the qualitative and quantitative findings to explain the relationship between HSW experiences of trauma and moral injury.

Findings: Preliminary analyses suggest that HSW who share experiences of trauma also have experiences of moral injury. Qualitatively, finding that trauma and moral injury symptoms overlap in the domains of exposure and emotional and cognitive responses, and differ in the intrusion criterion of PTSD. Quantitatively, we found an association between moral injury (using the MISS-HSW scale), and trauma exposure (using the LEC-5 scale).

Discussion: As social workers continue to support patients and teams within medical systems, it is critical that employers and mental health professionals understand the psycho-social and emotional burden of the work. Examining the relationship between HSW experiences and mental health outcomes is fundamentally related to occupational health.

Funding: NIOSH MAP ERC Pilot Project Fund via Center for Work, Health, and the Environment (CWHE).

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Authenticity at Work: Multiple Pathways to Well-Being

Author: Shelby Davis

Abstract: Job satisfaction is a key organizational outcome often linked to employee feelings of authenticity at work. Previous research posits that feelings of authenticity is higher in environments that align with an individual's identities and values, leading to various motivating behaviors and evaluations with job satisfaction being one such evaluation. This study critically evaluates the assumed unidirectional relationship between authenticity and job satisfaction, proposing a bidirectional perspective based on the broaden-and-build theory. Existing research has consistently shown a positive association between authenticity and work-related well-being, with authenticity mediating relationships between person-environment fit, job resources, and job satisfaction. However, this literature has predominantly taken a confirmatory approach, assuming authenticity precedes job satisfaction without empirical testing. This study introduces a novel hypothesis, suggesting a reciprocal relationship between authenticity and job satisfaction. Drawing on the broaden-and-build theory, it posits that satisfied employees, through their positive attitudes, contribute to personal resources over time, leading to increased authenticity at work.

Funding: This research is supported by the NIOSH Mountain and Plains Education and Research Center (T42OH009229). Its contents are solely the responsibility of the author(s) and do not necessarily represent the official views of the Centers for Disease Control and Prevention or the Department of Health and Human Services.

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Designing Work for Employee Flow, Creativity, and Well-Being: Initial Discoveries

Author: Ryan Lizerbram

The specific aims of this project are 1) to determine work design recommendations to increase the quantity and quality of work-related flow experiences and health outcomes, and 2) determine key phases of the creative process that leaders should encourage to promote these favorable consequences. Considering the impact of well-designed work on the employee experience, it is important to identify job characteristics that may improve flow at work; this is because employee flow states are associated with personal and organizational resources, positive mood, job performance, recovery from work, and reduced burnout.

I propose that employee occupational health can be predicted in part by job characteristics; moreover, I propose that creative process engagement (i.e., degree to which workers engage in various stages of the creative process) and work-related flow experiences serially mediate the relationship between job characteristics and occupational health. That is, I predict that work high in relevant job characteristics will allow employees to engage more highly in creative processes, and in turn, experience more flow and beneficial occupational health outcomes.

I aim to recruit up to 750 participants with roles varying along the degree to which “thinking creatively” is important to the job itself. Participants will respond to survey items about job characteristics, creative processes, flow, and occupational health variables. Furthermore, demographic items will target participants’ job titles, related industry, job tenure, and general work tasks, among others. I will use structural equation modeling as my main method of analysis. By the date of this presentation, I will be able to present my research findings utilizing a smaller sample size, as data collection may not be entirely complete at that point. Despite this, findings may help fill a gap in the flow, creativity, and occupational health psychology literatures, while simultaneously merging these concepts.

Funding: This research is supported by the NIOSH Mountain and Plains Education and Research Center (T42OH009229) and the Kraiger Research Award from the CSU Department of Psychology.

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Exploring Qualitative Insights into Workplace Interpersonal Mistreatment, Social Identities, and Interventions

Author: Brittany Lyner

Abstract: Interpersonal mistreatment refers to a broad range of negative interactions between people, ranging from mild disrespect or rudeness, to more serious acts such as consistent harassment, social exclusion, or verbal abuse. In the workplace, interpersonal mistreatment predicts negative mental and physical health outcomes for employees. To gain insight into interpersonal mistreatment as an ongoing workplace phenomenon, researchers designed a mixed-methods study. 227 participants recruited from Amazon's Mechanical Turk were asked to complete an online self-report survey. Participants described an instance of interpersonal mistreatment that they personally observed at work and that occurred on the basis of one or more social identities (e.g., race, gender). Thereafter, participants responded to measures that evaluated the conditions surrounding the incident. The conditions under investigation included the power and status of the third-party witness as well as the held values and felt authenticity of that individual. In my previous Research Day presentation, I discussed the quantitative findings of this study. The 2024 presentation will focus on reviewing qualitative themes extracted from participants' narratives detailing instances of interpersonal mistreatment, the specific social identities targeted, and the responses elicited. The findings aim to shed light on which social identities are most commonly subjected to workplace interpersonal mistreatment and the circumstances influencing both mistreatment and intervention occurrences. Furthermore, the study places a central emphasis on diversity, equity, and inclusion (DEI), with the intention of making significant contributions to the field of occupational health psychology.

Funding: This work was supported by the NIOSH Mountain & Plains Education and Research Center (T42 OH009229). No conflicts of interest exist.

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Intuitive Eating, Income, and Workplace Environment

Author: Katie McMahon

Abstract: To combat the negative mental and physical effects of mainstream dieting, the practice of intuitive eating has gained attention as it is associated with increases in body image, life satisfaction, and decreases in disordered eating and internalized weight bias (Tylka et al., 2014; Burnette & Mazzeo, 2020). Although there is growing evidence for the benefits of intuitive eating, it is considered a privileged approach that is predominantly available to people with higher socioeconomic status (Fine 2022; Cantu, 2019). People experiencing food insecurity (FI) are at greater risk of disordered eating and FI is associated with a higher BMI suggesting that IE could play an important role for lower income communities where FI is more common (Burnette et al., 2023). In the present study, we investigate how income and a toxic workplace environment (higher levels of stress, lower psychological safety) relate to intuitive eating practices. The sample will consist of undergraduate students at Colorado State University who are currently employed with a variety of workplaces, and students will be compensated with course credit for completing our questionnaires. Students will fill out basic demographic information and complete the Intuitive Eating Questionnaire (IES-2), the US household food security module, Perceived Stress-Scale (PSS), and the Psychological Safety Index (PSI). We hypothesize that participants in more stressful workplaces, characterized by higher perceived stress and lower levels of psychological safety, will be associated with lower intuitive eating scores. We also hypothesize that students experiencing more food insecurity and those earning a lower income will have lower intuitive eating scores. All data will be collected in the fall of 2024.

Funding: his research is supported by the NIOSH Mountain and Plains Education and Research Center (T42OH009229).

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Addressing Newcomer Adjustment, Well-Being, and Safety Through Organizational Support and Self-Determination Theory.

Author: Rosalyn Stoa

Abstract: New employees in an organization (i.e., newcomers) may experience poor well-being during the beginning of their job tenure, including stress, surprise, anxiety, confusion, awkwardness, and an increased risk of injury and illness. Although organizational support is related to positive aspects of newcomer adjustment and reduced strains, this study will investigate how organizational support relates to new employee socialization tactics, work experiences, safety behaviors and well-being outcomes. Participants in this study will be new employees, who will be asked to complete three online surveys over the course of 6 months about their work-related attitudes and experiences. Data will be analyzed using structural equation modeling. This study has implications for how to design and conduct training for new employees and foster newcomer socialization. Results will also make contributions to research and practice about understanding worker safety and well-being in relation to the organizational socialization process. We anticipate that results can be used to inform safety managers in ways to structure new employee onboarding in ways to reduce newcomer injury.

Funding: This research is supported by the CDC NIOSH Mountain and Plains Education and Research Center Grant Number T42OH00229.

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Alignment in Work & Life Disclosure as Predictive of LGBT Wellbeing

Author: Danielle West

Abstract: Alignment in Work & Life Disclosure as Predictive of LGBT Wellbeing Danielle West, Danielle M. Gardner & Joshua J. Prasad, Colorado State University. Disclosure refers to the degree an individual with a marginalized, concealable identity (such as sexual orientation) informs external others of their standing on that identity. The potential impact of disclosing one's identity is large, with some potential negative and positive outcomes including stigma exposure and facilitating self-acceptance and authenticity. Prior work examining the consequences of disclosure typically focuses on the phenomenon contextualized within a single life domain (e.g., disclosure at work), without considering how one's sense of self is composed of potentially distinct areas of work and life. The purpose of the current research is to investigate the notion of disclosure alignment across work and life spheres as consequential to LGBT+ employee wellbeing. We predict that perceptions of societal and organizational acceptance of LGBT+ identities will be negatively associated with misalignment in disclosure levels across work and life contexts. Further, we hypothesize the degree to which disclosure levels in work and life contexts are misaligned will be negatively related to subjective wellbeing. A path model was estimated via MPlus to evaluate hypotheses based on archival data collected by the Pew Research Center on LGBT+ employees. As expected, organizational acceptance was negatively associated with disclosure misalignment, though societal acceptance was not significantly related to the outcome. Further, disclosure misalignment was negatively associated with subjective wellbeing, as predicted. The present results support the notion that alignment in disclosure levels across work and life contexts may act as an important antecedent to wellbeing in LGBT employee populations. Findings additionally underscore the importance of the workplace in fostering alignment in disclosure levels.

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Examining Employment Patterns and Implications for Newly Diagnosed Cancer Patients

Author: Amy Dye-Robinson

Abstract: A cancer diagnosis may pose challenges to workers who want or need to stay employed through cancer treatment. The purpose of this research is to examine employment patterns and factors associated with negative employment outcomes for newly-diagnosed cancer patients. The population was characterized with descriptive statistics and factors that impact employment outcomes were assessed using probit regression for employment status and linear regression for difference weekly hours worked. Of the 95 participants who were working full-time at diagnosis, only 63 remained working at survey 1. On average, participants worked 9 hours less per week at survey 1 compared to diagnosis. Having a job that required physical effort, heavy lifting, or kneeling, stooping, and crouching significantly increased the probability of reduced work status and increased the difference in weekly hours worked between diagnosis and survey 1. In addition, we found that having a household income over \$85,000 a year was significantly associated with decreased probability of reduced work status and decrease in the difference in hours worked. These findings suggest that cancer patients with physically demanding or low wage jobs are at an increased risk of negative employment outcomes.

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The Association Between Supportive Physical Work Environments and the Wellbeing of Nursing Home Employees: Findings from a Pilot Research Study

Author: Cedra Goldman


Abstract: Our study seeks to identify physical work environment (PWE) characteristics that have been shown to support the health and wellbeing of employees, objectively quantify the quality of PWEs in 10 nursing home facilities in the Denver metro area, and assess the association between supportive PWEs and the wellbeing of nursing home employees. In order to quantify the quality of PWEs in nursing home facilities we developed the Staff-supportive Physical Environment Characterization (SPEC) audit tool. Using the SPEC tool, we have been able to gather the data needed to calculate "quality scores" for PWEs in each of the individual facilities. Employee wellbeing data was gathered using a modified version of the NIOSH WellBQ tool. The survey was distributed to all of the employees that worked in the 10 nursing homes that were audited using the SPEC tool. We had a response rate of 30%, equating to 307 completed surveys. Currently we are in the process of analyzing our data. We are using the SPEC scores for the nursing home facilities and the wellbeing metrics for employees in the specific facilities in order to investigate the association between higher quality physical work environments and improved wellbeing of employees. Factors that will be considered in the analysis include employee demographics, employment tenure, job type, and job characteristics. Our presentation at Research Day will discuss the gaps in knowledge related to the association between physical work environments and employee wellbeing, describe the methods we used to assess the association between the quality of physical work environments and employee wellbeing, summarize our findings, and communicate potential implications for future research and practice.

Funding: We received partial funding from the CHWE TWH Pilot Project Program.

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Employer Engagement to Promote and Add Evidence-Based Diabetes and Cardiovascular Prevention and Management Programs as a Covered Benefit

Author: Sarah Levine

Abstract: Chronic disease is a serious workforce issue with significant economic impacts on employers and employees. The workplace is a key venue for health protection, health promotion, and disease prevention program delivery where employers can offer access to a variety of no or low-cost evidence-based prevention programs to employees. While there are several evidence-based chronic disease prevention and management programs (CDPMPs), they are underutilized in the workplace due to a lack of awareness and understanding by employers. There are few studies to inform how best to engage employers to help support at-risk employees and provide coverage of evidence-based programs. This research aims to present the gaps and opportunities in how these programs are implemented and promoted by employers to increase awareness and adoption of evidence-based CDPMPs, specifically the National Diabetes Prevention Program (National DPP) as a covered benefit among employers. We designed, executed, and evaluated engagement strategies including education and training, evidence-based resources, and advising. As a result, we reached 349 organizations representing over 160,000 employees. We present a case study of three employers representing 3,370 employees that have adopted the National DPP as a covered benefit and reflect on the findings of an ongoing engagement and evaluation program, providing proven strategies for conducting workplace outreach and intervention delivery. These cases show the importance of employer engagement to support and maintain chronic disease prevention and management efforts and what key roles and practices within an organization that are most common to successful implementation. This research highlights the importance of health promotion and evidence-based programs such as CDPMPs, specifically the National DPP, and the strategies for engaging employers to promote and cover the cost of these programs.

Funding: This program is supported by the Grant or Cooperative Agreement Number, U19OH011227, funded by the Centers for Disease Control and Prevention.

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A Mixed Methods Dissemination & Implementation Study of the WELL Program

Authors: Emily Maiurro, Julia Pangalangan, Charlotte Farewell University of CO
Anschutz

Introduction: The early childhood education (ECE) workforce is underpaid and overworked, leading to substantial health disparities. The WELL program is a multi-dimensional intervention aimed at improving ECE worker well-being in Head Start settings through professional development opportunities, hands-on activities, and enhancing policies, systems, and environments of participating sites. This study applies a dissemination and implementation (D&I) framework to investigate the most pertinent factors related to the implementation of the WELL program in 5 Head Start agencies in Colorado in order to inform sustainability and scalability.

Methods: This mixed-methods D&I study included a 45-minute video or phone interview and 22-item survey. 27 participants completed the interview, with 26 of those completing the survey. Interviews were recorded and transcribed using Otter.ai, then transcriptions were cleaned by a group of research assistants (RAs). A team of 2 RAs coded interviews using deductive codes identified using the Consolidated Framework for Implementation Research (CFIR) framework and further identified inductive codes. The RAs coded 5 interviews together to ensure reliability. A thematic analysis was used to identify and interpret patterns in the data.

Results: Initial analysis suggests that constructs within the inner setting domain, the setting where the intervention is implemented, may have the biggest impact on the successful implementation of the WELL program. For example, leadership engagement emerged as crucial to the adoption and sustainability of the WELL program in ECE settings. Researchers will complete analyses prior to the symposium.

Conclusion: We expect the results will highlight the importance of specific constructs derived from the CFIR framework essential for effective execution and sustainability of ECE well-being promotion programs.

Funding: The Well-being of the ECE Workforce in Low Resourced Locations (WELL) study is funded by the Administration for Children and Families (ACF).

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