The purpose of this study is to examine contributing factors of ATV injuries and deaths through application of the Agent-Host-Environment epidemiological model. By analyzing the associations between contributing factors, appropriate intervention strategies may be identified.

Incident reports of ATV fatalities and injuries were obtained from the Consumer Product Safety Commission (CPSC). Each report was read and coded based on information available in the narrative report. Each coded variable was classified as either an agent, host, or environmental variable. Descriptive statistics were obtained for the coded variables and a Chi-Square Automatic Interaction Detector (CHAID) analysis was performed to identify associations between predictor variables.

A total of 1,230 incident reports were obtained and, after cleaning the data, a total 1,193 fatality reports remained. While only 12% of cases occurred on farms, the calculated incidence rate in the farming population (.62 per 100,000 population/year) is higher than the overall incident rate in the United States (.13 per 100,000 population/year). Descriptive statistics showed low helmet use (11.85% of fatal cases) and high prevalence of alcohol and drugs (84.2% of fatal cases). The CHAID results showed significant associations between all types of variables: agent, host, and environment.

The three aspects of the epidemiologic triangle each contribute and build upon each other to create the combination of risk factors that lead to a fatal event.

By modeling and categorizing risk it is possible to develop targeted intervention strategies. Through use of legislation and training, many host-related risk factors can be controlled; use of engineering controls can mitigate risk due to the agent and/or physical environment; and use of targeted marketing strategies and education may limit risk due to the social environment.

Funding Sources:

MAP ERC
HICAHS
Climate change is anticipated to increase the severity of episodic flooding and drought in northeastern Thailand (IPCC 2013). Though residents of this rural, agricultural region are accustomed to managing seasonal flooding and drought, little work has been done to understand the perceived health risks (ex. food-security, water-borne illness) associated with flooding and how changing flood/drought regimes may necessitate shifts in community adaptation strategies. In this pilot effort, we will conduct household surveys and key informant interviews with village leaders from three different communities in northeastern Thailand to collect data regarding how community members perceive flood risk, flood adaptation strategies, and how climate change may impact flood management in northeastern Thailand. Surveys will be conducted and information captured using Open Data Kit (ODK) mobile data collection platform. We anticipate locals’ perceptions of flood risk are closely linked to socioeconomic status and livelihood. Also, we anticipate that mobile data technology provides a more interactive, and efficient system to collect and share data with collaborators and community members, especially in areas where community access to technology is limited. Coupling the increased understanding of community flood risk perceptions with novel data collection and sharing strategies may help to elucidate actionable steps for community members, public health officials, and community leaders in preparing for changing seasonal flooding and drought patterns.
Isolation of Reactor-Borne Neptunium Using Ion Specific Extraction Chromatography Resins and Detection by Gamma Spectroscopy

B. Rosenberg¹, G. Steinhauser¹, K. Shozugawa²

¹Colorado State University, ²The University of Tokyo

During the course of a reactor meltdown, the core can reach temperatures in excess of 2400 °C, the temperature at which actinides can be volatilized. Therefore, environmental release of actinides is indicative of a meltdown. The actinide used for core evaluation following a meltdown is plutonium. Evaluation requires activity and isotopic ratios for $^{238,239,240}\text{Pu}$ to discern reactor plutonium from plutonium deposited in the environment by nuclear fallout. An alternative radionuclide that we have shown to be an effective and rapid sentinel for core temperatures in excess of 2400 °C is $^{239}\text{Np}$. The gamma rays emitted from $^{239}\text{Np}$ are greater than 100 keV and emitted with ample intensities, making detection by gamma spectroscopy favorable. Furthermore, environmental $^{239}\text{Np}$ cannot be detected long after an event due to its short half-life ($T_{1/2} = 2.4$ d). Although volatile radionuclides released during the course of a meltdown spectrally interfere with $^{239}\text{Np}$ detection, we have demonstrated that ion specific extraction chromatography with Eichrom® resin cartridges are effective at isolating $^{239}\text{Np}$ from aqueous and soil matrices and volatile radionuclides contained therein. Isolation of $^{239}\text{Np}$ from volatile radionuclides was best observed when aqueous samples were eluted through UTEVA and RE resin cartridges primed with HNO₃. Organic components from soil samples had the potential to interact with the stationary phases of the cartridges, requiring dissolution of the stationary phases to remove neptunium. Continuous sampling of rainwater and soil, and extraction chromatography of treated samples, would provide an understanding of the core’s condition through the course of a meltdown and the fraction of the fuel inventory released. Such information is necessary for emergency response implementation during the event and environmental remediation following.
Indoor Hockey Officials’ Hearing Threshold Shifts and Helmet Visor Effects

Karin L. Adams\(^1\) & William Brazile, PhD, CIH\(^1\)

Introduction: More than 25,000 hockey officials in the United States may be at especially high risk of hearing loss at an earlier age because their noise exposures have not been evaluated and officiating may begin as early as ten years of age. Hearing thresholds of indoor hockey officials of the Western States Hockey League and American Collegiate Hockey Association were measured to assess the impact of hockey game noise on hearing sensitivity. Effects of the official’s helmet visor length on exposure levels from whistle noise was assessed using a KEMAR manikin with an in-ear microphone.

Methods: Hearing thresholds of 29 hockey officials were measured prior to and after officiating a hockey game to determine whether a 10 dB or greater decrease in hearing sensitivity resulted from noise exposures during the game. Noise from whistle blowing was measured at the ear of the manikin for three helmet configurations, including a helmet without a visor and with 2.75” and 4.0” height visors. A whistle blowing apparatus was designed to ensure consistent releases of air pressure to blow the whistle, mounted near the mouth of the manikin.

Results: Pure-tone hearing threshold shifts of 10 dB or greater were observed in 86% of sampled officials. Mean peak whistle noise exposure levels of the manikin without a visor and with the 2.75” and 4.0” height visors were 141 dB, 142 dB and 144 dB, respectively.

Conclusions: Potential for repetitive temporary hearing losses among indoor hockey officials is supported by the results of this study and hockey officials should be enrolled in a hearing conservation program and provided hearing protection. Methods and results from the manikin study suggest future research into the contribution of visor length to hockey officials’ exposure to whistle noise is warranted.
Do Wearable Physical Activity Monitors Promote Physical Activity at Work?

Ken Scott, MPH

Department of Epidemiology
Colorado School of Public Health

Background: Walking is both a health-promoting physical activity and a behavior that exposes individuals to slip, trip and fall injuries - a leading contributor to workers' compensation insurance claims. Sedentary work is gaining increasing attention in the research and practice communities as a potential contributor to chronic disease. Occupational physical activity may be amenable to objective measurement, like many other occupational exposures.

Methods: Pilot data was collected over a period of 16 weeks to assess occupational walking patterns among a group of 33 healthcare workers 55 years of age and older using commercially-available Fitbit Flex™ physical activity monitors. Follow-up time was divided into two phases - a 6-week period in which participants were "blinded" to their data and a 10-week period in which participants could access their data through an online dashboard developed by Fitbit. Mixed effects regression models (linear and Poisson) were used to assess the variability between and within individuals over the “baseline” 6-week blinded period. Walking patterns during the blinded data collection period were compared with patterns after data was made visible to participants. Potential sources of bias and missingness were identified.

Results: Contrary to expectations, participants' objectively-measured occupational physical activity did not increase during the unblinded data collection period. A statistically significant decrease in physical activity levels was observed.

Conclusions: This pilot study suggests that physical activity monitors may not increase employees' physical activity levels.
Quantifying air pollution intake with wearable sensors

N. Good\textsuperscript{1,2} T. Carpenter\textsuperscript{1,2,3}, B. Anderson\textsuperscript{1}, W. Board\textsuperscript{3}, R. Browning\textsuperscript{3} J. Peel\textsuperscript{1} and J. Volckens\textsuperscript{1,2}

\textsuperscript{1}Department of Environmental and Radiological Health Sciences, Colorado State University, Fort Collins, CO
\textsuperscript{2}Department of Mechanical Engineering, Colorado State University, Fort Collins, CO
\textsuperscript{3}Department of Health and Exercise Science, Colorado State University, Fort Collins, CO

Air pollution exposure is traditionally assessed by measuring pollutant concentration within a person’s breathing zone, without accounting for their breathing (ventilation) rate. As a result, this method can result in inaccurate exposure estimates. Direct measurement of breathing rate is precise but expensive and may modify behaviour and exposure, therefore alternative methods are required. This study aimed to develop and validate predictive models of personal ventilation rate from wearable sensors.

Two groups of adults (n=36 and n=25) were recruited to participate in this study. The first group completed work-related tasks in the laboratory to develop the ventilation models; the second group performed free-living activities for model validation. Participants wore a biometric shirt (Hexoskin) that measured ECG, plethysmography, and acceleration in addition to wearing an indirect calorimetry system that measured ventilation (Oxycon Mobile). Data from the second group were also used to quantify differences between exposure and intake (i.e., exposure misclassification) of ultrafine particles.

Predictive models improved estimated ventilation rates, producing RMSE’s in the range of 10\% to 30\% compared to over 50\% when a constant ventilation rate is assumed. Accounting for ventilation rate was found to substantially modify the exposure estimate for the different activities performed. This approach transforms the relative risk associated with performing different activities and alters the assessment of who is at greatest risk of exposure to air pollutants.
Promoting psychosocial health and empowerment among sex workers in Nepal

Lauren M. Menger, Michelle R. Kaufman, Gwenith G. Fisher, Lorann Stallones

Abstract

Female commercial sex workers (FCSWs) in Nepal are exposed to an array of occupational hazards, including sexual and reproductive health risks and various forms of violence, harassment and exploitation (NCASC, 2011). These women generally have poor psychosocial health (Frederick et al., 2010) and a low sense of personal agency (Ghimire et al., 2011), which negatively impacts their ability to protect themselves from harmful work situations. The aim of this study was to pilot a brief peer education intervention to promote psychosocial health and empowerment among FCSWs in Kathmandu. In collaboration with a non-governmental organization (NGO), ten FCSWs were trained as peer educators and, through formal and informal teaching opportunities, reached over 140 FCSWs with psychosocial health messages. As part of a larger impact evaluation (data analysis currently underway), exit interviews were conducted with nine of the ten peer educators and two NGO field staff to collect in-depth feedback regarding the training and peer educator teaching experiences. Interviews were recorded, transcribed and translated into English, and a two-step qualitative analysis was conducted to identify key themes. The training was well received, and many expressed a desire to receive additional training in the future. Numerous positive program impacts were identified, including the acquisition of valuable knowledge and skills, increased self-awareness, enhanced self-care behaviors, and positive dispositional and relational changes. The peer educators found their teaching experiences to be relatively easy and well received by others, although some challenges were noted. Suggestions for how the program could be improved and sustained were also offered. Overall, exit interview findings suggest that peer education methods are a feasible and promising means to enhance the psychosocial health and empowerment of FCSWs. This pilot study can be used to inform future programs targeting FCSWs and other vulnerable and hard-to-reach working populations.

References


A Randomized Controlled Trial of A Mindfulness-Based Stress Reduction Intervention on Healthcare Worker Safety

Morgan Valley, MS, MPH\textsuperscript{1} & Lorann Stallones, PhD, MPH\textsuperscript{1,2}

Institutions: \textsuperscript{1}Department of Psychology, Colorado State University, \textsuperscript{2}Colorado School of Public Health at Colorado State University

Background: Occupational injuries represent a significant public health problem, especially among healthcare workers, who face a high non-fatal occupational injury rate. This project aimed to determine if mindfulness training, which teaches individuals to bring awareness and acceptance to the present moment, decreases cognitive failure or momentary mental lapses and improves worker safety performance. Procedures: Twenty-three healthcare workers at two hospitals in Colorado volunteered to participate and were randomly assigned to a control group or to participate in a Mindfulness-Based Stress Reduction session. The intervention included eight 2.5-hour group sessions of meditation, yoga, and group discussion and one 7-hour silent session. Participants completed questionnaires pre- and post-intervention measuring workplace cognitive failure and safety performance (consisting of two factors, safety compliance or adherence to safety regulations and safety participation or promotion of safe practices at work). Analyses: Mean scores were calculated for each participant on the study variables at each time point. We used RM ANOVA tests to compare the baseline and post-intervention effects. Results: Twenty (91\%) of the participants were female and most (86\%) were nurses. There was a significant time by treatment group interaction effect for workplace cognitive failure (F\textsubscript{1,20}=7.79, p=.011) with the treatment group having a greater decrease in workplace cognitive failure. There was a significant time by treatment group interaction effect for safety compliance (F\textsubscript{1,20}=7.44, p=.013) with the treatment group having a greater increase in safety compliance. While there was a significant main effect for time on safety participation (F\textsubscript{1,20}=12.73, p=.002), the interaction effect between treatment group and time was not significant (F\textsubscript{1,20}=0.39, p=.54). Conclusions: The findings of this project suggest that mindfulness training can decrease workplace cognitive failures and increase safety performance, particularly safety compliance, among hospital healthcare workers. The results contribute to the novel understanding of the role mindfulness practice plays in worker safety and may support future larger-scale studies testing the longer-term impacts of the intervention.
An Examination of Colorado Workers’ Compensation Lost-Time Claims for the Oil and Gas Industry

Maggie Cook-Shimanek, MD, MPH\(^1\) and Roxana Witter, MD, MSPH\(^1\)

\(^1\)University of Colorado Occupational Medicine Residency Program

Introduction: National fatality rates for oil and gas are higher than construction despite a lower reported non-fatal injury rate. Given the growing Colorado oil and natural gas extraction industry, there is a need to characterize injuries to inform prevention efforts, monitor trends, and measure the impact of hazard reduction.

Methods: Retrospective cohort analysis of Colorado Workers’ Compensation oil and gas industry lost-time claims, defined by North American Industry Classification System for extraction (211), support activities (213112), and drilling wells (213111) from 2003 to 2012. Rates were calculated using denominator data from the Bureau of Labor Statistics and compared to construction. A description of injured workforce age, sex, and injury circumstances were included.

Results: Most injured oil and gas workers were 18-29 years old (31.1%) and male (96.9%). The rate of lost-time injury claims from 2003-2012 was 7.8/100,000 for oil and gas and 13.0/100,000 for construction. Rates for both industries declined in the study period, but particularly in oil and gas which reached a nadir in 2012 with a lost-time claim rate nearly four times lower than construction.

Most injuries in oil and gas were strains and sprains (32.5%), contusions and crushing (14.6%), and fractures (14.5%), most commonly involving the upper extremity (31.2%), trunk/buttocks (24.4%), and hips/lower extremities (21.2%). The cause of most injuries was strain (29.8%), fall, slip, or trip (19.4%), or struck by (17.3%).

Conclusions: The consistently lower lost-time claims rates in the growing oil and gas versus construction industries is unexpected given its consistently higher fatality rate and merits further exploration. Information obtained from workers’ compensation claims data informs an industry- and injury-specific approach to reducing workplace hazards.
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Poster Presentations – please insert tab that says “POSTER PRESENTATIONS”
An ergonomic assessment was conducted at New Belgium Brewing Company located in Fort Collins, Colorado to assess process efficiency and the risk for musculoskeletal disorders (MSDs) at the labeling station of the bottling facility. The overall objective of this assessment was to reduce the risk for stress, strains, and injuries, improve worker quality of life, increase production efficiency, and enhance product quality. Variables taken into consideration included workstation measurements, operator insight, observation of individual worker tasks, and weight and measurements of product. Based on this assessment, there were several areas of potential ergonomic and process improvement: front label station, storage and shelving of back labels, work shift duration, availability of a sit-stand workstation, and handling of glue bucket. The recommendations made included removing exposure to risk factors, reducing manual handling of products, and streamlining operations.
Mooooo! Comparing upper limb muscle activity between Colorado and Italian milkers

A. Mixco\textsuperscript{a}, F. Masci\textsuperscript{b}, J. Rosecrance\textsuperscript{a}

\textsuperscript{a}Colorado State University, \textsuperscript{b}University of Milan International Centre for Rural Health

Introduction: The process of milking cows in dairy farms has become heavily industrialized as dairy farms in the US move to large mega herd operations to meet milk demand. With the advancements in parlor systems, the milking process in the US has become similar to an assembly line procedure. Milkers complete five distinct tasks, predipping, stripping, wiping, attaching milk clusters, and postdipping, repetitively over an eight hour to ten hour shift. European dairies, conversely, have maintained much smaller herd numbers in comparison to the American counterparts. Because of the smaller herd, the same milking tasks are completed in smaller two to three hour shifts. Both dairy farm conditions have been associated with development of musculoskeletal symptoms and disorders. However, direct comparison between small herd European dairies and large herd American dairies has never accomplished.

Purpose: To examine surface electromyography (sEMG) data to compare muscle activity associated from milking activities in large herd Colorado dairies to small herd Italian dairies.

Methods: sEMG sensors were placed on subjects to collect data from the upper trapezius, anterior deltoid, long head of the biceps brachii, and wrist flexors and extensors. Subjects performed maximum voluntary contractions (MVC) for each muscle group. Data were then collected for all muscles groups for the first pen of the shift. sEMG data were normalized using MVC contractions for root mean square (RMS) analysis, amplitude probability distribution analysis (APDF), and percentage of muscular rest (%MR).

Results: Brief visual analysis of RMS data shows that there is more muscle activity generated in Colorado dairies compared to Italian dairies. APDF data reveals larger values for Colorado dairies compared with Italian dairies across all muscle groups. %MR may reveal further differences between milking tasks.

Conclusion: Brief overview of processed sEMG data suggests that milkers in Colorado dairies are required to use more muscle activity to complete milking tasks than Italian milkers. This may attributed to a higher pace of work in generally seen in large herd dairies. However, the wrist extensors did exhibit APDF value for Italian milkers. More in depth analysis may reveal further differences or similarities among dairy tasks.
Blades of Glory: Noise Exposure of Hockey Officials

Kate Johnesee, William Brazile, Del Sanfort, Tiffany Lipsey

Colorado State University

Funded by MAP-ERC

Introduction: According to National USA Hockey League, tens of thousands of hockey officials could be affected by noise induced hearing loss. For this study, personal noise dosimeters and a sound level meter were used to record noise exposures during hockey games for the 2014 season. The aim of this project was to fill the current gaps in research by increasing sample size and sampling at a larger arena than the pilot study.

Methods: A total of 30 personal samples and 20 area samples were collected. The study was completed in December, 2014. Results were compared to the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL), American Conference of Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and World Health Organization (WHO) guidelines and standards.

Results: Noise dose was reported for each official at each game to determine if noise controls needed to be put in place at this specific venue. Five officials were overexposed to noise according to the OSHA standard (90dBA). All referees and linesmen were overexposed to noise according to the ACGIH and WHO recommendations (85 dBA). In addition to area and personal monitoring, the number of whistle blows was counted during the first period of four games to get an average number of whistles blown per game. According to previous researchers, whistle blows are one of the loudest and closest noise sources to referees with some whistles reaching sound levels of 116 dBA.

Conclusion: Based on the results, it is recommended that this venue take preventative action in reducing noise exposure for hockey referees and future research should focus on implementing control measures in hockey arenas.

This research was partially funded by NIOSH Mountain and Plains Education and Resource Center.
Design of a Compton Scatter Based Radiation Source Tracking System

Heather Healy, Alexander Brandl

Department of Environmental and Radiological Health Sciences, Colorado State University

Radiological detection serves as one of the most useful tools in the field of nuclear and national security. A novel detector designed by the Remote Sensing Laboratory at Andrews Air Force based is a detection system comprised of multiple detectors. These detectors are sensitive to gamma rays up to 3 MeV. An intended use of the OSCAR detector is to determine the location of radiological sources based on incoming particle interactions with multiple detectors. Compton scattering has been previously explored for location analysis within the detector; however, the thickness of the current detector produced very few Compton scatter events. The current project goal is to determine the optimal detector length, width, and height dimensions that produce the most Compton scatter events within the detection system. The investigatory dimensions range from one to 5 inches in thickness for the length and width of the detector, while keeping the height constant at 16 inches. Preliminary results show no significant difference in the number of Compton scatter events produced by the various detector systems.

In the upcoming weeks further investigation will be conducted using larger sample sizes assuming further coding in Geant4 is achieved to count Compton scatter events of large samples. By the completion of this project, the detector dimensions that produce the most Compton scatter events and the best source location determination by Compton scatter will be determined for the novel detector.

This work was supported by Grant Number T42OH009229-07 from CDC NIOSH Mountain and Plains Education and Research Center. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the CDC NIOSH and MAP ERC.
Fluoroscopy is an imaging technique that uses x-rays to form real-time continuous images. This can allow medical procedures to be performed without the need for invasive surgery. The trade-off will be increased patient and staff radiation doses. X-ray scatter from the patient is the primary source of occupational dose. There are several factors that influence staff radiation doses, delivering different doses to operating room staff. In transcatheter aortic valve replacement (TAVR), fluoroscopy is used to guide a catheter for replacing the aortic heart valve. Due to the complexity of the procedure, a significant amount of fluoroscopic imaging is used, resulting in relatively high patient and staff radiation doses. This study will measure the radiation doses for personnel in specific roles in the Hybrid OR at University of Colorado Hospital (UCH). Hybrid OR staff doses will be measured using the Philips DoseAware Personal Dose Meter clipped on to the outside of the lead apron. After each procedure, each dosimeter will be evaluated and the data recorded by job function. Doses will be normalized to fluoroscopic output so that they can be used as references for future TAVR procedures at UCH and other facilities. Physicians are expected to receive the highest doses because of their close proximity to the fluoroscopy system. Nurses and technicians will also receive doses, however, dose levels are expected to be less than those of physicians.
Development of Novel Algorithms for Improved Source Detection using Bayesian and Classical Statistics

Mann, Jenelle; Brandl, Alexander

Colorado State University

The detection of sources with low signal compared to background is important in national security applications, such as border control and monitoring of special nuclear material. In these circumstances, the source may have weak ionizing radiation emissions or is heavily shielded. Complex algorithms and processing are often needed to distinguish special nuclear material from background. Additionally, it becomes more difficult to distinguish sources in low signal-to-background conditions if there are changes in the background radiation levels. An increase in background radiation can cause a false positive (background is interpreted as a source); whereas a decrease in background radiation can cause a missed detection (a source is interpreted as background). Background radiation varies naturally due to weather, season, and the time of day. The goal of this research is to develop improved algorithms for detection of sources in a low signal-to-background environment and in a changing or varying background environment. Novel algorithms will be developed using Bayesian and classical statistics that incorporate prior information. Inclusion of prior information will increase detector sensitivity, allowing for improved source detection in a low signal-to-background environment. Current progress of this research includes statistical analysis of background and electronic noise distributions: rectangular, triangular, sinusoidal, Poisson, and Gaussian distributions. Resulting algorithms developed by this research can be incorporated into any detection system. Possible uses include environmental monitoring, clean up of a radioactive site, contamination monitoring of workers, portal monitors, and potentially medical imaging applications.
The Monte Carlo code, RITRACKS(1), is being developed at the Universities Space Research Association. This code has the capability to generate the initial energy angular distribution of electrons produced by energy heavy ions passing through liquid water. Every ion and secondary electron is transported by simulating all interactions with the medium, such as excitations and ionizations. The position of each radiolytic species is also calculated. The program has been applied to describe patterns of ionization responsible for DNA damage on the molecular scale with target dimensions of the order of 10 nm. We have extended the reach of this program into the micro-dosimetry range. The objective of these studies is to benchmark this code using models of track structure to compute energy deposited in a spherical target as a function of traverse distance from the track of the ionizing particle, and comparing this model to calculations obtained from RITRACKS. This calculation would yield details beyond linear energy transfer, possibly giving more insight into radial energy deposition along a particle’s track, and allow dose to a target to be determined as a function of radius.

References

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INDUSTRIAL HYGIENE (colored paper)
Evaluation of Bacterial Preservation during Air Sampling of Culturable Bioaerosols

L. Krause, S. Reynolds, J. Schaeffer, Colorado State University, Fort Collins, CO

Objectives: Agricultural workers experience increased exposure to inhalable bacteria and particulate matter, leading to a variety of occupational lung diseases. Analyses of these bioaerosols are generally performed using culture-based techniques, which typically only yield a 1% survival rate for environmental bacteria. The objectives of this study were to: 1. Evaluate the difference in bacterial growth rate between a novel resuscitation buffer and Phosphate Buffered Saline (PBS). 2. Assess the difference in collection capability between resuscitation buffer and PBS when used as a collection media in SKC BioSamplers.

Methods: Initially, an inoculation experiment was conducted using one Gram-positive and one Gram-negative bacterium isolated from environmental air samples from a dairy field sampling visit. Both bacteria types were inoculated in PBS and resuscitation buffer and then were plated in triplicate on tryptic soy agar (TSA). Colony growth was counted after 24, 48, and 72 hours of incubation at 37°C. The second experiment was conducted inside a bioaerosol chamber using a nebulizer to aerosolize each bacterium. Duplicate SKC BioSamplers with PBS or resuscitation buffer as the collection media were used to collect the bacteria. The collection media was then plated on TSA and colony growth was counted after 24, 48, and 72 hours of incubation at 37°C.

Results: Resuscitation buffer yielded higher growth mean colony forming units (CFUs) than PBS for both Gram-positive and Gram-negative bacteria. PBS and resuscitation buffer had comparable collection effectiveness and ability to grow bacteria after aerosolization. Mean counts for Gram-positive bacteria for PBS versus resuscitation buffer were 48.0 to 51.5 CFUs, and 193 to 211 CFUs for Gram-negative bacteria.

Conclusion: Resuscitation buffer offers a more cost efficient, multi-purpose collection and growth media for agricultural bioaerosol sampling.

Students Full Name: Laura Krause

School: Colorado State University

School Address: 1681 Campus Delivery

City, State, Zip: Fort Collins, CO 80521

Country: U.S.

Email: laura_krause3@comcast.net

Phone: 719-671-8391
Noise Characterization And Exposure Of Indoor Hockey Officials

Ammon Langley, William Brazile, Delvin Sandfort, and Tiffany Lipsey

Colorado State University

Introduction

Researchers have recently associated self-reported hearing loss in sports officials who use whistles. However, the actual noise exposures or degree of hearing loss to sports officials have not been determined to date. Therefore, a pilot study was conducted to assess hockey official noise exposures at two sporting arenas that host junior and collegiate hockey games. The purpose of this study was threefold: (1) to measure the noise to which hockey officials are exposed; (2) to determine if hockey officials are at increased risk of hearing damage from officiating games; and (3) to determine if hearing protection is warranted. This pilot study will help determine if a more comprehensive study, including audiometric testing, at louder, larger sports arenas is warranted.

Methods

A total of 23 hockey official noise exposure samples were taken over the course of six hockey games. The hockey official noise exposure samples were collected while they were officiating games using Larson Davis personal noise dosimeters. The dosimeters were pre-calibrated and attached to the officials with the microphone positioned within a one-foot radius of their heads on their dominant sides. The dosimeters were post-calibrated and the data were downloaded using the Larson Davis Blaze Software.

Results

Although the hockey games were only approximately three hours in duration, 15 of 23 (65%) of the officials were overexposed to noise based on the ACGIH TLV-TWA of 85 dBA (3 dB exchange rate). Furthermore, all officials sampled had Leqs that exceeded 85 dBA. None of the hockey officials were exposed to noise levels in excess of the OSHA PEL of 90 dBA (5 dB exchange rate) or the OSHA action limit of 85 dBA (5 dB exchange rate).

Conclusion

Based on the results of this pilot study, hockey officials are overexposed to hazardous levels of noise that can likely contribute to hearing loss. Therefore, recommendations that include the use of earplugs were provided to reduce hockey official noise exposure and reduce the risk of developing noise-induced hearing loss in this population of workers. However, to determine if temporary hearing loss occurs from hockey game noise, future research using audiometric testing pre- and post-game exposure should be performed.
An Automated Microenvironmental Aerosol Sampler (AMAS) For Location/Activity Exposure Assessment

C. Quinn, D. Cate, D. Miller-Lionberg, C. Henry, and J. Volckens

Colorado State University, Fort Collins, CO.

This work describes the development and evaluation of an automated microenvironmental aerosol sampler (AMAS). Existing personal exposure assessment devices and methods are expensive and cumbersome which hinders exposure assessment for larger-scale epidemiology studies. The AMAS is a low-cost, wearable device containing three filter-pump assemblies designed to measure personal exposure to air pollution for both panel-based epidemiological studies as well as 'citizen science' applications. A novel aspect of this device is that it collects particulate matter from within distinct personal microenvironments (such as at home, at work, and in transit). The device operates autonomously, using data from on-board sensors (GPS, light intensity, temperature, pressure, acceleration) to determine when an individual enters a given microenvironment and then initiates sampling through one of three micropump-filter assemblies. Anodic stripping voltammetry, colorimetric microfluidic paper-based analytical devices (mPADs), and image processing are used to quantify the trace metals (lead and cadmium), reactive oxygen species, and black carbon collected on the filters. These analytic techniques provide rapid but accurate sample analysis which also reduce analytic costs by a factor of 10 overall (total analysis cost under $2 per sample).
Efficacy of Nail Tissue as Biomarker for Welding Fume Manganese Exposure

Bainter, Jeffrey C.

Advising Professors: Ulrike Dydak and Frank Rosenthal – Purdue School of Health Sciences

Funding: National Institutes for Health Research Project Grant Program (R01 grant R01 ES020529, Dydak) and NIOSH trainee program. No conflict of interest exists.

Introduction: Recent studies have shown correlation between manganese exposure and both nail tissue concentration as well as concentrations in dopaminergic regions of the brain. This indicates the potential utility of nail tissue as a biomarker of body burden of manganese exposure which could prove useful in areas of toxicological research such as Parkinsonism and Manganism in welding workers. Potential exogenous contamination of Mn on nail tissue has created concern about the validity of the quantification of endogenous Mn in nail. Previous studies have used a surfactant/ultrasonic cleaning method attempting to remove exogenous welding fume contamination prior to analysis. Preceding work, however, has not established the presence of significant exogenous Mn contamination or the effectiveness of these cleaning methods.

Methods: A custom welding fume containment vessel and methodology for intentional GMAW welding fume contamination were developed in order to deposit welding fume Mn onto control nail samples in a within-subject design in order to test the efficacy of the prior nail tissue cleaning method. Determination of the potential level of exogenous Mn from welding fume on welder nail tissue was also investigated. Nail tissue digestion technique followed by inductively coupled plasma-mass spectrometry (ICP-MS) was used to determine nail Mn concentration.

Results: Paired within-subject welder fingernail samples exhibited significant exogenous Mn contamination (uncleaned 8.78 µg/g Mn vs. cleaned 3.22 µg/g Mn, p-value p=0.0117). The cleaning method on GMAW contaminated control fingernails reduced the exogenous Mn contamination by over 95% (removal efficiency CI 94.18%, 96.70%).

Conclusions: Mn contamination is likely a threat to validity of nail tissue as a biomarker of body burden. Exogenous Mn can be cleaned effectively leading to utility of nail tissue as a biomarker for welding fume Mn internal exposure.
The World Health Organization and Centers for Disease Control and Prevention have determined that antimicrobial resistance (AMR) poses significant threats to human and animal health. Calves have been identified as high shedders of bacterial, and the use of antibiotics in calves create a risk for development of AMR genes in calf microbiomes. Occupational practices in dairies generate bioaerosols. The objective is to provide a framework for investigating microbial exposures encountered by dairy workers and address AMR concerns. The specific aims and hypothesis are: Aim-1. Characterize and compare airborne and host-associated bacterial community structures encountered by dairy workers, focusing on handling pre-weaned calves. Hypothesis-1a: Airborne bacterial diversity in personal breathing-zone samples will correspond with calf rectal bacterial diversity. 1b- area-based air samples will have spatiotemporal variations. Aim-2. Identify potential sources of worker exposure to AMR bacteria associated with handling pre-weaned dairy calves. Hypothesis-2: Bacterial genomic DNA isolated from rectal and calf-hutch swabs will contain AMR genes. Aim-3. Characterize worker exposures to AMR bacteria in bioaerosols on a dairy, focusing on handling pre-weaned calves. Hypothesis: AMR genes are present in inhalation exposures of dairy workers who work with pre-weaned calves. Personal air samples, area-based air samples, calf nose, mouth, rectal, and hutch samples were collected in conjunction with the E. coli O157 Shedding and Antimicrobial Susceptibility on Colorado Dairies project. DNA will be extracted from samples using Powersoil® DNA Isolation Kits, following manufacturer’s and Earth Microbiome Project’s protocols. Extracted DNA will be analyzed at the Genomics and Microarray Core at the University of Colorado Denver using high-throughput 16S rRNA and shotgun metagenomic sequencing to assess bacterial diversity the presence of AMR genes.
Noise Characterization of Oil & Gas Operations

Cameron Radtke, Delvin Sandfort, Tiffany Lipsey and William Brazile

**Introduction:** The oil and gas (O&G) industry is rapidly expanding across the United States and as a result, O&G operation sites are developing near residential communities and within city boundaries. A significant and persistent concern that has proved to be difficult to manage is noise exposure to the surrounding communities from the O&G operations. The Colorado Oil and Gas Conservation Commission (COGCC) receives weekly complaints from communities and individual households about noise originating from nearby O&G sites. The COGCC is interested in revising the current COGCC noise regulations by which O&G operators must abide, and as such, partnered with CSU to investigate current noise levels. The focus of this study is to measure sound levels at different O&G sites to characterize noise levels produced by the different phases of O&G development. The four phases of O&G development include drilling, fracking, completion and production. The Colorado State University researchers will serve as an external third party to provide study results that the COGCC can use to amend the current COGCC noise regulations if necessary.

**Methods:** Four noise dosimeters and a handheld sound level meter (SLM) were used to collect noise samples at 24 O&G sites. All equipment was pre- and post-calibrated to maintain data quality. Given the variability between sites, at least three representative surveys for each type of site were taken. Four noise dosimeters with tripods at a height of five feet were placed 350 feet from the noise source in each cardinal direction. The dosimeters collected noise data the entire time the investigator was on site. The SLM was used to collect five-second readings at various distances from the noise source in each cardinal direction so that a noise map of each type of site could be developed.

**Results:** Larson Davis Blaze, DNA software, and a statistical analysis software package will be used to analyze the data and develop a visual representation (i.e., noise map) of sound pressure levels in and around each site sampled. Results will be used to model sound pressure levels at certain distances from O&G sites of different types and sizes. In addition, the SLM data will be used to develop a noise predictive model to estimate the noise for future proposed O&G sites. Preliminary results indicate relatively high sound pressure levels, particularly in the lower frequency spectrum. These low frequency sound levels present unique health hazards and are difficult to control.

**Conclusions:** No conclusions have been made to date since the data are being analyzed. However, the results of this study will be used to determine if it is necessary to amend current COGCC noise regulations in an effort to minimize the environmental noise impact of O&G operations on local communities.
Evaluating Safety Management Systems in U.S. Microbreweries

by Reva Golden (Industrial Hygiene Masters Candidate)

Microbrewing is a growing industry in the United States. In the past ten years, the number of microbreweries in the US has nearly quadrupled from 376 in 2003 to 1412 in 2013. Microbrewers can come from a diversity of backgrounds ranging from artists, accountants, and businessmen to former scientists, engineers, and manufacturing associates. Microbrewery production systems may be brand new, well designed, and automated while others may be secondhand, piecewise, and manual. With the diversity of brewer backgrounds, unstandardized operating systems, and strict demands of production, safety hazards can arise from a number of origins and may go unrecognized until someone gets hurt. After a few high profile industry fatalities, safety is becoming an emerging topic. Many breweries say they value safety and want to be safe but many also do not know where to start. This study surveyed U.S. microbrewers to assess industry safety culture, climate, participation, and needs. Additionally, it was the intent of this project to provide a safety and health management system checklist and development tool. It was found that microbrewery safety culture and climate need improvement and recommended that microbrewers use the self-assessment checklist to develop safety management practices as well as conduct do-it-yourself hazard assessments.
A Measurement-Feedback Approach for Personal Development

Dorey Chaffee a, Barbara Fritzsche b, Natalie Dixon b, Robert Pritchard b, Elissa Ashwood c

a Colorado State University, b University of Central Florida, c University of Rochester

Background: Personal improvement has important implications for both individuals and organizations. While many tools have been developed to improve employee performance, few have focused on improving important outcomes for people that positively impact both their work and non-work lives. Moreover, few behavioral change interventions are empirically supported or theory-based. In a two-part study, we examined an evidenced-based intervention to improve personal effectiveness.

Methods: First, participants identified areas of desired change and then with the guidance of a facilitator developed personalized measurement-feedback systems. Measurement data was collected weekly and entered into their system to generate a feedback report. Participants met weekly over four weeks with a facilitator to review the report and strategize for improvement.

Results: The effectiveness of the intervention was tested by examining the extent to which individuals improved on measures from baseline through feedback. Study One examined whether outcomes associated with behavior change improved long-term individual outcomes and exhibited positive spillover effects into the workplace. Participants experienced large effectiveness gains from baseline through feedback and perceived stress decreased, while life satisfaction, future change efficacy, job satisfaction, and perceived job efficacy increased significantly. Study Two examined whether the intervention could help individuals improve their physical fitness. Additionally, the influence of participation during system development on outcomes and attitudes was examined. In both conditions, participants’ physical fitness improved from baseline through feedback and life satisfaction increased. However, attitudes were poorer when participation in system development was reduced.

Conclusions: These studies provide empirical support for the effectiveness of a measurement-feedback intervention for personal development. Results suggest the intervention can be an effective mechanism to improve wellbeing, physical health, and job-related outcomes.
When do women, men, and workers become "old"?

Madison E. Hanscom, B.S., Colorado State University

Introduction

Although chronological age is a useful way to measure age, a number of studies have shown that alternative measures including subjective age may contribute to our understanding of how age is linked to both organizational outcomes. Subjective age refers to how old or young the individual feels. Because little research has examined the influence of subjective age among working adults, we examine the linkages among ones gender, chronological age, subjective age, and a set of outcomes including the age at which one perceives a man, woman, and employee to be considered “old”.

Method

Participants (N = 386) were MTurk workers recruited through Amazon’s Mechanical Turk website during Summer 2014.

Results

The purpose of this study was to investigate gender, chronological age, and subjective age differences in how a person perceives when women, men, and workers are considered to be “old”. We examined these relationships using a 3 x 2 x 2 factorial MANOVA for independent groups and also hierarchical multiple regression. Results indicated that there was a significant multivariate relationship for gender, chronological age, and subjective age measures on the combined outcome variables. In order to determine the effects of the independent variables on each of the outcome variables separately, hierarchical multiple regression was conducted. Each predictor contributed significantly to the age in which one perceived a worker, man, or woman to be “old”.

Conclusions

The findings show there are significant variations in the age at which men, women, and workers are considered to become ‘old’. The results will further explicate the importance of work conditions as they relate to age perceptions and work.
The Development of a Measure of Work-Related Underload

Megan N. Naude, BS, Colorado State University
Gwenith G. Fisher, PhD, Colorado State University

Background

Although the occupational health psychology literature has paid much attention to the notion of work role overload as a source of work stress, work-related underload has received far less research attention. Work-related underload has been defined as condition in which an individual has considerably less work than he is able to do in the time available. Prior research has linked the experience of underload with important individual and organizational outcomes, including depression, absenteeism, and turnover. However, there is confusion in the literature regarding how to define and assess underload. The purpose of this study was to develop and validate a survey measure of work-related underload that could be useful in occupational health research.

Methods

We generated and evaluated an initial pool of 25 survey items to assess work underload. The final scale consists of three dimensions—workload perceptions, expectations, and desires. A sample of N=370 working U.S. adults was obtained through Amazon’s Mechanical Turk online survey panel.

Results

Results provided empirical evidence to support the hypothesized three-factor structure of the work-related underload scale. Using confirmatory factor analysis, we found that a three-factor model fit the data well and better than a one-factor model. Additionally, our results provided evidence of convergent and discriminant validity.

Conclusions

A survey measure that is informed by theory provides a meaningful conceptualization of underload and can be useful for testing relationships between underload and outcomes such as psychological strain in the workplace. The ability to identify underload as a source of stress will help organizations to better address worker health and well-being, and future research can examine how job design, leadership, communication, and training can all be used to prevent underload.
Is the ‘grass’ greener? Work and well-being in the cannabis industry

Kevin M. Walters, BS¹, Gwenith G. Fisher, PhD¹, Liliana T. Starr, MPH²

¹Department of Psychology, Colorado State University
²Colorado School of Public Health, University of Colorado Denver

Introduction: The state of Colorado legalized cannabis for medical use in 2000 and legalized the growth, possession, and use of cannabis for recreational purposes via Amendment 64 in 2012 (Room, 2014). With this legalization comes the birth and growth of an industry in which we know extremely little regarding worker safety, health, and well-being. This research-to-practice (R2P) PILOT project is the first examination of the cannabis industry of Colorado from an occupational safety and health (OSH) perspective.

Methods: Data will be collected via two separate cross-sectional survey methodologies. We partnered with industry leaders to disseminate a recruitment survey to solicit participation from organizational leaders. Primary survey responses will then be collected via in-person or online surveys. Data will be collected on OSH and well-being of cannabis industry workers, such as psychological stressors and outcomes, workplace supports, training needs, safety climate, occupational hazards, the physical work environment, health care access, interest in health and safety topics, job characteristics (e.g., tasks, tenure, and motives for work) and basic demographics.

Anticipated Results: Data will be analyzed via descriptive statistics, psychometric analyses, correlation analyses, and regression analyses. We anticipate results which align with classic occupational health psychology models (e.g., job-demands resources model). Results of the study and complementary OSH training recommendations will be shared with cannabis industry leaders.

Conclusion: This study is the first to assess OSH in the cannabis industry of Colorado. We will primarily discuss the history and need for this project, specific methodologies and study design, and implications for the cannabis industry. Up-to-date results (real or anticipated) will be provided.

Conflicts of Interest: The authors have no relevant financial relationships or conflicts of interest to disclose.

References

OCCUPATIONAL MEDICINE RESIDENCY (colored paper)
Utility of Lung Clearance Index (LCI) as a Marker of Deployment Lung Disease


National Jewish Health – Denver, CO/US
University of Colorado Anschutz Medical Campus – Aurora, CO/US

Rationale: Military deployment to Iraq and Afghanistan is associated with exposure to hazardous inhalants. Deployers have returned with respiratory symptoms unexplained by pulmonary function testing (PFT) and chest computerized tomography (CT) and may be at risk for small airways diseases including constrictive bronchiolitis. The lung clearance index (LCI) has shown promise as a noninvasive marker of early small airways abnormalities in individuals with cystic fibrosis. We hypothesize that LCI will provide a useful early marker of lung injury that will correlate with and predict abnormalities found on lung biopsy better than PFT or chest CT.

Methods: Mean LCI will be compared between 20 deployers and 20 controls using a two-sample t-test. Logistic regression models will be fit for outcomes of bronchiolitis as a function of LCI, lung physiology, and chest CT variables. Area under the ROC-curve and model performance statistics will be calculated to determine if LCI is a better measure.

Results: We anticipate that mean (SD) LCI will be higher in symptomatic deployers with abnormal lung biopsies than in adult matched controls. We expect that LCI indices will be more sensitive than PFT and CT in detecting deployment lung disease (based on lung biopsy).

Conclusions: LCI testing may play an important role in evaluation of deployment lung disease and may obviate the need for surgical lung biopsy. It may be a marker for progression of lung disease in symptomatic deployers, though this requires further investigation. Our study expands normative values for adults without lung disease, essential in other applications of LCI as a noninvasive marker of early occupational lung disease.
Psychomotor Impairment in Occasional Marijuana Users: Public Health Guidance

K. Siegel, MD, MPH, M. VanDyke, PhD, CIH, and M. Kosnett, MD, MPH, Colorado Department of Public Health and Environment and University of Colorado Denver

Background: Legalization of recreational marijuana in Colorado has prompted the need for better knowledge about the pharmacological effects of marijuana in order to inform consumers, public health and health care professionals, and policy makers.

Our objective was to critically assess the scientific evidence about psychomotor effects relevant to driving ability from acute marijuana use in occasional or naïve users and translate it into public health guidance.

Methods: We posed research questions, identified relevant studies, and graded the quality of each relevant study finding. We developed graded evidence statements to address each research question and, where appropriate, translated these into public health statements and/or public health recommendations.

Results: We found substantial or moderate evidence for the following: an increased risk of impaired psychomotor skill or driving ability in occasional users with whole blood THC (delta 9-tetrahydrocannabinol) of 2-5 ng/mL; impaired psychomotor skill or driving ability in occasional users from smoking or ingesting $\geq 10$ mg THC; resolution or near resolution of impairment in occasional users within 6 hours after smoking $\leq 35$ mg THC; and resolution or near resolution of impairment in occasional users within 8 hours after ingesting $< 18$ mg THC. The evidence is insufficient regarding impairment from higher doses of marijuana and other routes of use (e.g. mucosal, dermal).

Conclusion: Current evidence about marijuana’s health effects, including impairment, will inform public health education efforts, surveillance, and policy to promote safer recreational marijuana use. More data about use habits, effects of higher potency marijuana, extent of tolerance to impairment in chronic users, and the predictive value of roadside testing for marijuana use are needed.
PILOT PROJECTS (colored paper)
Modern dairies have evolved into mechanized milking parlors replete with repetitive tasks for the milkers to perform. These tasks are outlined within best practice standards to ensure quality of milk and quality of cow care, and are equally applicable for 250-cow “small” dairy operations in Italy as 1,500-cow “large” herd operations found in Colorado. This study uses GoPro “cow-cams” to record videos of each milking operation in 12 small Italian parlors and 8 large Colorado parlors. Analysis of the tasks shown is by the Multimedia Video Task Analysis tool developed by the University of Wisconsin-Madison. Each task is tracked by cow, and the resulting timing data compared to best practice standards and between the two selected dairy types. While research is ongoing, herd size is expected to be the primary determinant for adherence to best practice standards. However, the relaxed standards and various non-milking tasks which characterize Italian dairies are cultural influences which affect the small dairy milking data strongly. This work furthers the study of occupational practices and risks associated with dairy parlor work. In the future, this task analysis will be paired MotionCapture analysis of worker strain in the upper extremities and low back due the particular ergonomic demands of each milking task.

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foos.rebecca@gmail.com
Microbial sampling and metagenomics approaches for workplace exposure studies

J.W. Schaeffer*¹, M.E. Davidson*¹, L. E. Epperson*², S.J. Reynolds¹, M. Strong² and R.M. Davidson²

¹Colorado State University, Fort Collins, CO; ²National Jewish Health, Denver, CO

*Authors contributed equally

Rationale: Inhalation exposure to opportunistic lung pathogens is a concern for individuals with inherent risk factors. Occupational workers with the highest risk of exposure include those in health care and agriculture, specifically dairy workers. Therefore, reliable and informative methods for collection and identification of bacterial pathogens in environmental samples are critical. Previous work has shown high variability in microbial composition dependent on collection media and analysis methods.

Objectives: Our objectives are to assess a range of microbial sampling filters and to measure microbial exposures using non-culture, high throughput DNA sequencing approaches.

Methods: Dairy workers will be the target population as they are exposed to a multitude of bacterial pathogens. We will use commercially available button samplers, filters and DNA isolation kits. DNA samples will be prepared for 16S amplicon sequencing and shotgun metagenomic sequencing on the Ion Torrent PGM at NJH. We will compare microbial profiles among filter and sample types and between 16S amplicon and shotgun assembly methods.

Anticipated Results: We will demonstrate the advantages and limitations of various sampling methods in terms of bacterial DNA recovery and preferential sampling of bacterial species. In addition, this project will give allow us to optimize both wet lab and bioinformatics workflows for 16S amplicon and shotgun metagenomics methods. Upon completion of the study, we will produce and deliver standard operating procedures (SOPs) that will be available to researchers at the CSU High Plains Intermountain Center for Agricultural Health and Safety and the NJH Integrated Center for Genes, Environment and Health to encourage standardization of sample collection and data analysis in future studies.

Joshua.Schaeffer@colostate.edu
Ma.Davidson@colostate.edu
EppersonE@NJHealth.org
Stephen.Reynolds@ColoState.EDU
StrongM@NJHealth.org
DavidsonR@NJHealth.org
[Insert judging criteria for poster]