



**University of Kentucky
Central Appalachian Regional Education and Research Center**

**Annual Program Highlights
Reporting Period: July 1, 2015 – June 30, 2016**

Principal Investigator: Wayne T. Sanderson, PhD

SECTION I

ERC SUMMARY:

The Central Appalachian Regional Education and Research Center (CARERC) provides graduate and continuing education for occupational safety and health professionals. Specifically, we (1) provide interdisciplinary occupational safety and health education for graduate students; (2) enhance the research skills of students and faculty in the targeted disciplines; (3) encourage and conduct interdisciplinary research on a variety of occupational diseases and injuries; (4) deliver continuing education, consultation and outreach to address environmental and occupational safety and health concerns; and (5) translate research into prevention practice. CARERC's scope includes counties in eastern Kentucky, western North Carolina, eastern Tennessee, western Virginia, and southern West Virginia, where elevated rates of occupational injuries and fatalities persist, particularly in production agriculture, forestry, mining, and transportation. CARERC combines the resources of the University of Kentucky College of Public Health (MPH, PhD and DrPH in Occupational Epidemiology and Injury, and MPH and DrPH in Agricultural Safety and Health); the UK College of Nursing (PhD in Occupational Nursing); the UK College of Engineering (MS and PhD in Mine Safety & Health), and the Eastern Kentucky University College of Justice & Safety (MS in Occupational Safety). CARERC collaborates with other regional institutions as well as industry, labor, and government in its Pilot Research Program (PRP), Outreach, and Continuing Education (CE) programs to enhance research capacity and catalyze the translation of research to practice. Building on our strengths and stature, CARERC continues to serve as a catalyst for interdisciplinary research in occupational safety and health and a centralized resource center for innovative education and training.

RELEVANCE:

Building on the strengths of our education and research programs and responding to the need for innovative, coordinated occupational safety and health training in central Appalachia, the Central Appalachian Regional Education and Research Center (CARERC) provides targeted instruction, training, and applied research while serving as a recognized source of knowledge and expertise.

KEY PERSONNEL:

Sanderson, Wayne T.	University of Kentucky	ERC Director & Continuing Education
Browning, Steven R.	University of Kentucky	Deputy Director
Mannino, David	University of Kentucky	Occ Epidemiology Director
Kane, Christin	University of Kentucky	Research Coordinator
Charles, Lynda	University of Kentucky	CE Assistant Director
Dunlap, Scotty	Eastern Kentucky University	OS Director
Anderson, Debra G.	University of Kentucky	OHEN Director
Sottile, Joseph	University of Kentucky	MineSH Director
Westneat, Susan	University of Kentucky	Center Evaluation

ERC Web Link: <http://www.mc.uky.edu/erc/>

SECTION II**PROGRAM HIGHLIGHTS OF HIGH IMPACT****Mining Safety and Health (MineSH)****Program Director: Joseph Sottile**

Trainees in the Mining Safety and Health core continue to develop innovative and relevant research projects. During the reporting period, 1 student completed the program receiving her MS degree in August 2015 with 2 others due to defend their theses in July 2016. Strong mentorship in the program has led one graduating student to continue her education with enrollment in the PhD program. Continuing education courses continue to be well received and in demand.

Selected training projects include:

Project Title: Automating Fan Ventilation and Measurement as a Means of Ensuring Proper Air Flow in Coal Mining Operations
Trainee: Kayla Mayfield – graduated with MS in August 2015, pursuing PhD in program

Summary of project:

Coal mines are required to be ventilated. Not only does ventilation bring fresh air to the workers but also removes contaminants such as coal and silica dust, methane, and diesel particulates which are harmful to workers. This project automated a fan and measurements along a ventilation network at the ventilation lab in UK's Mining and Mineral Resources Building. Then, using computer software, created an algorithm that can automatically adjust the fan for highest efficiency/performance at various ventilation network conditions. This work will result in upgrades to the University of Kentucky ventilation lab. In a full scale mine, this work has the potential to allow fans to adjust to changes in the mine environment in order to ensure proper air flow to the workers.

Project Title: Coal mine dust mitigation through novel scrubber development and numerical modeling

Trainee: Gregory Brenner – expected to graduate July 2016 and is employed in an Occupational Health and Safety-related job

Summary of project:

This project developed a scale model of a three entry room and pillar mine. The primary purpose was to investigate dust settling behavior in a coal mine. The secondary purpose was to develop an educational aid for demonstrating U-type ventilation patterns and the inherent leakages associated with that design. Brenner constructed a 1:20 scale model of a mine return entry for conducting experiments on dust deposition in mine airways.

Project Title: Utilization of a Small Unmanned Aircraft System for Direct Sampling of Nitrogen Oxides Produced by Full-Scale Surface Mine Blasting

Trainee: Robert Brendan McCray –thesis defense scheduled for July 2016

Summary of project:

Emerging health concern for gaseous nitrogen oxides (NO_x) emitted during surface mine blasting has prompted mining authorities in the United States to pursue new regulations. NO_x is comprised of various binary compounds of nitrogen and oxygen. Nitric oxide (NO) and nitrogen dioxide (NO₂) are the most prominent. Modern explosive formulations are not designed to produce NO_x during properly-sustained detonations, and researchers have identified several causes through laboratory experiments; however, direct sampling of NO_x following full-scale surface mine blasting has not been accomplished. The purpose of this thesis is to demonstrate a safe, innovative method of directly quantifying NO_x concentrations in a full-scale surface mining environment. A small, unmanned aircraft system is used with a continuous gas monitor to sample concentrated fumes. Three flights were completed – two in the Powder River Basin. Results from a moderate NO_x emission showed peak NO and NO₂ concentrations of 257 ppm and 67.2 ppm, respectively. The estimated NO₂ presence following a severe NO_x emission was 137.3 ppm. Dispersion of the gases occurred over short distances, and novel geometric models were developed to describe emission characteristics. Overall, the direct sampling method was successful, and the data collected are new to the body of scientific knowledge.

Project Title: Development of an Edge Effect Offset Algorithm for Subsidence Calculations

Trainee: Josh Hescocock

Summary of project:

This project includes an improvement of the Surface Deformation Prediction System (SDPS) program created by Dr. Zach Agioutantis. This program uses previous research, theories and equations to predict surface deformation as a result of underground mining operations. The current stage consists of creating code in Matlab to improve the accuracy of certain processes within SDPS. The code will then be analyzed for correctness and accuracy and implemented into the SDPS program.

Employment/Internships:

Greg Brenner has completed the coursework towards his degree and accepted an occupational health and safety-related position with Software Information System, LLC, Lexington, KY.

New course development:

Courses – MNG 699 (Mine Automation and Control) and MNG 699 (Advanced Safety and Health) have been taught as experimental courses; a New Course Application for each course has been filed to permit them to be taught on a continuous basis.

Trainee certifications/trainings/further education:

Kayla Mayfield graduated with her MS degree in August 2015 and is currently enrolled in the Mining Engineering PhD program at UK continuing her work in Mine Safety and Health.

Faculty publications:

Sottile, J., T. Novak, A. Tripathi, "Best Practices for Implementing High-Resistance Grounding in Mine Power Systems," *IEEE Transactions on Industry Applications*, Nov/Dec 2015, pp. 5254-5260.

Sottile, J. and T. Novak, "Mine Electrical Systems, Part 2 - Alternating Current Systems," *IEEE Industry Applications Magazine*, Institute for Electrical and Electronics Engineers, Inc., Nov/Dec 2015, pp. 8-13.

Novak, T. and J. Sottile, "Mine Electrical Systems, Part 1," *IEEE Industry Applications Magazine*, Institute for Electrical and Electronics Engineers, Inc., Sep/Oct 2015, pp. 7-13.

Other Faculty Activities

Dr. Sottile currently serves on the NIOSH National Research Agenda (NORA) Mining Sector Research Council.

Dr. Sottile is a member of the Kentucky Mining Equipment Review Panel

Dr. Sottile and other faculty continued their work on their grant: T. Novak, J. Sottile, W.C. Wedding, "Application of flooded-bed dust scrubbers to longwall mining systems," Alpha Foundation, 11/01/2013 – 10/31/2015, \$659,343.

Occupational/Environmental Health Nursing (OEHN)**Program Director: Debra Anderson**

The OEHN core continues to recruit and mentor strong students whose activities (publications, presentations, and invited oral presentations) show their increasing scholarly activities and involvement and recognition in the OEHN field. During the reporting period, Sharon Hunsucker was the first OEHN trainee to complete her PhD on the topic of "Effect of Obesity on United States Farmers: A Pilot Study". Other selected research projects include:

Project Title: Biomechanics of Back Injuries in Nursing

Trainee: Michael Callihan

Summary of project:

This project is exploring risk factors associated with biomechanics of back injuries in nurses. Currently Mr. Callihan is doing 3D motion capture and EMG studies on nursing students and EMTs to determine joint angles and muscle activation during several lifting and moving tasks. His goal is to identify areas of weakness that can be improved upon with proper training.

Project Title: Are Long Shifts Causing Nurse Burnout and Depression Causing Nursing Errors and Patient Dissatisfaction in the Workplace?

Trainee: Ashley Ziegler

Summary of project:

This new OEHN trainee's project will focus on analyzing if nurses working long hours experience higher rates of burnout and depression both of which in return can lead to workplace errors and a decrease of overall patient care satisfaction. The project will also focus on the risk factors that are associated with the two related disorders.

Project Title: Intimate Partner Violence in long-haul truck driving teams

Trainee: Kimberly Bourne

Summary of project:

This research will look at workplace sexual violence (harassment, sexual assault and intimate partner violence) in female long-haul truck drivers. I will explore how background variables (age, race, marital status, income, prior experience with sexual violence), social and work variables (driving status, company reporting policies, cultural views of women within the industry), and psychosocial variables (support systems, coping styles, tolerance levels, female drivers' perceptions of violence) affect the incidence of workplace sexual violence. I am also looking at the physical and psychological consequences of workplace sexual violence in this same population.

Trainee Publications:

Warshawsky, N., Brandford, A., Barnum, N., & Westneat, S. (2015). Achieving 80% BSN by 2020: Lessons Learned from Kentucky. *Journal of Nursing Administration* 45 (9), 449-456.

Abell, C.H., Evans, C., Alexander, L., Bourne, K., Jones, M.S. (in press). A unique clinical experience for RN to BSN students: Providing farm safety education. *Journal of Nursing Education*.

Bourne, K. (2015). Mine workers, heat related illnesses, and the role of the occupational health nurse. *KY Nurse*, 63(3), 6-7.

Shojaei, I., Allen-Bryant, K., & Bazrgari, B. (in print). Viscoelastic response of the human lower back to passive flexion: The effects of age. *Annals of Biomedical Engineering*. doi: 10.1007/s10439-016-1569-7

Trainee Published Abstracts:

Bourne, K. M. & Anderson, D. G. (2016, April). Workplace Sexual Violence in Female Truck Drivers: A Conceptual Framework to Look at the Problem. *Workplace Health and Safety*, 64(7), 291.

Bourne, K. M. (2015, November). Behind Closed Curtains on Eighteen Wheels: The Risk Factors and Consequences of Intimate Partner Violence in Female Long-Haul Truck Drivers. In *43rd Biennial Convention (07 November-11 November 2015)*. STTI.

Trainee presentations:

Bourne, K. (Nov 2015). "Behind Closed Curtains on Eighteen Wheels: The Risks Factors and Consequences of Intimate Partner Violence in Female Long-Haul Truck Drivers. Poster presentation at the Sigma Theta Tau International, Biennial Convention, Las Vegas, Nevada

Bourne, K. (March 2016). "Hidden Behind a 53 Foot Trailer: Are Women Truck Drivers at Risk for Sexual Assault?" Poster presentation at the Ending Violence against Women International (2016 International Conference), Washington, DC.

Bourne, K. (May 2016) "A Unique Clinical Experience Increases RN to BSN Students' Knowledge about Farm Safety" Poster presentation at the Kentucky League for Nurses 12th Annual Nurse Educator Conference, Louisville, Kentucky

Bourne, K. (May 2016) "Truck Drivers: The Challenge with Healthy Living" Oral presentation at the American Association of Occupational Health Nurses (AAOHN) Chapter meeting, Bowling Green, KY.

Bourne, K. (April 2016) "Workplace Sexual Violence in Female Truck Drivers: A Conceptual Framework to Look at the Problem" Poster presentation at the American Association of Occupational Health Nurses (AAOHN) 2016 National Conference, Jacksonville, FL.

Bourne, K. (April 2016) "Developing a Workplace Sexual Violence Framework Related to Women Truck Drivers" Oral Presentation at the University of Kentucky, Lexington, KY.

Bourne, K. guest lecturer in a Knowledge Development class presenting "Developing a Workplace Sexual Violence Framework Related to Women Truck Drivers".

Callihan, M. (April 2016). "Getting to the core of back injury prevention in nurses". Presented as a 90-minute concurrent session oral presentation at the AAOHN (American Association of Occupational Health Nurses) National Conference April 11-14, 2016, Jacksonville, FL.

Callihan, M. (pending August 2016). "Who Takes Care of Us" Oral presentation at the Kentucky ENA (Emergency Nurses Association) conference in August 18-19 2016.

Allen-Bryant, K. (Nov 2015) Total Worker Health: The role of nurses in improving the health of workers. Poster presentation. University of Kentucky Annual Nursing Research Papers Day. Lexington, KY.

Trainee Grants

Callihan, M. received a \$3000 AAOHN 2016 New Investigator Research Grant award sponsored by Medique Products. He will be recognized during the **AAOHN Awards Ceremony** on Wednesday, April 26, 2017, at the AAOHN National Conference in New Orleans, Louisiana.

Trainee awards/honors:

Kimberly Bourne was nominated for Sigma Theta Tau Mentorship award

Michael Callihan was inducted into Sigma Theta Tau International, April 2016.

OEHN Faculty Presentations

Reed, D.B. (2016). *"It's who we are". Work and health of aging farmers.* Oral Presentation East Carolina University. Greenville, NC. April 2016.

Jones, M. S., Honaker, A. & Reed, D. B. (2016). *Using technology to educate nurses about agricultural health and safety issues.* Oral Presentation International Society for Agricultural Safety and health (ISASH) annual conference. Lexington, KY, June 27-29, 2016.

Eastman, A. & Reed, D.B. (2016). *Health status of Kentucky's senior farmers.* Posters-at-the-Capitol. Frankfort, KY. February 25, 2016.

Garrett-Wright, D., Main, M.E., Jones, M. S. & Reed, D. B. (2016.) *Enhancing healthcare for an emerging agricultural population: Anabaptist perceptions of health care healthcare services.* Poster International Society for Agricultural Safety and Health (ISASH) annual conference. Lexington, KY, June 27-29, 2016. (Manuscript in progress).

Boots, S.R., Reed, D.B. (Jun 2016). *Zero minutes to post – the time for Ag safety on social media is now.* Poster International Society for Agricultural Safety and Health (ISASH) annual conference. Lexington, KY. June 27-29, 2016.

New course/material development:

The following courses were offered during fall 2015/winter 2016.

NUR 761 OEHN: Occupational and Environmental Health: Research and Policy. This newly designed course was launched in fall 2015. This course provides graduate nursing students with knowledge and skills needed to improve health outcomes of populations in occupational environments. Further, this course prepares the student to be proficient in the knowledge, skills, and abilities to effectively work with complex organizational and community systems, specifically in occupational settings. Students learned how to utilize occupational data sets for the development of workplace research and policies at the local, state, national and global levels. Emphasis was placed on research and policy development, total worker health, workplace violence, injury prevention, and crises and disaster management.

In fall 2015 Drs. Reed and Jones with the assistance of an instructional designer, a videographer and two nursing faculty members, launched a new 1 hour Continuing Education offering, The Nursing Response to Mental Health Issues in Agriculture Populations. This course was created using interactive technology and field expert video clips. The course, marketed on the Western Kentucky University (WKU) website (<http://www.wku.edu/lp/nursing-ce-ag.php>) is described as: Farmers are at risk for serious health issues, including anxiety, depression and suicide. This continuing education program is designed to help identify the sources and warning signs of these issues and develop successful interventions:

Identify sources of stress associated with farming

Recognize the unique manifestations of stress

Assessment tools

Identify nursing interventions to assist the farmer and the family deal with mental health issues

The course has received excellent reviews as evident by this quote: *“This relevant, well-designed interactive program offers evidence-based strategies for nurses. The videos of the farmers are powerful and capture a realistic picture of the stress associated with farming.”* Vivian McClellan, RN, MSN, Corporate Director of Education and Development, Commonwealth Health Corporation, Bowling Green, KY.

Dr. Reed created a 10 minute video on agricultural nursing and research for the undergraduate nursing research class in the UK College of Nursing.

An on-line continuing education (CE) program, *Providing Quality Health Care for Plain Populations*, has been created and currently in its final review stage. In preparation for the development of this CE program, information was collected from 25 members of Anabaptists communities from 13 states, and 18 health care providers were interviewed about their experiences in providing care for this diverse population. The objectives for the CE program are:

1. Describe the historical background and culture of plain people
2. Identify barriers to health care among the plain people populations.
3. Identify common health issues/concerns of plain people
4. Outline appropriate nursing interventions when providing occupational safety and health care for plain people.

Occupational Safety (OS)

Program Director: Scotty Dunlap

Trainees within the OS core have developed research projects that have become increasingly important in the field of occupational health and safety. These projects demonstrate how the OS program is reacting and evolving with academic support and expertise necessary to support these emerging occupational safety issues.

Selected projects include:

Project Title: Impact of employee engagement on developing a safety culture
Trainee: Madelyn Street

Summary of project:

Through her occupational internship with General Electric, Madelyn has developed an interest in researching the impact of employee engagement on the development of a safety culture within an organization. General Electric has graciously agreed to allow Madelyn to conduct her research within their organization.

Project Title: Effectiveness of flavored drinks on fluid consumption in heat stress conducive environments
Trainee: Rebecca Mullins

Summary of project:

Rebecca has identified her research to include an analysis of the impact of flavored drinks on the volume of fluids consumed by construction workers in a heat stress conducive environment in an effort to remain hydrated. Due to ambient temperatures dropping throughout Appalachia with the change of seasons, she will be continuing her coursework and will be postponing her actual research until temperatures rebound next spring/summer.

Project Title: Women overcoming challenges in entering and advancing in the profession of occupational safety
Trainee: Kelly Sowders

Summary of project:

Utilizing critical theory, Kelly has been designing her research to explore barriers women have experienced in entering the field of occupational safety and strategies employed to overcome identified barriers. She will be utilizing a qualitative research methodology by conducting an open-ended response survey among ten women in varying stages of their careers (early, mid, and late career).

Project Title: Occupational noise exposure in the entertainment industry
Trainee: Ethan Farris

Summary of project:

Having taken the ERC course within the scope of the grant, Ethan has developed a great interest in industrial hygiene. He has chosen to investigate noise levels to which workers are exposed in service establishments where live bands perform. Ethan will be conducting noise level monitoring and dosimetry. His research will be of use due to the volume of applicable small businesses throughout Appalachia.

Trainee Employment/Internships:

Kelly Sowders was hired by Boeing in Everett, Washington as a summer occupational safety intern.

Madelyn Street was hired by General Electric in Louisville, Kentucky as a spring occupational safety intern with her internship being renewed for the summer.

Ben Purcell was hired by Toyotetsu America in Somerset, Kentucky as a spring occupational safety intern with his internship being renewed for the summer.

New course development:

Leading Measures in Occupational Safety (SSE 890)- this new graduate course features topics of current relevance in the occupational safety field and has been added to our curriculum as an elective course for OS trainees to address both leading and lagging measures in occupational safety; leading measures has been a topic of great recent dialogue within the safety profession. Though we have offered the course during the reporting period, it has not yet been executed due to lack of enrollment. To address this issue, we will engage in a greater level of communication regarding course content and its value.

Throughout the spring and summer, Dr. Dunlap worked to finalize an agreement with the American Society of Safety Engineers (ASSE) to offer the Risk Assessment Certificate Program on the campus of ECU. The agreement includes the delivery of the three day risk assessment course, one day of training on an elective course supporting risk assessment, and a day dedicated to completing a risk assessment project. The launch of the Risk Assessment Certificate Program on the campus of ECU is scheduled for spring 2017. The target audience will be ERC and ECU occupational safety students and those in industry throughout the Appalachian Region.

Faculty awards/honors:

Dr. Dunlap continued to serve in his selection as a US Technical Advisory Group (TAG) member for the development of ISO 45001, a global standard being drafted that addresses the development of safety and health management systems.

Dr. Dunlap continued to serve as an invited member of the American Society of Safety Engineers Risk Assessment Institute Committee.

Dr. Dunlap was selected as the ECU College of Justice and Safety Faculty Innovator for his work in college teaching. One faculty member from each of ECU's six colleges was selected for this honor.

Agricultural Safety and Health (ASH)**Program Director: Wayne T. Sanderson**

The ASH core shows a breadth of research activities and topics. In addition, graduating trainees are taking their training into relevant jobs and further education opportunities further extending the reach and impact of the CARERC ASH program.

Selected projects include:

Project Title: Occupational Dust Exposure and Chronic Obstructive Pulmonary Disease

Trainee: Caroline Holsinger – graduated with DrPH spring 2016

Summary of project:

Chronic obstructive pulmonary disease (COPD) is a progressive disease that is characterized by limited airflow associated with inflammatory response in the airways and lungs to particles and gases. Agricultural dust exposure is a contributing factor to the morbidity and mortality of COPD. Recent epidemiologic studies suggest that organic and inorganic dust accounts for 20 percent of the patients with COPD. Forced expiratory volume (FEV) is the parameter most commonly used to assess COPD. The purpose of this research proposal is to use a handheld COPD screening device, Vitalograph, to characterize the disease burden among agricultural workers in Appalachia and surrounding counties who report dust exposure related to agricultural practices.

Project Title: Reported Injuries and Fatalities in the Kentucky Master Loggers Training Program

Trainee: Logan Ray – graduated with MPH spring 2016

Summary of project:

The purpose of this study was to identify demographic, operational, and task-related characteristics associated with increased frequency and severity of injury in Kentucky's commercial loggers. Kentucky Master Loggers attending mandatory continued education courses completed a survey tool eliciting demographic and operational characteristics of their companies, and details of any on-site injury in the years 2012 through 2015 that led to medical costs, lost days or time, and/or decreased production. Associations to injury frequency and injury severity were assessed using logistic regression analysis.

Project Title: Equine Leptospirosis Seroprevalence in the Central and Bluegrass Regions of Kentucky from 1993- 2015

Trainee: Charlene Siza – graduated with MPH in spring 2016

Summary of project:

Leptospirosis is a worldwide zoonotic bacterial disease of significant importance for both human and animal health. There are many sources of infection and shedding of the bacteria, including horses. There is a known occupational hazard for leptospirosis, especially in occupations that work directly with animals or animal products. This study examined the

prevalence of equine leptospirosis in Kentucky in relation to trends over time and geographical distribution.

Project Title: Undiagnosed COPD and Restrictive Lung Disease Among Rural Workers

Trainee: Devon Collins – graduated with MPH spring 2016

Summary of project:

The main purpose of this study was to evaluate the relationship between occupational inhalable exposures and the presence of respiratory impairment, and identify higher risk occupational categories. Methods: In August 2015, data on 627 Kentucky State Fair patrons was collected via self-reported survey, and lung function test using the Vitalograph COPD-6®. Verbal consent was obtained from participants who answered questions on demographics, occupational history and exposures, use of personal protective equipment, medical and smoking history.

Trainee publications:

Swanberg, J. E., Clouser, J. M., Gan, W., Mannino, D. M., & Flunker, J. (2015). Individual and occupational characteristics associated with respiratory symptoms among Latino horse farm workers. . *American Journal of Industrial Medicine*, 58(6), 679-687. doi: 10.1002/ajim.22452

Trainee presentations:

Collins, Devon (Mar 2016)" Evaluating the Relationship of Inhalable Particulate Exposures by Occupational Categories, in Relation to Lung Function, Among Kentucky State Fair Patrons" oral presentation at the Southeastern States Occupational Network (SouthON) Conference 2016.

Flunker, John (Mar 2016)" Poor Safety Climate, Long Work Hours, and Musculoskeletal Discomfort among Latino Horse Farmworkers" oral presentation at the Southeastern States Occupational Network (SouthON) Conference 2016.

Siza, Charlene (April 2016) Equine Leptospirosis Seroprevalence in the Central and Bluegrass Regions of Kentucky from 1993-2015. Poster presentation at College of Public Health Research Day at the Center for Clinical and Translational Science Annual Conference, Lexington, KY.

Holsinger, CE, Mannino D, Collins D. Occupational Dust Exposure and Chronic Obstructive Pulmonary Disease: A pilot study. Poster presentation at American Public Health Association. 2015.

Trainee awards:

Jennifer Walch and Devon Collins were finalists in the 2016 University of Kentucky Global Health Case Competition, an inter-professional/multi college competition.

Trainee certifications/trainings/further education:

Charlene Siza accepted into the CDC's Epidemic Intelligence Service (EIS) two year fellowship to begin post-graduation.

John Flunker, MPH graduate in 2014 is taking courses to prepare for pursuing his PhD in Epidemiology at the University of Kentucky. Potential dissertation topic would use data collected from his work as a research team member for the Mountain Air Project (MAP), also at the University of Kentucky, examining respiratory exposures from mountain top removal among residents of Eastern Kentucky.

Employment/internships

Logan Ray accepted a position at the CDC starting in August as a Surveillance Epidemiologist/Data Manager and ORISE Fellow to the Enteric Disease Branch's FoodNet Team.

Kady Rogers accepted a position as Threat Preparedness Coordinator position at the Kanawha-Charleston Health Department in Charleston, West Virginia

Charlene Siza was accepted into the CDC's Epidemic Intelligence Service (EIS) two year fellowship.

Devon Collins accepted a position as Research Coordinator at Inova Fairfax Hospital in Falls Church, VA.

Caroline Holsinger accepted a position as Director of the Division of Environmental Epidemiology, Virginia Department of Health at the Virginia Health Department.

Faculty Publications

Rocheleau CM, Bertke SJ, Lawson CC, Romitti PA, Sanderson WT, Malik S, Lupo PJ, Desrosiers TA, Bell E, Druschel C, Correa A, Reefhuis J (2015): Maternal occupational pesticide exposure and risk of congenital heart defects in the national birth defects prevention study. Birth Defects Res A Clin Mol Teratol. doi:10.1002/bdra.23351.

New course development

The redesigned ASH core course CPH 728 Health of Agricultural Populations was launched in fall 2015 by CARERC faculty Drs. Sanderson and Purschwitz. This course brought together a multi-disciplinary team of guest lecturers speaking across a wide variety of agriculture/forestry/fishing topics.

Occupational Epidemiology (Occ Epi)

Program Directors: David Mannino/Steven Browning

The Occ Epi core, the newest of the CARERC cores, has shown great success in recruiting, training, graduating and placing quality trainees. Four of the graduate students (Siegel, Maxwell, Bush, and Martin) completed their degrees in spring 2016 and three are employed in relevant occupational safety and health jobs. The Occ Epi core will maintain this momentum with the recruitment of three new trainees, 2 pursuing their DrPH degrees; 1 pursuing his MPH degree.

Selected projects include:

Project Title: Evaluating the Association between Atrazine and Other Triazine Herbicides and Non-Hodgkins Lymphoma in Kentucky (2005-2009)

Trainee: Justine Maxwell - graduated with DrPH spring 2016

Summary of project:

Atrazine, one of the most widely used agricultural pesticides, largely sprayed on corn throughout the Midwest. The Environmental Protection Agency (EPA) has estimated 76.4 million pounds are applied annually where its usage on corn accounts for approximately 86% of total United States (US) domestic usage (in pounds). Approximately 75% of the field corn acreage grown in the U.S. is treated with atrazine. Once atrazine enters into waterways, it can persist having a half-life greater than 200 days in surface waters. In Kentucky, atrazine is the most heavily applied in heavy corn-producing locations, which are mostly in western regions of the state. Although some research has suggested a possible link between atrazine exposure and cancers, including breast, thyroid, and ovarian cancers, few studies have focused on the association of atrazine exposure and non-Hodgkin's lymphoma (NHL). Even fewer of these studies have assessed atrazine exposure using water sampling data. The purpose of this study was to conduct a descriptive exposure analysis and to evaluate the association between atrazine exposure metrics and NHL in Kentucky. Among the four metrics used to assess atrazine exposure, acres of corn planted, mean concentration level, number of samples above the maximum contaminant level, and percent above the Limit of Detection (LOD), the study found no evidence to support an association between atrazine and NHL. Study findings support the majority of previous research, therefore, strengthening the notion of no association between NHL and atrazine. (From the published capstone at http://uknowledge.uky.edu/cph_etds/).

Project Title: Central nervous system effects of occupational exposures in agricultural workers

Trainee: Miriam Siegel - graduated with DrPH spring 2016

Summary of project:

Pesticides and organic solvents are two classes of neurotoxic substances regularly used in agriculture. Pesticides have been studied in relation to a range of nervous system effects, and have been repeatedly shown to relate to depression in agricultural workers. Likewise, occupational solvent exposure is recognized as a risk factor for central nervous system effects, including mood disturbances and cognitive impairment, across various industries. Many gaps in knowledge regarding the effects of chronic exposure to these substances on mental/neurological health in agricultural workers still exist. The specific aims of the current analysis were to 1.) Estimate associations between metrics of a.) pesticide exposure and b.) organic solvent exposure and results from the Center for Epidemiologic Studies Depression Scale of depressed mood; and 2.) Estimate associations between questionnaire-based organic solvent exposure metrics and measures of central nervous system function assessed from a battery of nine neurobehavioral tests. Data from 701 licensed pesticide applicators were utilized from the Neurobehavioral Testing Study add-on to the Agricultural Health Study (AHS). Ever-use and cumulative use of pesticide information was compiled from all phases of the AHS for 16 specific organophosphates, 4 specific carbamates, all-organophosphate pesticide use, all-pesticide use, and high pesticide exposure events (HPEEs). At the time of neurobehavioral evaluation, solvent exposure was assessed in a questionnaire. *(From the published capstone at http://uknowledge.uky.edu/cph_etds/).*

Project Title: Hispanic Agricultural Workers: The Nexus of Demographics, Employment Characteristics, and Health

Trainee: Ashley Bush – graduated with DrPH, spring 2016

Summary of project:

Agriculture, which is home to elevated occupational injury and illness rates, has a substantial demographic makeup of Hispanic workers. Hispanic farmworkers are at increased risk of poor occupational health outcomes due to the precarious nature of work and other socio-ecological influences. These adverse occupational health outcome counts are inadequate and undercounted, failing to capture the true scope of agricultural work. To gain more knowledge about agriculture, this project will focus on the personal and work characteristics of agricultural workers to help further understand disparities within the agricultural sector by: providing a literature review of agricultural worker health; examining missed work due to work-related illness among Hispanic agricultural workers; exploring farmworker characteristics in two agricultural subsectors; and, offering implications for public health practice and research. *(From the published capstone at http://uknowledge.uky.edu/cph_etds/).*

Project Title: Risk Factors Associated with Severe Injuries in Inland Aquaculture Farms

Trainee: Amah Martin – graduated with MPH spring 2016

Summary of project:

The main objective of this study was to analyze risk factors associated with severe occupational injuries among inland aquaculture farms. Survey results were compiled in a data set that consisted of qualitative data from 51 farmers who were interviewed between 2008 and 2011 in 10 states and the Canadian province of British Columbia. Chi-square and Fisher's exact test were used to assess the differences in the dichotomous level of severity among several farm and injury variables. Logistic regression was used to predict the outcome of a severe injury event.

Faculty are continuing to work with all four of our recent CARERC graduates to assist them with the publication of their capstones as professional manuscripts. In addition to their research projects, our students have been engaged in work-related practicums which have supported their interest in occupational safety and health. In addition, faculty in the occupational epidemiology core were involved in the planning and implementation of the field studies course in spring 2016 which included on-site visits to a variety of industries to assess occupational safety and health conditions.

Selected Trainee Publications:

Swanberg J., Clouser, J., Bush, A., Westneat, S. From the Horse Worker's Mouth: A Detailed Account of Injuries Experienced by Latino Horse Workers, Journal of Immigrant and Minority Health (under review).

Bunn T., Bush A., Slavova S. Drug Overdose Deaths by Specific Employment Industry, and Occupation, and Drug Type, Drug and Alcohol Dependence (under review).

Selected Trainee Presentations:

Siegel, M. "Risk of visual impairment in individuals with a history of a farming, forestry, or fishing occupation." Poster presentation at the 143rd APHA Annual Meeting and Exposition in Chicago, IL. November, 2015.

Siegel, M., Starks, S.E., Sanderson, W.T., Hoppin, J.A., Gerr, F. "Organic solvent exposure and neuromotor performance in agricultural workers" Oral presentation at the 2016 International Society of Agricultural Safety and Health Conference (ISASH), Lexington, KY. June, 2016.

Bush, A., Swanberg, J.E., Clouser, J.M, Gan, W., Browning, S., Westneat, S. "Work organization factors and injuries among Latino workers: What increases risk of injuries on horse farms?" Oral presentation at the 2016 International Society of Agricultural Safety and Health Conference (ISASH), Lexington, KY. June, 2016.

Employment/Internships

Justine Maxwell accepted a position as Epidemiologist with the Tennessee Department of Health in the Health Surveillance and Bioinformatics branch.

Miriam Siegel has taken a position at the California Public Health Department's Environmental Health Investigations Branch as an Epidemiology fellow (Cal-EIS) and is pursuing research related to the health effects seen among firefighters who are engaged in wildfire suppression.

Ashley Bush is currently employed at the University of Kentucky and continuing research on the health of Latino farm workers in the equine industry.

Pending Faculty awards/honors

Occ Epi core Director Dr. David Mannino will be giving the keynote address at the Black Lung conference to be held in Lexington, KY Sep 2016.

Continuing Education (CE)**Program Director: Wayne Sanderson/Lynda Charles**

A planning committee, composed of the core directors and key staff, met throughout the reporting period to develop the annual training plan.

Continuing education directed towards working professionals was supported throughout the reporting year with CARERC organizing/hosting/managing the following major events:

1. CARERC helped organize and host the June 2016 International Society of Agricultural Safety and Health conference, a 3.5 day event which drew over 200 attendees across the United States as well as from Canada, Norway, Australia and other countries.
2. In June 2016, CARERC hosted two seminars related to work place health, stress, and wellness attended by public health staff professionals in the College of Public Health.
3. In April 2016, CARERC in collaboration with the Kentucky Department of Public Health (KDPH) hosted K-PHAST training designed to prepare public health professionals and students to serve as volunteers to help with public health outbreaks/investigations and assist with special projects at the state and local levels. The team remains "on call" to be deployed as needed by the KDPH.
4. Also in April, 2016 CARERC provided support to the Southeastern States Occupational Network conference. The event drew approximately 70 attendees, professionals from across the region. The conference included health, safety, injury, work-organization, policy talks across the industries of construction, agriculture, oil, transportation; as well as presentations by NIOSH officials.
5. During the reporting period, the CARERC CE core was engaged in the design and logistics for the annual Occupational Health and Safety Field Studies course. This required course provides practical field experience in addressing (in depth) a real safety and health problem in industry. In addition, the course provides field site visits to several of our priority industries in the region; including coal mining, distillery, and manufacturing operations among others.
6. The OHEN core with the College of Nursing and UK HealthCare hosted a Nursing Leadership Lecture Series during spring 2016 which included a session on Leadership for a Healthy Work Environment and Compassionate Care: An Academic View.
7. Following a multi-industry needs assessment survey effort the previous year, CARERC efforts were directed towards industry-specific surveys. During late winter/spring 2016, CARERC completed a targeted needs assessment survey aimed at owners/workers/other professionals in the beef cattle industry. As Kentucky is the eighth larger beef cow producing state in the United States, and the largest east of the Mississippi River, bettering occupational health and safety in this industry is a priority. Responses from 110 stakeholders across Kentucky and Tennessee were collected. These data will allow us to direct our focus on safety and health concerns specifically towards the beef cattle industry, an industry with elevated rates of occupational illnesses, injuries, and fatalities in our region. In following years other dominant industries in the

region will be targeted with industry-specific needs assessment surveys that will provide data to best target our continuing education efforts.

8. The CARERC professional seminar was coordinated through the CE core. Several innovative seminars were held during the fall 2015 semester bringing in professionals from the government, state and university speaking on a variety of occupational health and safety topics relevant to the region. Seminars were interdisciplinary and enjoyed high attendance by the CARERC students and were open to working health and safety professionals as well. Selected speakers and topics included: Dr. Babak Bazrgari, Center for Biomedical Engineering: Lower back pain biomechanics and occupational low back pain; Ken Anderson, Manager of Safety, Health and Security, Toyota Motor Manufacturing of Kentucky discussed his responsibilities caring for the safety and health of some 9000 team members who work at the Toyota Georgetown facility.
9. In fall 2015 Drs. Reed and Jones with the assistance of an instructional designer, a videographer and two nursing faculty members, launched a new 1 hour Continuing Education offering, The Nursing Response to Mental Health Issues in Agriculture Populations. This course was created using interactive technology and field expert video clips. The course, marketed on the Western Kentucky University (WKU) website (<http://www.wku.edu/lp/nursing-ce-ag.php>) is described as: Farmers are at risk for serious health issues, including anxiety, depression and suicide. This continuing education program is designed to help identify the sources and warning signs of these issues and develop successful interventions. The course has received excellent reviews as evident by this quote: *"This relevant, well-designed interactive program offers evidence-based strategies for nurses. The videos of the farmers are powerful and capture a realistic picture of the stress associated with farming."* Vivian McClellan, RN, MSN, Corporate Director of Education and Development, Commonwealth Health Corporation, Bowling Green, KY.
10. Dr. Reed created a 10 minute video on agricultural nursing and research for the undergraduate nursing research class in the UK College of Nursing.

Pending CE activities

The OS core is actively engaged in adapting their newly released Leading Measures in Occupational Safety graduate course into a condensed workshop that will be offered to businesses in Appalachia. The faculty have already delivered a workshop through the American Society of Safety Engineers (ASSE). Also conversations with the OSHA Training and Education Center at Eastern Kentucky University (where OS core is housed) have resulted in getting this into their course offerings to leverage their contacts for marketing and recruiting attendees throughout Appalachia. With the course developed and marketing plan in place we anticipate this to be a well-received CE offering throughout our 5 state region.

The OS core is also tasked with establishing a Risk Assessment Institute <http://www.asse.org/education/cra/>. OS faculty Dr. Scotty Dunlap, a member of the ASSE Risk

Assessment Institute Committee is establishing the Risk Assessment Institute(www.oshrisk.org); He has been in contact with ASSE about partnering with Eastern Kentucky University (EKU) to deliver the certificate program on the ECU campus. Dr. Dunlap expects CARERC to market this as a CE opportunity to the Appalachian Region.

In addition to the certificate program, the OS core has a number of online videos that will be marketed to companies throughout Appalachia to use to increase their skill set in conducting risk assessments (<http://www.oshrisk.org/videos/>).

The Ag Safety and Health (ASH) core continues to develop its lecture series from Dr. Sanderson's course: Health of Ag Populations Course. In addition the field studies course has been opened up and marketed to individuals throughout the region. Close collaboration with the University of Kentucky's Southeast Center for Agricultural Health and Injury Prevention along with professionals at the North Carolina AgroMedicine Institute is generating a multi-state training program that will provide in-class academic courses, on-line, and continuing education instruction in the ten-state region of the southeastern United States. The in-class training, which may be used for academic credit will be conducted as a short-term (40 contact hour) courses at selected institutions across the Southeast. The course will also be offered on-line and in topic modular format.

The Occ Epi core Director Dr. David Mannino will be giving the keynote address at the Black Lung conference to be held in Lexington, KY Sep 2016.

An on-line continuing education (CE) program, *Providing Quality Health Care for Plain Populations*, has been created by OEHN faculty member Dr. Deborah Reed and is currently in its final review stage. In preparation for the development of this CE program, information was collected from 25 members of Anabaptists communities from 13 states, and 18 health care providers were interviewed about their experiences in providing care for this diverse population. Occupational health and safety programs targeted specifically for this unique population will be developed and disseminated. The objectives for the CE program are:

1. Describe the historical background and culture of plain people
2. Identify barriers to health care among the plain people populations.
3. Identify common health issues/concerns of plain people
4. Outline appropriate nursing interventions when providing occupational health and safety care for plain people.

Pilot Research Training Program**Program Director: Wayne T. Sanderson**

CARERC continues to provide funding for a variety of pilot projects to explore emerging issues. The selected projects shown below show the range of projects across a variety of industries. CARERC will be hosting a “Research Day” in fall 2016 inviting pilot research fund participants, students, and industry members for a day of collaboration and discussion.

Selected 2015-2016 Pilot Projects:

Project Title: Enhancing musculoskeletal health and preventing injury in migrant and seasonal farmworkers

Summary of Project:

Migrant and seasonal farmworkers (MSFW) are at risk for developing musculoskeletal symptoms and injuries (MSSI) due to repetitive, physically demanding tasks sustained over long periods. They have limited access to health care and educational resources to promote musculoskeletal health and minimize injury. This pilot project will involve approximately 35 MSFW who will be in western North Carolina (WNC) for approximately six weeks, between the months of September and November 2015, to work for a grower/farm owner to uproot, bundle, trim and load strawberry plants. The MSFW are, or will be, enrolled in Vecinos Farmworker Health Program (Vecinos). Faculty and students in the Doctor of Physical Therapy (DPT) program at Western Carolina (WCU) will develop resources/programs for MSFW to promote musculoskeletal health and minimize injury risks related to the specific physical demands of uprooting strawberry plants. Working from the camps where the MSFW live, the investigative team will assess MSSI using a slightly modified screening tool and self-report survey developed for a prior research project and will provide education using some innovative strategies. Staff from Vecinos (lay health workers) will assist with translation and general communication with MSFW. The investigative team will inform growers/farm owners of their efforts to reduce MSSI among the farmworkers and seek their support. They will also offer ergonomically sound tools for trial use by MSFW when performing their work in the fields.

Project Title: Agricultural and Forestry Worker Health Risks from Pesticides: Evaluation of Global Impact, Epigenetic Effects and Synergism Directly on Human Systems

Summary of Project:

The US Department of Labor Statistics report that agriculture is one of the most dangerous occupations in the country. If chronic health conditions are included in this analysis, the threat is even greater. Exposure to agrochemicals, the use of pesticides for personal protection, and exposure to mixtures of these chemicals in farming and forestry are among the occupational hazards of greatest concern. Better information is needed on human health risk to chemicals in these occupations, and the US National Academy of Sciences has

recognized the need for using human (not animal) models. Experimental techniques are now available to examine global molecular impacts of agrochemicals on human systems, and the recent discovery of long non coding RNAs in human epigenetics has never been considered relative to chemical exposure and risk analysis to environmental chemicals. Our goal is to change these paradigms, focusing on chemistries where human exposure and potential multiple chemical exposure to farmers and foresters are highest, with pesticides like DEET, fipronil and permethrin (as model chemicals). We present preliminary data that the exposure of primary human hepatocytes to low levels of DEET (a popular insect repellent) and examination of global gene expression (using RNAseq) broadly disrupts male and female steroid hormone synthesis, affects at least one breast cancer gene, and mostly down regulates long non-coding RNAs. The aim of this proposal is to compare these data to that of fipronil (commonly used in urban applications and on animals), to examine potential synergism related to risk analysis, and to provide the first studies of the impact of environmental chemicals and mechanisms of action of these chemistries at the epigenetic level involving long non-coding RNAs and micro RNAs.

Note: A graduate student working on this project earned 1st place in the 11th Annual North Carolina State University Graduate Research Symposium. His work is very timely because he is studying the impact of DEET and other urban chemicals on global gene expression in primary female human hepatocytes to obtain leads on potential human health risks. The system that he has developed allows us to now examine rapidly the potential health risks of the repeated use of repellents like DEET but also chemical mixtures and potentially develop a blood test for exposure to these compounds. DEET has been the gold standard for mosquito repellents for over 50 years and has an excellent safety record. The need for the repeated use of repellents like DEET for potentially extended periods on pregnant women and women during their child bearing years and potentially for protection from Zika is one important interest of the laboratory. This information is also potentially of importance to worker safety in professions like Agriculture and Forestry in our state and country (where repellents are used for insect and tick protection), to military personnel, and for the public at large in North Carolina. His research is in press in the Journal of Biochemical and Molecular Toxicology.

Project Title: Exploring the epigenetic link for occupational woodsmoke exposure induced inflammatory response among wildland firefighters

Summary of Project:

We are proposing to investigate epigenetic changes (DNA methylation) in association with occupational wood smoke exposure among wildland firefighters. Specifically, we will investigate changes in DNA methylation in the promoter regions of pro-inflammatory cytokines, interleukin-8 (IL-8) in DBS. IL-8, together with IL-6 has been observed to increase consequent upon occupational wood smoke exposure in wildland firefighters, and would be examined in the already ongoing study. We previously observed increases in pro-inflammatory biomarkers with a statistically significant increase of 70% ($p < 0.01$) in the blood levels of IL-8 in wildland firefighters after acute occupational smoke exposure. We

envisage that the results of the proposed study, together with those of the already ongoing one, will contribute towards a better understanding of the health effects of occupational wood smoke exposure among wildland firefighters. The results should help inform how these molecular and physiological responses could be used in longitudinal studies, in conjunction with indicators of cardiovascular health, to determine long term effects of occupational wood smoke exposure, assess the effects of PM related exposures in other situations, and assess the effectiveness of exposure mitigation efforts for wildland firefighters.

Project Title: Role of biomechanical causation mechanisms for LBP among truck drivers

Summary of Project:

Within the transportation, warehousing, and utility industry sector, truck transportation has the highest number of work-related musculoskeletal disorders with low back pain (LBP) at the root of more than 35% of all disorders. Truck drivers are exposed to a number of occupational risk factors for low back pain, including physical (i.e. prolonged and constrained sitting, whole body vibration, infrequent manual material handling), personal (i.e. poor eating habits, smoking, lack of exercise and resting time, and lack of family time), and psychosocial (i.e. high levels of stress, low job satisfaction, poor mental health) factors. Truck driver exposures to such a diverse range of LBP risk factors imposes a significant challenge for the development of risk management strategies to minimize exposure levels. Knowledge of the underlying physiological mechanism(s) responsible for the development of LBP among this cohort can open new venues for managing this problem, via practical interventions that specifically target the underlying tissue malfunctions rather than simply reducing generic physiologic risk factor exposures.