CENTRAL STATES CENTER FOR AGRICULTURAL SAFETY AND HEALTH
University of Nebraska Medical Center, College of Public Health
Annual Report – September 2016 - August 2017
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Center Summary

The Central States Center for Agricultural Safety and Health (CS-CASH) conducts high quality research and translates scientific discoveries into practical applications to reduce the burden of injury and illness among farmers, ranchers, their families, and workers. CS-CASH, with a strong network of collaborators, provides regional leadership in research and outreach. Research teams from several states and institutions bring multi-disciplinary expertise and access to special populations. With our advisors and partners, we can leverage the Center's, resources to address local, regional and national issues. CS-CASH has built a cohesive approach that links planning, evaluation, research, and outreach to reduce agricultural occupational injury and illness. The Center's Planning and Evaluation Core provides strategic direction, administration, and evaluation and it responds to emerging issues. The Research Core conducts basic, intervention, translation, and surveillance research. The Research Core also manages pilot/feasibility projects with substantial in-kind support from UNMC. The Outreach Core has a special emphasis on vulnerable populations: women, veteran farmers, immigrant workers, and Native Americans. Several Center projects address health and safety in feed yard and livestock production work, a major gap in previous efforts of the Ag Centers. CS-CASH has collaborative agreements with several other Centers to work on issues of mutual importance. CS-CASH is well established with a clear vision, mission, goals, organization, and service area.

Relevance

The Central States Center for Agricultural Safety and Health (CS-CASH) serves a highly productive agricultural region: North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, and Missouri. CS-CASH partners with NIOSH and other Ag Center, and works towards fulfilling our common mission to improve health and safety and reduce the burden of injury and illness in agriculture.

Key Personnel

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Section II Program/Project Highlights

Surveillance || PI - Risto Rautiainen

CS-CASH has created a multi-modal surveillance system that provides a comprehensive picture of agricultural injuries including characteristics of injuries and injured persons, as well as injury rates, risk factors, lost time and cost of injuries. The surveillance includes annual surveys, systematic reviews, media monitoring, and collaborating with national and international partners.

The Specific Aims of this project are to:

1. Conduct annual surveys of agricultural injuries in the Central States region, linked with existing data on farm production and operator characteristics from the Census of Agriculture. We aim to augment current mail surveys with calls to non-respondents to improve data quality and to reduce biases.

2. Explore alternative surveillance methods for injuries and illnesses, including analyses of 'big data' from existing administrative databases, automated online surveys, and media tracking services, thus expanding the evidence base for prevention.

CS-CASH – USDA NASS injury survey data analysis. Data from 2011-2015 surveys were analyzed during the project period. Approximately 35,000 surveys were mailed out and 11,332 responses were received (32.4% response rate). The responses provided information for 15,271 operators (80.9% male, 19.1% female); 10,996 (72.0%) were first operators, 3,594 (23.5%) second operators, and 681 (4,5%) third operators. The average age was 60 years for principal operators, 52 years for second operators and 42 years for third operators. A total of 1081 injuries were reported over the five-year period, and the average annual injury rate was 7.1 injuries/100 operators. The most frequent injury sources were: livestock, working surface, tractors, hand and power tools and machinery. Numerous injury risk factors were identified using regression methods. Future data collection with USDA NASS was discontinued due to changes in USDA policies and increased pricing. An alternative for the data collection was designed, using similar agricultural production data from Farm Market iD. A database of 20,000 farm operations was purchased and annual surveys will be continued starting in January 2018. The survey modality will be augmented to include three options to respond: email/online, mail, and phone survey.

Media Monitoring. Mr. Murray Madsen has developed a press clipping system for agricultural injuries. A total of 163 cases of non-fatal (75) and fatal (88) injuries were captured during 2016. The incident types included tractor overturn (30), runover (8), crushed/struck by (10), collision (42), entanglement (7), other machinery incident (18), grain handling (9), livestock work (6) and other (34). This data collection was augmented by electronic (Google Alerts) media monitoring. Comparison of print media and electronic records systems is underway. While CFOI is the 'gold standard' for occupational fatality counts and rates, media reports add value by providing more detailed fatal and non-fatal case information which is valuable for prevention.

Collaborating with other surveillance research teams. The CS-CASH surveillance team collaborated with other NIOSH Ag Centers with active surveillance projects, as well as national and international

research teams working on agricultural injury surveillance issues. This collaboration has resulted in sharing of resources, joint publications, and plans to coordinate surveillance efforts in the future.

OUTPUTS

1. Patel K, Watanabe-Galloway S, Gofin R, Haynatzki G, Rautiainen R. Non-fatal agricultural injury surveillance in the United States: A review of national-level survey-based systems. Am J Ind Med. 2017;60:599–620. https://doi.org/10.1002/ajim.22720
2. Jadhav R, Achutan C, Haynatzki G, Rajaram S, Rautiainen R. Risk Factors for Serious Injuries to Farm and Ranch Operators in Central States. Am J Ind Med 2017
3. Karttunen JP, Rautiainen RH. Recurrent musculoskeletal conditions among farmers: A path towards disability pension. Chemical Engineering Transactions. Vol 58, 2017.

OUTCOMES

Annual injury surveys provided information on agricultural injury characteristics, rates, risk factors, lost time, and costs in the central states region. Results indicate that farmers and ranchers have higher injury rates than workers in any other industry sector.

Systematic review and meta-analysis identified 25 significant risk factors for agricultural injury. This first analysis of its kind provides a common understanding of risk factors, rather than relying on single studies that may have conflicting results.

This project established a media monitoring system, collecting injury information from electronic and printed media. The system has been used to inform policy makers and the public about agricultural injuries and emerging issues.

Collaborating with NORA Injury Surveillance Working Group and national and international research teams has resulted in numerous joint publications from large datasets using advanced research methodologies. This collaboration provides comparative information validating our findings and developing more advanced injury surveillance systems.

Livestock were reported as a leading source of injury to agricultural workers in the CS-CASH annual Ag injury surveillance survey. Other significant sources included working surfaces, tractors, hand and power tools and machinery.

Health & Safety Risks among Immigrant Cattle Feedlot Workers in Nebraska and Kansas
PI – Athena Ramos

Cattle production is an economic driver for the United States, producing $76.4 billion of economic impact in 2014. Cattle feedyards represent a $36.4 billion industry with the highest production concentrated in Nebraska, Texas, Kansas, Iowa, and Colorado. According to the U.S. Bureau of Labor Statistics, 52.5% of the workforce is Hispanic/Latino, and many of these workers are immigrants. Unfortunately, limited data exists about the health and safety of immigrant feedyard workers. Understanding Latino immigrant cattle feedyard workers' health status, unique risk and protective factors, and specific occupational educational and training needs are imperative to addressing the health and safety risks within cattle production and the long-term economic impacts of such problems.

The aims of this project include:

1. Systematically explore and describe the health status and occupationally related risks among Latino immigrant cattle feedyard workers in Nebraska and Kansas.
2. Test the Ecological Stress-based Model of Immigrant Health and Safety, which predicts if workers' intrapersonal mechanisms (i.e., stress appraisal, ethnic identity, and cultural values) mitigate culture-related occupational stress and negative health outcomes.
3. Review, develop, evaluate, and disseminate bilingual (English/Spanish) health and safety materials to feedyards across the U.S.

Since September 2016, we have held six meetings to bring the team together to develop the immigrant feedyard worker questionnaire. We piloted tested the questionnaire and made adaptations based on the feedback we received. We visited a feedyard in Westpoint, Nebraska. We also met with Extension staff in Kansas to discuss the project and build relationships to be able to access workers. The field team workers completed their IRB research ethics and specific protocol training. We began data collection in Kansas in August 2017 and completed six interviews with workers in that state. In Nebraska, we built relationships with community partners and have identified workers in four locations. Interviews will begin in the fall 2017. Our team has participated in professional development activities providing a better understanding of the unique health and safety risks of agriculture. We also had one of our field team members participate in the agricultural medicine course at UNMC in July 2017.

Enhancing the Health and Safety of Range Bison Herd Workers || PI – Clayton Kelling

Agriculture is one of the most hazardous industries in the US. Raising livestock is particularly hazardous. The bison industry is growing in the central states of the US with many tribal communities introducing herds into their agricultural operations. Tribal bison workers may have little to no training on the safe handling of livestock prior to working with these dangerous animals. Untrained workers and poor working conditions make bison handling a particularly hazardous occupation.

This project aims to characterize injuries and hazards associated with working bison under contemporary conditions on tribal reservations and on non-reservation facilities, develop and implement intervention strategies to mitigate worker safety risks and assess outcomes and impacts of intervention strategies, and disseminate updated intervention strategies widely to bison herd managers and workers.

During the first year of this workplace safety-assessment forms were developed using Certified Safe Farm (CSF) checklists as models. Forms were developed for injury data collection that contain OSHA 300 log information, applicable questions from the annual CS-CASH injury survey, and questions designed to capture incidents directly related to working with bison. On-site assessments were conducted in project year 1 by the PI and trained study personnel. Hazard assessment was based on industry standards: use of electric prods, collision with head gate, chute exit speed, etc.

To date ten bison handling sites (seven tribal facilities and three non-tribal sites) have been assessed. One worker injury was observed. The primary safety issues observed on reservation sites included unsafe approaches to rounding up bison, inadequate bison confinement practices, faulty ready chute design, lack of safety barrier fence, poorly maintained and dysfunctional squeeze chutes, and high stress bison handling practices. These practices resulted in injury to seven animals. Upon recommendation by the research team, a modern portable hydraulic chute was ordered to replace an existing chute used at a tribal herd location. Recommendations were shared with bison herd managers regarding interventions to address worker safety issues. Onsite visits to bison facilities have been scheduled for fall 2017. Research staff will collect the injury reports and interview managers yearly. An overall facilities and animal handling safety score will be calculated and tracked for each herd. Injury, working condition, animal handling, and hazard score variables will be constructed and compared between reservation and non-reservation facilities. Changes in these indicators will be measured within each group.

Agricultural Dust-Induced Airway Injury and Repair: An IL-10 Centered Approach
PI – Todd Wyatt

The long-term goal of this project is to determine molecular targets and approaches to accelerate lung repair following agriculture dust-induced airway injury and to improve the health of exposed workers. The central hypothesis of this proposed project is that the anti-inflammatory/pro-resolving IL-10 cytokine is central for enhancing repair response to agriculture dust-induced airway injury.

The aims of this project are to:

1. Characterize the role of IL-10 in governing the post-inflammatory homeostasis repair and recovery response in an animal model of agriculture organic dust-induced airway injury.

2. Identify the mechanism(s) of scavenger receptor A (CD204) in regulating the IL-10 response to agricultural dust using in vitro cell models and in vivo animal models.

3. Determine the relationships between systemic IL-10 levels, IL-10 pathway genetic polymorphisms, and pro-inflammatory cytokine hyper-responsiveness in persons with prior agricultural exposure.

We have made significant progress in all three aims. First, we have established the normative, time-dependent post-inflammatory homeostasis recovery and resolution phase following swine confinement organic dust extract (ODE)-induced lung disease in an animal model. This body of work was accepted for publication in Safety in 2016. Collectively, these results identified important processes during recovery period following agricultural dust-induced inflammation highlighting new roles for amphiregulin and amphiregulin production in lung macrophages and ILC2 in the post-recovery.

Breathing organic dusts in Ag environments may lead to airway disease.

Next, we are actively investigating whether targeting IL-10 impacts agricultural dust-induced airway injury and repair. As we had hypothesized, our studies are demonstrating that administration of IL-10 results in a reduction of inflammatory cell infiltrates and mediator release in animals exposed daily for one week to ODE (N=6 mice/group, 2 independent studies). Next, our results demonstrate that IL-10 administration during the one week recovery phase following repetitive ODE exposure for 3 weeks does hasten resolution of ODE-induced lung injury (N=5 mice/group, 1 study). Interestingly, the impact of IL-10 administration is targeted at macrophages by reducing macrophage activation and the clearing of T and B lymphocytes. In aim 2, we have optimized the experimental assay and conditions utilizing a murine lung macrophage cell line (MH-S) demonstrating significant ODE-induced IL-10 production in a

dose-and time-dependent manner. We are reproducibly able to detect IL-10 protein release following ODE exposure. These studies were presented in abstract form at the American Thoracic Society (ATS), May of 2017 meeting. Furthermore, we have now demonstrated that pre-treatment of macrophages ex vivo with IL-10 prior to stimulation with ODE results in significant reductions in TNF-alpha release. In corollary, pre-treatment of animals with recombinant IL-10 reduces the macrophage responses, particularly TNF-alpha release. In aim 3, we completed running ELISA determinations of IL-10, IL-6, and TNF-α protein measurements on the supernatants collected from the whole blood assay on the human subject participants of the AgCOPD cohort (N>600 subjects). Our statistical analysis reveals that the responsiveness to organic dust, as measured by TNFα and IL-6 production, is predicted by high IL-10. Namely, increased IL-10 levels significantly correlate to less TNF-α and IL-6. Furthermore, a high IL-10 concentration is highly correlated with high FEV1/FVC. We are currently writing up these results for publication. We are will start genotyping the genomic DNA for IL10 single nucleotide polymorphisms (SNPs) and IL10 haplotypes this next year.

Summary of Translational Impact: We anticipate that our studies could ultimately lead to improved approaches to impact respiratory disease burden in affected workers. Our studies are the first to focus on the repair and recovery response following agricultural exposure-induced airway injury.

Publications – Year 1:

1. Wyatt, T. A., K. Canady, A. J. Heires, J. A. Poole, K. L. Bailey, T. M. Nordgren, and D. J. Romberger. Alcohol Inhibits Organic Dust-induced ICAM-1 Expression on Bronchial Epithelial Cells. Safety 3(1), 5; doi:10.3390/safety3010005, 2017.
2. Warren K, Wyatt, TA, Romberger, DJ, Ailts I, West, WW, Nelson A, Nordgren TM, Staab E, Heires AJ, Poole JA. Post-injury and resolution response to repetitive inhalation exposure to agriculture organic dust in mice. Safety 2017, in press
3. Schneberger, D., J. M. DeVasure, K. L. Bailey, D. J. Romberger, and T. A. Wyatt. Effect of Low-level CO2 on Innate Immune Response to Organic Dust from Swine Confinement Barns. J Occ Med Toxicol 12:9, doi: 10.1186/s12995-017-0155-8, 2017.
4. Sapkota, M., J. M. DeVasure, K. K. Kharbanda, and T. A. Wyatt. Malondialdehyde-Acetaldehyde (MAA) Adducted Surfactant Protein Induced Lung Inflammation is Mediated Through Scavenger Receptor A (SRA). Respir Res, doi: 10.1186/s12931-017-0517-x, 18:36-45, 2017.

Abstracts and Presentations:

1. Chandra, D., M. Sapkota, J. M. DeVasure, J. A. Poole, and T. A. Wyatt. Agricultural Dust Exposure induces IL-10 production in tissue macrophages which may have a role in airway inflammation and repair. Am. J. Respir. Critical Care Med.;195:A3890, 2017.
2. Invited Lecturer/Professor (Poole JA) at Iowa State University in Ames, Iowa, September 2016. Title of presentation: Respiratory & Systemic Illness from Large Animal Farming Environments: An Immunologic Perspective.
3. Agri-Safe Webinar entitled "Allergic and Non-allergic Respiratory Disease in Farmers" April 26, 2017 (Poole JA).
4. INBRE presentation (Wyatt TA) at Nebraska City, NE, August 7, 2017. Title of Presentation: Organic Dust Induced Lung Injury and Repair: Bi-directional regulation by TNFa and IL-10.

Pilot Program || PI – Eleanor Rogan

An essential program within CS-CASH is the Pilot Program that supports pilot and feasibility projects, with the goal of enabling investigators to collect preliminary data to support submission of grant applications for independent, longer-term, larger projects related to agricultural safety and health. The central hypothesis of this program is that pilot and/or feasibility projects funded from this Center will result in subsequent grant submissions to NIOSH or other funding agencies to advance agricultural health and safety research. The projects selected for support by this program must address a critical issue in agricultural safety and health and clearly lead to future, more extensive study of the selected critical issue. In first five years of funding CS-CASH funded 26 pilot projects Using Pilot Grant data, project PIs have generated over 5 million dollars in additional funding (Figure 1).

Figure 1. New Awards generated from CS-CASH Pilot Project funding 2011-2016.

Year of Funding	Initial Awards	New Awards
Year 1	$95,000	$536,981
Year 2	$100,000	$863,872
Year 3	$60,789	$15,000
Year 4	$100,000	$2,490,000
Year 5	$100,000	$1,220,000
Total	**$455,780**	**$5,125,853**

Recognizing the research impact that has been made by these pilot grants, Dr. Jennifer Larsen, University of Nebraska Medical Center (UNMC) Vice Chancellor of Research has awarded CS-CASH $40,000 per year for the Pilot Program (Years 2016 through 2021). This allows two additional proposals to be funded each year.

In the first year of the new funding cycle, (FY06), CS-CASH awarded seven Pilot Project grants. Five of these grants were funded through the NIOSH Agriculture Forestry and Fishing grant ($60,000) and the UNMC Vice Chancellor of Research funded two additional awards ($40,000).

In addition to evaluation plans that are built into project proposals, the CS-CASH evaluation team also assesses the progress, outcomes and outputs of each project. The results of these evaluations are shared with the grantees as well as with Dr. Eleanor Rogan, the Pilot Program investigator.

Following are reviews of the seven projects that received funding in FY06, and two projects that were funded in FY05 and were recently completed.

Navigating Cancer Prevention, Education and Detection for the Agricultural Worker
PI Jamie Arens

Avera Cancer Institute Navigation Center's (ACINC) aim was development and delivery of cancer prevention outreach-related information to farm families at farm shows in South Dakota and Minnesota. Utilizing educational materials and screening intake documents, navigators offer personalized cancer screening recommendations. Data from this project will provide ACINC with information regarding the impact of attending these events, the cancer prevention education that is needed in farming communities, barriers that need to be overcome and the needed resources necessary for long term outreach.

ACINC has participated in six outreach programs with one more planned for January 2018. Intake requests, collected at these events, for follow-up calls regarding cancer risk and screenings totaled 61. The navigators have to date successfully completed follow up with 32 people. Data were collected on ages, occupations, region of residence, if rural or not, family and personal cancer history status. Education on prevention and screening, and connection to screening is tracked as well as barriers to care.

Creating Healthier Agricultural Communities || PI Laura McDougal

The aim of the Healthier Agricultural Communities project was to support the health and safety of the agricultural community within the Four Corners Health Department District, by establishing stronger partnerships in the local public health system. This was accomplished by adapting and evaluating evidence-based strategies used in rural businesses and implementing it in specifically agricultural-related businesses

Key partners included a local hospital and clinic, University of Nebraska Extension, and University of Nebraska Medical Center. At different levels, their involvement equipped Four Corners staff to build a new relationship with Frontier Cooperative. This agricultural business has 21 sites across four different local health department (LHD) regions. This creates the opportunity for collaboration in order to meet individual health and safety needs.

Four Corners has been providing worksite wellness services for manufacturing and service sector businesses. The past year has provided learning opportunities to transfer the successes from those partnerships Ag businesses. The Frontier Cooperative headquarters and its many sites have been the focus for delivering and adapting worksite wellness principles. Through the partnership, we have been able to accomplish a baseline assessment of individual health and of the perceptions of the worksite culture, establish a wellness plan, offer a mini health fair at the bi-annual staff meeting, and provide a health incentive campaign with pre-and post-assessments. Five measurements were assessed with this campaign: blood pressure, weight, body mass index, waist circumference, eating patterns, and physical activity. Of those who completed the post-assessment, 100% had improved in at least one area. Future efforts will be committed to engaging the multiple sites, delivering programs other than on-line, and pilot testing service delivery collaborations with other LHD's.

Safety in the Agricultural Work Camp Comic Book Development & Evaluation for Latino MSAW Families || PI Jill F. Kilanowski

The purpose of this mixed-methods study was two-fold: to develop a bilingual culturally-specific comic book (graphic novel) to teach Latino migrant and seasonal agricultural worker (MSAW) parents and children about safety working and living in an agricultural work camp; and to test the comic book for satisfaction and usability by the intended recipients. An ethnographic framework was used that views the participants as key informants.

Youth and children in agriculture are highly vulnerable to health hazards associated with agricultural work and rural environments. The National Children's Center for Rural and Agricultural Health and Safety (NCCRAHS) estimate every three days a child dies in an agricultural-related injury, 115 children each year, and every day 38 children are injured. There is evidence that Latino children are especially vulnerable to farm-related health and safety hazards and while data is limited, a study found that Latino children have a 70% higher farm-related fatality rate. However, prevalence of injuries and appropriate health education is missing for the subgroup of children of Latino MSAWs. A safety comic was developed in collaboration with an artistic team and incorporated NCCRAHS safety materials.

The questions addressed in this research study were: 1) How do MSAW parents and students perceive the message of safety in the agricultural safety comic book in terms of satisfaction and usability and 2) What suggestions for improvement do MSAW parents and children offer before its publication.

This multistate-multidisciplinary study used a criterion-based convenient sample of MSAW families who met in focus groups to share their opinions of the already created comic book and completed quantitative surveys on satisfaction and usability with IRB expedited approval. Ninety-one percent were satisfied or very satisfied with the comic book and 91% thought the information was helpful. Usability scores were high: 83% - 100% on 6 questions for adults, and 70%-100% for youth. Focus group themes from parents showed they wanted the comic book to call out youth should not be allowed in the fields and working in the fields made them sick. Youth said they did not want to work in the fields, but did so to help their families. Suggestions for improvement by the group were made before the comic book was sent for publication. The PDF was sent to CS-CASH and the University of Missouri Extension it can be download. Link to *Seguridad Para Los Ninos En Los Campamentos De Trabajadores Migrantes*: https://www.unmc.edu/publichealth/cscash/_documents/Downloadable-safety-comic-book-for-migrant-families-in-English-and-Spanish.pdf

Development of a Mobile Application for Agricultural Safety – AgHealth || PI Ka-Chun Siu

Loss of balance leading to injury while working in agriculture has not been widely studied. The aim of this project is to develop and validate a mobile application (App) that can be used by farmers to self-evaluate their balance while performing daily tasks. The AgHealth mobile App has been developed and is currently being tested with 32 subjects (5 healthy young, 10 older adults, and 17 patients with orthostatic tremor, OT). The AgHealth App was developed for use on the iPhone. The iPhone's accelerometer is used to measure the subject's acceleration. Data collected by the App is transferred via email to a server located at Clinical Movement Analysis Laboratory (University of Nebraska Medical Center). Data is analyzed using customized Matlab code. All subjects are asked to perform 5 tasks: standing with eye-opened, with eye-closed, normal walk straight forward 6 meters, tandem walk straight forward 6 meters and walk on a 6 meter long T-bar. Data has been collected on three subjects in each group. Preliminary results indicate that patients with OT, which had severe instability in standing, showed smaller mean frequency of acceleration in frontal plane than other groups to overcome the instability. While, when walking, in order to maintain balance, patients with OT demonstrate higher mean frequency of acceleration in vertical plane than do the other two groups. The results to date indicate that the AgHealth application is sensitive enough to measure balance while conducting daily activities.

Evaluation of Medication-Related Agricultural Injury among Missouri Farmers |
PI Kelly Cochran

This project aims to determine the extent to which farm-related injuries that result in hospital admission or emergency department visit are associated with drug-related problems in the farmers' home medication regimen, characterize, and measure the frequency of drug-related problems. The investigators anticipate that medication-related problems will be readily collected from the medical record for cases of farm injury resulting in a hospital admission or emergency department visit, as home medications are a component of the questions asked upon entry to the Level 1 Trauma Center. The defined comparison group of farmers in the community, who have not experienced a farm injury resulting in hospital admission or emergency department visit, will be recruited through advertisements located in rural clinics/pharmacies. Investigators defined the qualifications of the doctoral pharmacy student investigator, described their role in assisting with data collection from the medical record, and completing questionnaires for the comparison farmers. The data collection instruments, questionnaires, and advertisement have all been developed. Additionally, a strategy for data collection and recruitment of farmers for the comparison group has been outlined, all of which has been submitted to the IRB. Recruitment will begin in fall 2017.

Contributions of Allergic Versus Non-Allergic Lung Injury with Agriculture Exposure to Bone Loss || PI Kristi Warren

Underlying airway inflammatory diseases such as asthma are common among rural agricultural workers, and often these airway diseases are linked to comorbid conditions, such as musculoskeletal disorders. Agricultural dusts (ODE) are complex containing both bacterial and fungal components known to exacerbate these inflammatory diseases. Project aims:

1. Ascertain how gram-negative LPS and OVA-induced allergy independently mediate the airway-bone inflammatory axis following inhalant exposures.
2. Determine whether co-exposures to OVA and LPS inhalant treatments synergize to enhance airway injury-bone disease inflammatory axis.

Our aims were designed to investigate OVA + LPS specifically, but early on in our studies we determined that the response to OVA + ODE (contains LPS) generated detectable immune measurements. We previously characterized the ODE response in a murine model, and in the current studies, we evaluated the lung and systemic immune response in OVA-ODE co-exposed animals to determine a specific role for innate and adaptive lymphoid cells in this response. Innate lymphoid cells have been linked to chronic allergic inflammation in recent years, and adaptive immune populations such as T cells and B cells are important in the long-term, chronic airway responses as well. In this new co-exposure model we showed, (1) a significant influx of innate lymphoid cells, following OVA exposure alone, and increased T and B cells following OVA-ODE exposure, (2) the cytokine/chemokine profiles varied in animals treated with OVA, ODE and OVA-ODE in comparison to saline, and (3) OVA-ODE exposed animals had higher airway hyper-reactivity in comparison to the OVA or ODE treatment alone. These results will be submitted as a manuscript by December of 2017. Our future studies will evaluate the bone microenvironment specifically as we detected no changes in the spleen or in circulation. Our end goal is to understand how the lung microenvironment is 'communicating' with the bone marrow precursor cells to elicit the lung immune response. Furthermore, whether the lung response is mediating the bone loss is still to be determined.

Cardiovascular Disease Risk and Physical Activity in Farmers || PI Paula Schulz

The aims of this pilot study were to: 1) describe health behaviors (physical activity [PA] and dietary habits), quality of life, and cardiovascular disease (CVD) risk of farmers during peak farming season and off season and 2) explore relationships between cardiovascular (CV) risk, and health behaviors (PA levels and dietary habits), personal (age, body mass index) and quality of life variables.

Data collection occurred during farming season using the Actigraph® GT3X accelerometer for PA, MEDFICTS Dietary Assessment Questionnaire, and EuroQual (EQ-5D) for health-related quality of life (HRQoL). Demographic and biomarker data (blood pressure, height and weight) were collected at baseline and used to assign CVD risk using a non-laboratory method.

Farmers (M=52.77 ± 14.7 years), reported few comorbidities and self-identified their peak season (late spring or fall) and off-peak seasons (winter and early spring). Significantly more time was spent in moderate or greater PA during peak season (M= 54.2 ± 25.6 minutes/d) compared to off peak season (M= 46.3 ± 26.2 minutes/d) (p=.025). There were no significant differences in diet or HRQoL between seasons. A majority of the sample was overweight or obese (82.5%). Minutes per day spent in moderate or greater PA during off peak season was inversely associated with CVD risk (p=.025). Age and body mass index (BMI) were positively correlated with CVD risk (p<.01). The farmers in this study were physically active, ate consistent diets, and rated their health status high throughout the year. Farmers with high CVD risk could benefit from flexible strategies to lose weight and maintain PA throughout the year.

An abstract was submitted to the Midwest Nursing Research Society for presentation in April 2018. We have also submitted a manuscript to a professional journal and are collaborating to submit for larger funded studies focused on improving rural CVD health.

Farmer Evaluation of Agricultural Fatality Messaging: Best Practices for Disseminating Prevention Messages Based on FACE Cases || Stephanie Leonard

The Iowa Fatality Assessment and Control Evaluation Program (IA FACE) has collected information on all work-related fatalities occurring in Iowa from 1995 to 2015. One-third of these deaths involved farmers and agricultural workers. This pilot project engages farmers to provide feedback on several formats of IA FACE safety messages that are based on agricultural fatality case investigations. The aims of the project are:

1. To conduct farmer-led evaluations of existing FACE fatality investigation reports, hazard alerts, and media articles. We want to understand the message format, content, technical information, and dissemination methods that are most useful to farmers.
2. To develop new prototypes of messages that incorporate the information learned from farmer evaluation (gained in aim 1) and include personal stories from close survivors including family members and coworkers who are impacted by agricultural fatalities.
3. To conduct farmer-led follow up evaluations of the materials developed in aim 2 that incorporate survivors experiences and input gained in the first round of evaluations with technical recommendations from FACE cases.

The FACE prevention messages selected for evaluation focus on incidents involving grain engulfment, tractor rollovers, and exposure to hydrogen sulfide gas during manure handling. We have developed evaluation forms to rank content, presentation, clarity, and usefulness of our messages. Farmers are enrolled to participate in focus group meetings to discuss their feedback and suggestions.

This project will enhance our knowledge about developing and targeting injury prevention messages for agricultural workers. The products developed in this project will be available as resources for farmers and their employees, agricultural safety and health professionals, media outlets and journalists.

United Support and Memorial for Workplace Fatalities || PI Tonya Ford

United Support and Memorial for Workplace Fatalities (USMWF) is a family based organization that knows first-hand the affect a tragic work related incident has on one's life. Our mission is to offer support to family members that have been affected by a preventable work related incident. We aim to increase awareness of work incidents by telling the stories of the fallen/injured workers with the goal of preventing future incidents.

Throughout the past 12 months, with assistance from CS-CASH, USMWF was able to include farm/agriculture incidents into our fatality and injury database. We extensively researched past and present incidents involving Midwest farmers, determining who, what, when and where of each farm incident. USMWF contacted 100 next-of-kin offering support and guidance and the offer to assist them in telling their story.

We connected with Allison Weston, widow and Linda Weston, mother of Jason Weston who was killed while working in a grain bin. Ms. Weston is ready to be her husband's voice and tell his story gaining awareness to the importance of farm safety, including auger safety, emergency training and improved communication.

USMWF has posted approximately 275 articles on their website and Facebook page regarding agriculture issues such as entrapments, suffocations, falls, fires, and tractor accidents. We have highlighted safety training conferences and tips on multiple social media pages reaching out to over 3,500 followers.

Using information gained over the past 12 months, USMWF is creating a presentation highlighting safety concerns in the grain industry. Our presentation includes safety concerns, tips, stories and the powerful life story of a fallen farmer.

Photograph (Left): Linda Weston (right) mother of fallen agriculture worker Jason Weston. Photograph (center) Daughter Angela Bennet and Granddaughter Katelyn Bennet of fallen agriculture worker John Bennet. Photograph (right): Cindy Malley sister of fallen agriculture worker Robert Fitch. These families took part in the 2017 Harvest of Harmony Parade in Grand Island, Nebraska.

Emerging Issues || PI - Risto Rautiainen

The Central States Center for Agricultural Safety and Health (CS-CASH) established an Emerging Issues Program that examines trends in injury and illness hazards and preventive solutions, and provides coordinated responses to emerging issues. With access to the Center's injury surveillance system, media monitoring service, network of experts and other resources, we are in position to detect emerging issues and respond to them in collaboration with NIOSH, Ag Centers, professional organizations, the extension service, industry, media channels, and our growing email address database of producers in the CS-CASH region.

The Specific Aims of the Emerging Issues Program are to:

1. Examine trends and identify emerging issues affecting the health and safety of farmers, ranchers, family members and agricultural workers. CS-CASH identifies emerging issues from 1) monthly injury and fatality case reports from the Center's media monitoring service, 2) annual data from the Center's injury surveillance project, 3) reviews of the literature, and 4) case reports from a network of experts in the field.

2. Respond to identified emerging issues without delay by investigating the problems and solutions and communicating preventive information to the affected populations and stakeholders. CS-CASH prepares and delivers coordinated evidence-bases responses to identified emerging issues. The program also funds small grants to outside entities that are in position to respond. Proposals can be submitted at any time. The Center Director and the Pilot Projects Program team evaluate the proposals and issue expedited funding decisions.

During the project period, CS-CASH utilized media monitoring to identify emerging issues. These issues were addressed in media products, including a growing database of 'Ag Stories ready to Go'; 24 stories are currently available at the Center's website. We received calls from the media, industry, and health and safety professionals related to specific hazards, particularly after incident reports in the media. With our growing database of injury and fatality cases, we have been able to provide instant feedback to callers about similar incidents in the past, and available information for preventing similar incidents in the future.

NIOSH Ag Centers partner on "Telling the Story" project.

Outreach specialists from CS-CASH, the Great Plains Center for Agricultural Health and the Upper Midwest Agricultural Safety and Health Center (UMASH) - are collaborating on a new translation activity to convey the story of agricultural safety.

While statistics and numbers are important to identify injury trends and emerging issues related to workplace health and safety, Telling the Story (TTS) is creating injury prevention messages that highlight personal stories and are based on first-hand experiences.

Who are the storytellers? Farmers, agricultural workers, and family and community members who've been impacted by injuries, fatalities, or close calls. Told in their own words, their experiences, provide

valuable information to learn what went wrong and how to prevent or avoid similar incidents. Regardless of the type of incident, the common thread among those telling their stories is “We don’t want this to happen to anyone else.”

The TTS team includes Stephanie Leonard at GPCAH, Scott Heiberger and Melissa Ploeckelman at UMASH, and Aaron Yoder and Ellen Duysen at CS-CASH. Their combined resources bring to the table experience in injury and fatality investigations, occupational safety, interviewing, agricultural eXtension and outreach, journalism and media communications, and agricultural production.

Telling the Story’s initial interviews and stories focus on a persistent, under-recognized hazard that continues to claim both human and livestock lives in the Midwest: hydrogen sulfide gas released during agitation or transfer of stored manure. The topic is timely due to 2016 farmer fatality that occurred near an open air lagoon, multiple fatalities involving would-be rescuers, and livestock deaths that occurred at open cattle confinement buildings during agitation and pumping. Storytellers include family members who have lost family members and a farm worker who was found by his wife after succumbing to hydrogen sulfide in a swine confinement building. We add important prevention messages aimed to help producers identify the best practices to work safely. Stories planned for coming year will include ATV injuries and barn fires.

Telling the Story updates will be available on collaborating Ag Centers’ home and Facebook pages. A dedicated website, Tellingthestoryproject.org, will house multi-media articles that include video interviews, prevention resources, contact and feedback information, and press kits for Ag communicators, the media, Ag educators, and employers.

Emerging Issue Pilot Project.

One project was funded from the Emerging Issues Program, titled: *MAPPER Immersion: Developing an Augmented Reality Prototype to Protect Lives and Increase Emergency Responder Effectiveness* || PI Bryan Weichelt

Farm Mapping to Assist, Protect and Prepare Emergency Responders (Farm MAPPER) is an interactive, device-agnostic, prototype developed by the National Farm Medicine Center (NFMC) that provides emergency responders onsite information about hazards, resources and physical layouts of agricultural operations. This pilot project incorporated Augmented Reality (AR) by developing a Farm MAPPER mobile version on iOS and Android platforms.

Farm MAPPER displays map icons representing items important in emergency events such as hazards, access points, water sources, etc. After the farmer/user drops icons onto their farm map, the information is accessible to emergency responders in the fire station, in route by smartphone/tablet. This assists responders to efficiently and safely respond to farm emergencies. Integrating another visual layer of technology is anticipated to provide real-time, on-site mixed reality information to responders to improve situational awareness, efficiency and safety during the emergency response. Many different frameworks and design methodologies were considered to satisfy the original scope and requirements while remaining within budget. The end-result is a cross-platform, multi-view prototype application with aerial and augmented reality components. The AR MAPPER system will continue as a tool for Dr. Casper Bendixsen’s 5-year project working with Rural Firefighters to Deliver Agricultural Safety and Health (RF-DASH) across the Upper Midwest.

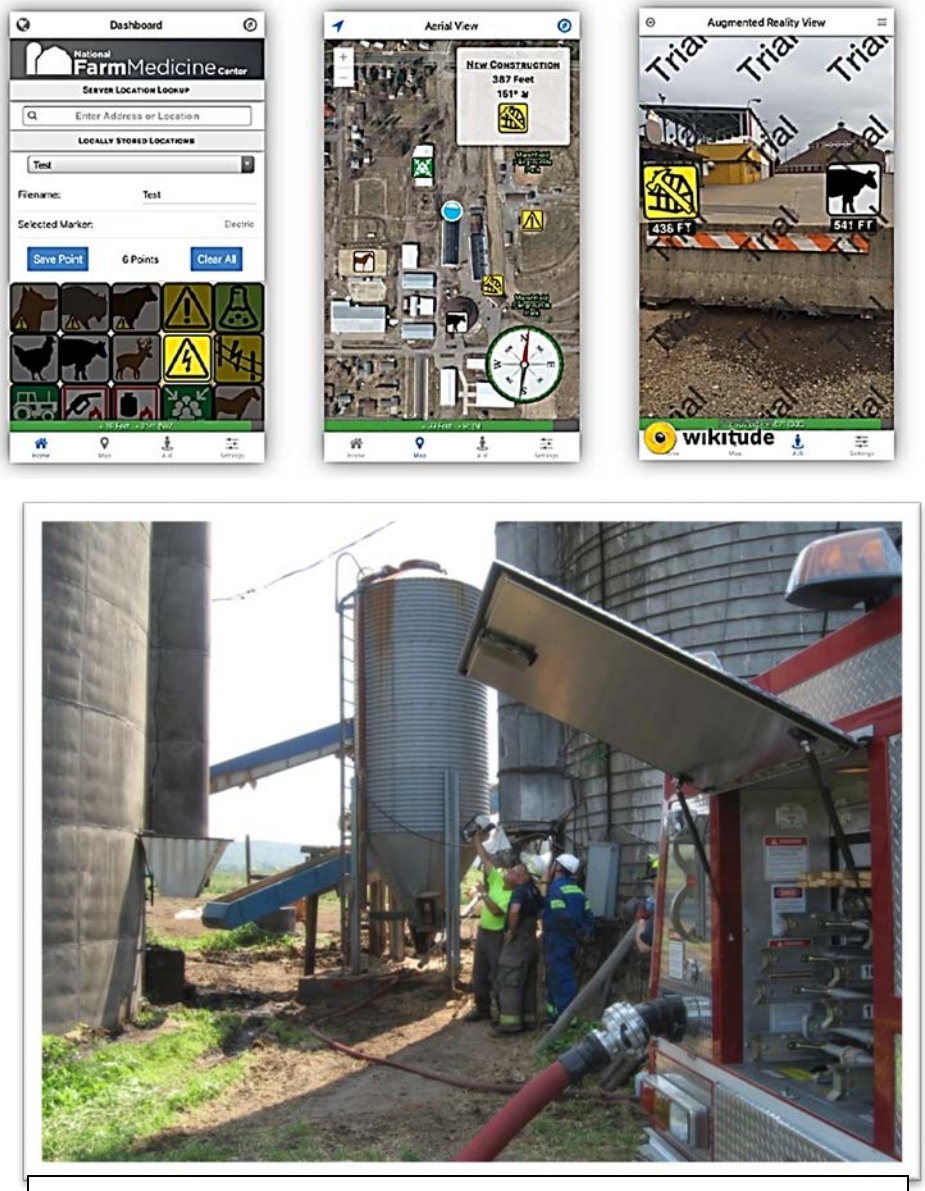
Outputs.

The app prototype is now available via iOS (for Apple users) and through Android (Fig 1). Installation instructions for testing and demo videos are available on our website - http://www.marshfieldresearch.org/nfmc/farm-mapper

Weichelt, B., Yoder A., Pilz M., Minor G., Keifer M. (2017). Augmented Reality Farm MAPPER Development: Lessons Learned from an App Designed to Improve Rural Emergency Response

Figure 1.

App Prototype Developed by Matthew Pilz – linkedPIXEL LLC for NFMC – 2017



Farm MAPPER is an interactive, device-agnostic, prototype that provides emergency responders onsite information about hazards, resources and physical layouts of agricultural operations.

Outreach || PI – Debra Romberger

In 2016 and 2017 the CS-CASH Outreach Program has implemented a coordinated outreach strategy directed at two primary audiences a) agricultural producers, with a focus on women working in agriculture and b) agricultural, health, and safety professionals. The Program has been strengthened by working in partnership with members of the AgriSafe Network, USDA Extension, National Agricultural Safety Database, Farm Bureau, Ag magazines and rural newspapers, Women in Agriculture Organizations, agri-insurance agencies, news organizations and other NIOSH funded Agricultural Centers. The Outreach team continues to use the Center's vast surveillance database to detect emerging issues, allowing a rapid response to immediate concerns affecting the agricultural community. The Center continues to create content for distribution, including Internet-based applications; traditional media, including print and radio; and existing human networks that have access to farm families and workers on more than 500,000 farms and ranches in our Center's region. Our comprehensive 27,000-member database made up of farmers and ranchers, public health officials and safety and health professionals has provided an effective method to reach farmers and ranchers with information on emerging issues as well as with other safety and health information. Face-to-Face outreach continues as an effective method for the Center to demonstrate, train and discuss proven safety and health measures. A new initiative by AgriSafe addresses the needs of women in agriculture. Dr. Aaron Yoder has worked with a network of safety, health and information technology experts to evaluate existing technology tools and methods for disseminating information, determining risk and improving safety and health outcomes.

The CS-CASH Outreach Program has the following Aims:

1. Integrate information from the Center's Research, Evaluation and Pilot Program projects, as well as information from external sources, translating it into a coordinated outreach effort and effectively disseminate the information using a wide range of proven methods.

2. Develop and launch radio social marketing campaigns, innovative training webinars and eHealth web-based toolkits targeted to women in agriculture and to military veteran farmers.

3. Support and advance current information technology efforts that disseminate occupational safety and health information and education to workers, managers, educators, researchers and health and safety professionals in the agricultural industry.

4. Identify, evaluate and disseminate new technology products and applications to workers, managers, educators, researchers and health and safety professionals in the agricultural industry through crowdsourcing and citizen science.

Promote evidence-based interventions.

CS-CASH Community Contact Network (CCN). This electronic database currently houses email and address information for 25,401 farmers/ranchers, extension, commodity groups, farm organizations, public health departments, universities, and media outlets who are located in our 7 states region. We have used this valuable resource to disseminate information throughout the year. Newsletters and blasts were sent for National Farm Safety and Health Week in September 2016, to announce the annual CS-CASH FFA Video Contest in December 2016, for Farm Safety Week in March 2017, and to announce the ATV simulator in July 2017. It is an essential resource for reaching agricultural workers with information on emerging issues. We continue to update this valuable CCN database weekly.

Collaborating with regional organizations. We continue collaborate with numerous organizations located throughout the CS-CASH 7-states region. Examples of collaborative outreach:

Creation of an ATV Simulator. Working in collaboration with the University of Nebraska Extension, the Nebraska Safety Center and the Nebraska Highway Patrol, a full size ATV simulator was created. The simulator will be used to train safe riding practices. Completed in July 2017, the simulator has already been used at 14 outreach events. CS-CASH conducted an ATV training for the community of North Platte Nebraska at the Great Plains Hospital and will be bringing the simulator to the National FFA Convention in the fall of 2017. (See image below.)

Dr. Aaron Yoder demonstrates the proper body position while riding an ATV uphill.

Training, as part of the simulator experience, includes:

- Proper personal protective equipment (PPE)
- Proper size of ATV - recommendations by age
- State laws pertaining to ATV ownership and use
- Hazards
- Statistics on fatalities and injuries
- Proper body position

In addition to farm shows and FFA events, the simulator will be used as a training tool during the Tractor Safety Certificate Course that is taught by CS-CASH outreach members. Tractor Safety trainings are planned at 10 locations across Nebraska in 2018.

Creating Safety Programs in collaboration with the U.S. Custom Harvesters. CS-CASH continues to work with the U.S. Custom Harvesters organization to create safety presentations for their yearly safety conference and to conduct hearing, respiratory and injury prevention outreach at their yearly business conference. These opportunities provide contact with 600-700 custom harvesters each year.

CS-CASH outreach team members provided training and educational information to custom harvesters on how to properly choose and use respiratory and hearing protection during their January 2017 conference. As an added bonus, participants were able to have their blood pressure checked by CS.

CS-CASH personnel presented an instructional seminar on roadway safety and general hazards during the conference. A presentation on hearing conservation was presented to the children in attendance as part of a Progressive Ag Safety Day.

Cross-Center collaboration. Cross-Center collaboration continues with CS-CASH members participating in calls and subgroups of the Evaluator, Coordinator, and Outreach (ECO) team. Ellen Duysen and Aaron Yoder head up the USAg Centers YouTube group. CS-CASH has joined forces with the IA and MN Ag Centers in exhibit booths at the IA Farm Progress Show (2016), NE Husker Harvest Day (2016), NE Triumph of Ag (2016) and MN FarmFest (2017).

Conducting collaborative outreach with other Agricultural Centers and safety and health organizations brings diverse topics and the strengths of each Center to these outreach events.

Outreach teams from CS-CASH and the Iowa Great Plains Center for Agricultural Health Center (GPCAH) are pictured here in a combined booth at the Triumph of Ag Show in March 2017.

Conferences and meetings. CS-CASH personnel are on planning committees for numerous conferences including the International Society for Agricultural Safety and Health (ISASH), the Midwest Research Agricultural Safety and Health Conference (MRASH), the Agricultural Safety and Health Council of America (ASHCA), and the American Society of Agricultural and Biological Engineers (ASABE). In addition to assisting in the planning, CS-CASH hosts exhibit tables and presents research findings at these conferences. This provides an opportunity to share resources and discuss outreach and research with other Ag safety and health professionals. In addition to assisting in the planning these conferences, Dr. Aaron Yoder serves on the Board of ASHCA and ASABE and was the President of ISASH (2016-2017).

Face to face demonstrations, presentations and materials distribution. CS-CASH outreach personnel participated in agricultural farm shows and agribusiness events in the Center's seven state region. Outreach took place at Husker Harvest Days (NE), Boone Power Show (IA) FFA Conventions (NE, IA), Custom Harvesters Convention (KS, NE), Triumph of Ag (NE), AgConnect (MO), Western Farm Show (MO), Women in Agriculture Conferences (NE, IA); Farmfest (MN)). CS-CASH provides training and demonstrations at these events, interacting with up to 500 people/day at some of the larger events. This Boots on the Ground outreach, reaches large numbers of farmers and ranchers in all seven of our regional states, encourages long-term community relationships to flourish and valuable new relationships to be established. New focus topics are presented each year. This year the focus was ATV safety, along with respiratory and hearing protection.

Ag Media. Research conducted in 2011-2016 by CS-CASH investigator Shari Burgus demonstrated that regardless of age and farming type, print media is a trusted and used source for finding information about Ag safety and health. With this information in mind, Ag journalist Loretta Sorensen has been employed to create media ready Ag safety and health related stories for the Ag newspapers, journals and TV stations. Story content is created using experts in the field and reviewed by two content experts. Loretta disseminates the articles through Midwestern media sources and the Associated Press. Examples of a few of the articles are shown in Figure 1. From September 2016-August 2017, 39 Ag safety and health articles written by Loretta Sorensen for CS-CASH have appeared in rural and agricultural print newspapers, magazines and in online news sources. These articles are available to the media and to the public on the CS-CASH website as "Ag Stories Ready to Go". Link to the articles: https://www.unmc.edu/publichealth/cscash/news/index.html

Figure 1. Example of articles written by Loretta Sorenson appearing in Ag and Rural newspapers and magazines.

Safety and Health Training Courses and Workshops. The 2017 annual weeklong Agricultural Safety and Health Course took place at UNMC College of Public Health with 18 students. From 2011 to 2017, 110 participants have received training as well as academic and continuing education credit through this course including rural health care professionals, veterinarians, public health professionals and students. These trainings are being converted to asynchronous on-demand training modules. A 3-day Ag safety certificate course was also offered as part of the 2016 ISASH conference.

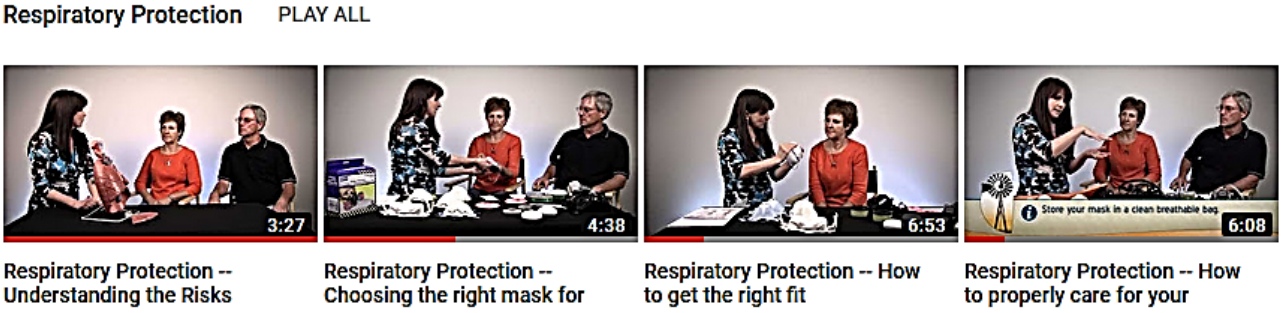
Healthcare and safety professionals taking part in the CS-CASH annual Agricultural Medicine Course spend an afternoon touring the University of NE experimental farm. They learn first-hand about the hazards present in the farming environment. Noise dosimetry, tractor hazards and grain bin safety are among the topics covered.

In collaboration with the Grain Safety Coalition, CS-CASH co-sponsored grain safety trainings in Nebraska (November 2016) and Missouri (January 2017). Over 40 EMTs and grain handling workers were trained during of these 8-hour programs.

Annual FFA Video Contest. The fourth annual Future Farmer of America (FFA) Ag safety and health video contest was held with 12 chapters submitting 60-second videos on the topic of ATV safety. These videos were posted on the CS-CASH website and the public was invited to vote on their favorite. The top four videos received monetary prizes for their FFA group and all participants received a personal protection equipment (PPE) bag containing agriculture related PPE (dust masks, ear muffs, gloves and goggles). There were over 2600 views and votes. This program increases topic knowledge in young and new farmers, uses crowd sourcing to educate the public on Ag safety and health concerns and introduces the public to useful information housed on the CS-CASH website. View the winning videos: https://www.unmc.edu/publichealth/cscash/news/video-contest.html

Social Media. The CS-CASH website, Facebook Page, and Twitter account are important parts of the Center's internet presence. CS-CASH personnel research and review materials to be included on these sites. These internet and electronic messaging tools provide cost-effective dissemination channels for information produced by the Center projects. These sites are monitored and updated regularly. Facebook followers increased from 156 to 207 in a one-year time-period. In the same period, the CS-CASH website had over 11,000 views; the FFA Video Contest drove many of the visits to the website. Link to Facebook: https://www.facebook.com/unmccscash/ ; Link to CS-CASH Website: https://www.unmc.edu/publichealth/cscash/index.html ; Twitter @UNMC_CSCASH.

NIOSH AFF Centers YouTube Channel Collaborative. Training and Education Videos are enduring resources that can be targeted to specific occupations, education levels, language and culture. Videos provide 24/7 access to information. With these facts in mind, the NIOSH AFF Centers collaborated to create the Agricultural Centers (USAgCenters) Safety and Health YouTube channel (https://www.youtube.com/user/USagCenters). This channel was designed to reach a new generation of agricultural workers and producers with agriculture, forestry and fishing health and safety videos. Videos are produced, maintained, and monitored by AFF Center personnel. Content experts review each video. Guideline documents assure quality and consistency. CS-CASH personnel discuss analytics and other topics pertaining to the channel during monthly teleconferences lead by CS-CASH personnel. With 108 videos and over 284,667 minutes watched since 2013, this channel has proven to be a great success. During the first year of the new cycle of AFF funding, the channel seen an increase of 200 subscribers and has seen significant spikes in viewership during the Ag Safety Awareness and National Farm Safety and Health Week Campaigns. This channel continues to grow as Centers produce additional videos and as more educators and trainers consistently use these videos in the classroom and in the field.



Since posting in 2013, the CS-CASH four-part series on respiratory health for agricultural workers has been viewed over 8500 times on the USAgCenter YouTube Channel, the CS-CASH YouTube Channel and the CS-CASH website.

CS-CASH Photo Sharing Website. Research conducted by CS-CASH investigator Shari Burgus determined that agricultural workers preferred to see practices and images in educational materials that mirrored their personal demographics. Images depicting hazards or work practices for use in educational materials and presentations may be difficult to find. To provide safety and health professionals and educators with access to copyright free, no-cost, high quality images, CS-CASH developed the Ag Safety and Health Photo-Sharing website. This site, accessed through the CS-CASH website, hosts over 750 images related to agriculture. This site grew from 420 images to 707 images in the past year with new images being added on a regular basis. CS-CASH sent out a call to other safety and health professionals to see what images they needed. In response to requests, ATV, children on farms and aging farmer images have been added. From September 2016-August 2017 there were 807 downloads. Link to the CS-CASH Photo Sharing website: https://www.flickr.com/photos/cscash/

Photos, such as the one pictured above, were shot and added to the CS-CASH Photo Sharing Website in response to a request for more images showing youth on the farm.

Tractor Safety Training, in collaboration with the University of Nebraska Extension, took place at 10 locations across NE in 2017. Aaron Yoder, Ellen Duysen and 2 UNMC CoPH graduate students conducted the 2-day certification courses, training 75 young agricultural workers.

Training Masters of Public Health graduate students to be part of the CS-CASH Outreach team has provided valuable experience to the students and has allowed significantly more Ag safety and health programs to take place. Four students worked on the outreach team in 2016-2017.

Develop and launch radio social marketing campaigns, innovative training webinars and eHealth web-based toolkits targeted to women in agriculture.

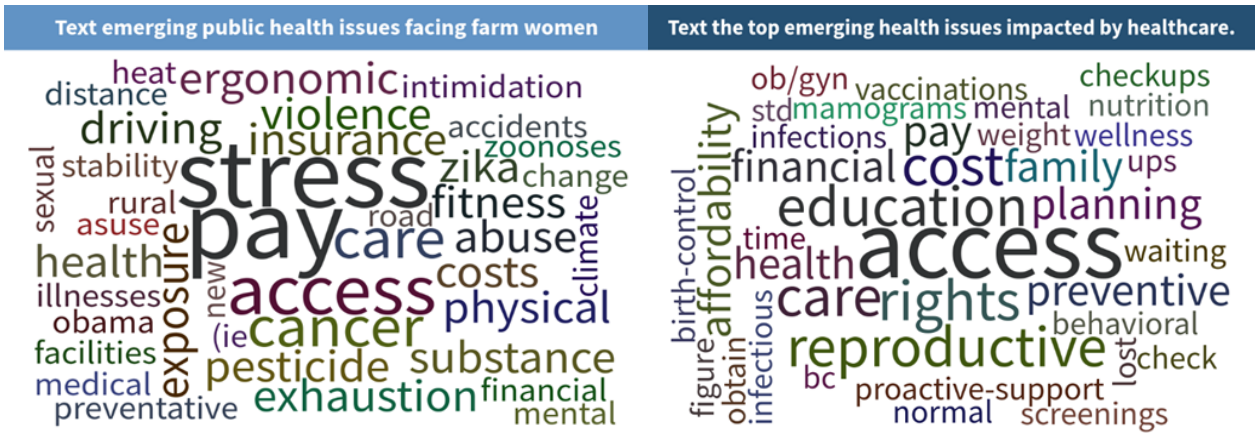
The AgriSafe Network is a national non-profit organization representing rural nurses, doctors, researchers, and other professionals who strive to reduce health disparities among farm families. During fiscal year 2016, AgriSafe built CS-CASH capacity to serve the unique health care needs of farmwomen. The agricultural work that women perform has changed through time and the impact of that work on women has only recently been recognized. Most agricultural safety and health information and trainings have been geared toward men. However, there are unique risk factors for women working in agriculture.

The focus is to first complete a needs assessment to identify priority health concerns of farmwomen. Data collected through focus groups with farm women and a national “think tank” were studied to determine how best to impact the health and safety of farm women. The national “think tank” incorporated web conferencing technology combined with polling participants to create a virtual brainstorming session. Thirty-nine participants joined the open forum Think Tank to identify emerging public health issues facing farmwomen that are not being addressed.

- 73% agreed that “it will be easy to apply the information that I received to my work”.
- 89% of participants learned something new
- 94% were either satisfied or very satisfied with the think tank experience

Results of the Think Tank were shared with all participants as a strategy to disseminate the findings to wellness champions who aim to assess their impact with farmwomen. Following are examples of a word clouds that were developed through the open forum Think Tank held on August 2, 2017.

Word Clouds from "Women in Ag – Health Care Concerns" Think Tank held August 2017.



The second phase of programming focused on designing trainings, resources and an Agricultural Health Risk Assessment (AgHRA) that matched the high priorities identified during the needs assessment.

AgHRA is a web-based tool that asks users questions about their health and work in agriculture. This brief assessment takes about 10-15 minutes to complete and is confidential. At the end of the assessment, a report is created that lists the participants answers with suggestions to protect their health. The current AgHRA was customized to meet the unique health and wellness needs of women farmers. Future development includes pilot testing the AgHRA with at least 30 farmwomen.

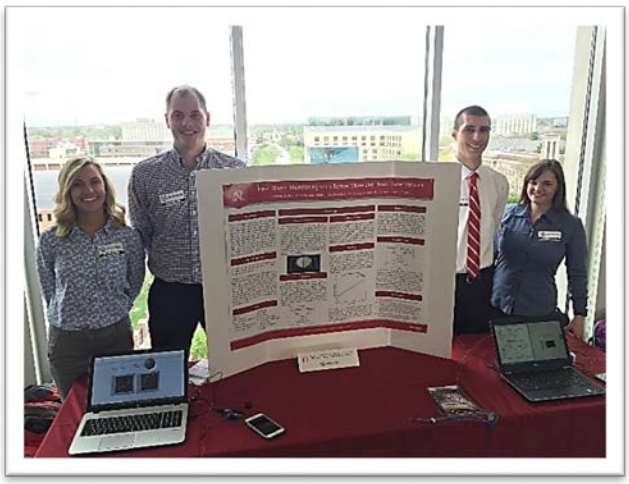
Wellness Podcasts were offered at three different times of the day to determine optimal attendance time. Thirty-nine participants were trained. Podcast content was determined by the priorities identified in the needs assessment phase. Topics include: 1) choosing the correct safety equipment, 2) mental health and 3) ergonomics. AgriSafe will continue to train farmwomen through scheduled events and web-based distance learning to reach the target goal of 100 trained farm women and ranchers.

Ready to Farm Social Media Campaign includes a 30-minute fitness plan that matches the high intensity work of various farm tasks. Photos are being prepared that depict farmwomen performing ten unique farm tasks; these will be matched with photos of strengthening exercises.

Stories from the Field are narratives collected from women working in agriculture. Individuals relate stories from their personal experiences. These written and video dialogues will serve as case studies. Relevant educational information will be linked to each story.

Identify, evaluate and disseminate new technology products and applications to workers, managers, educators, researchers and health and safety professionals in the agricultural industry through crowdsourcing and citizen science.

A wide array of mobile health and mobile application software (apps) and health monitoring devices are now available for use by the public. Few of these apps or devices have been evaluated for effectiveness. We have initiated a process to evaluate the feasibility, practicality and potential usability of electronic health monitoring devices with agricultural workers. The initial phase of the project included Dr. Aaron Yoder working with two senior design groups in the Department of Biological Systems Engineering (BSE) at the University of Nebraska-Lincoln (UNL). Heart rate monitoring through wearable devices was explored as a method to monitor lone workers and detect the early onset of heat illness in agricultural workers. Projects conducted by the students identified and evaluated new technology related to these two topics.



UNL Biological Systems Engineering students (shown above) presented their CS-CASH funded research on devices to monitor heat-illness at an engineering conference in 2017.

The first project was a collaboration between students in the UNL Department of BSE and LoadOut Technologies. This research explored technology designed to assist lone workers. Lone workers are more likely to be injured and to have poorer outcomes than do workers who are in the company of others. The students researched the use of heart rate monitoring to protect grain handling system workers by monitoring the workers with automated systems.

The second project looked at monitoring the core body temperatures of agricultural workers exposed to high temperature environments. The group determined that core body temperature is the best indicator of heat illness and can be monitored through skin temperature and heart rate monitors.

This research will lead to the development of a new framework for evaluating technology and provide evidence for new, user-evaluated technologies that will improve worker health and safety. Dr. Yoder continues to review current literature and web sources to identify potential technology to evaluate.

Evaluation Program || PI – Mary Cramer

The Evaluation Team continues to monitor the Center's progress using the CS-CASH Logic Model, with several data collection methodologies and mixed methods research approaches to achieve our three specific aims.

1. Assess the effectiveness of CS CASH leadership and governance.
2. Conduct quality assurance by tracking CS CASH Logic Model Activities, Outputs, and Intermediate Outcomes.
3. Evaluate CS CASH Logic Model End Outcomes for social and economic impacts.

Aim 1. We have incorporated metrics from the Institute of Medicine (2015) and other literature to measure our social and economic impacts in the region. These include 1) improved quality of life, 2) improved safety and health practices, and 3) improved health status. Additionally, we are conducting a cost-benefit analysis of our programs. Where available, we will use longitudinal and/or national comparison data to estimate our overall contributions. We will continue to collaborate with other Ag-Center evaluators to refine common measures and methods that demonstrate collective end outcomes. Evaluation used a mixed methods approach to measuring organizational success. The Internal Coalition Effectiveness (ICE©) instrument survey was conducted with 49 CS-CASH members and leaders. In general, CS-CASH governance effectiveness scored a mean score of 4.59 on a five-point scale. When comparing to the 2014 survey (in all constructs except Resources as this was added in 2017) scores in each of the categories increased modestly (Figure 1). The highest increase was Participation at 9%. Two other constructs (Practices and Relations) increased at an 8% rate. The Center continues to have strong levels of effectiveness in each of the conceptual constructs of a coalition.

Focused field visit interviews followed with seven new pilot investigators, one five year funded investigator and one external advisory board member to assess Center governance and leadership. This study revealed high levels of satisfaction with the Center governance:" relationships are positive and supportive; Outstanding organization in all respects". Specific member suggestions for program quality improvement included scheduling more researchers to go along to farm shows and Center activities, more support and resources for project publications, establishing a shared site for Center files, and receiving more feedback from the external advisory board (EAB) to see if projects align with community needs. The study was presented at the August 2017 member meeting. Center members will be contacted in the 2nd year of renewal funding to determine if changes made were helpful. Field visit interviews will continue on an annual basis as they are helpful with orientation of new investigators to the CS-CASH project, provide reminders of reporting deadlines, and are motivators regarding timeline tracking in addition to giving meaningful information back to the leadership team.

Aim 2: The evaluation team received requests to use several UNMC developed survey instruments (ICE© and the Population-based Outcome and End Result Evaluation Survey instrument) from external researchers on five additional projects. Other evaluation consultation occurred with various groups (new Florida Ag Center and ongoing pilot projects).

A new Social Network Analysis (SNA) survey was developed to identify networks and individuals involved in moving CS-CASH products and activities to "End Users" described as Ag Workers, Ag Employers and Ag Operators. A total of N=80/207 participated for a 39% response rate. Preliminary

data revealed that many of the stakeholder respondents are either very interested in advancing the use of respiratory PPE or somewhat interested. Results will be presented at the October member meeting. The continued use of social network analyses improves understanding of the relationship between CS-CASH stakeholders and their influence on the End Users who are impacted by the dangers of the agricultural profession.

Aim 3: A Population-based Outcome and End Result Evaluation Survey, which includes data for Social and Economic benefits, is planned in FY19. Dr. Fernando Wilson (UNMC Health Economist) will compile data from secondary databases for cost benefit analysis, conduct interviews for Social Return on Investment (SROI) and prepare an Economic Impact Report to share with CS-CASH governance.

The evaluation team will continue participation with the Ag Centers Evaluator, Coordinator and Outreach (ECO) bi-monthly phone conference meetings to benefit our efforts with resources and shared learnings about evaluation practices.

We envision a vibrant agricultural sector in our region and the United States where health and safety is highly valued and work-related injuries and illnesses are rare.

Section III Outcomes and Outputs

CS-CASH Publications – 2016-2017

Bailey, K. L., Smith, L., Heires, A. J., **Romberge**r, D. J., & **LeVan**, T. D. (2016). Aging Induces a Hyper inflammatory Response to Organic Dust Stimulation of Peripheral Leukocytes. In B24. OCCUPATIONAL MEDICINE (pp. A2993-A2993). American Thoracic Society.

Burgus, S., **Duysen**, E., **Wendl**, M. (2017) What influences farmers to use farm safety and health information? Journal of Extension Volume 55 Number 1 Article # 1RIB5

Burgus, S**., Duysen**, E. (2017) Identifying Topics and Dissemination Methods for Agricultural Safety and Health Messages. Safety. 3(1), 3; doi: 10.3390/safety3010003

Cannon, A.R., Morris, N.L., Hammer, A.M., Curtis, B., Remick, D.G., Yeligar, S.M., **Pool**e, L., Burnham, E.L., **Wyatt**, T.A., Molina, P.E. and So-Armah, K.(2016). Alcohol and inflammatory responses: Highlights of the 2015 Alcohol and Immunology Research Interest Group (AIRIG) meeting. Alcohol, 54, pp.73-77.

Cramer, M. E., **Araz**, O. M., & **Wendl**, M. J. (2017). Social Networking in an Agricultural Research Center: Using Data to Enhance Outcomes. Journal of Agromedicine, 22(2), 170-179. DOI: 10.1080/1059924X.2017.1282905

Cramer, M**., Wendl**, M., **Sayles**, H., Achutan, C., **Duysen**, E. (2016) Knowledge, attitudes, and practices for respiratory and hearing health among Midwestern farmers. Public Health Nursing. Nov, DOI: 10.1111/phn.12306

Donham, K. J., **Yoder**, A., Grafft, L., & Thelin, A. (2016). Acute Injuries in Agriculture. Agricultural Medicine: Rural Occupational and Environmental Health, Safety, and Prevention, 379.

Duysen, E., Irvine, K., **Yode**r, A., Topliff, C., **Kellin**g, C., & Rajaram, S. (2017). Assessment of tribal bison worker hazards using trusted research facilitators. Journal of Agromedicine, (In Press).

Gerald, C. L., **Romberge**r, D. J., Devasure, J. M., Khazanchi, R., Nordgren, T. M., Heires, A. J., **Wyatt**, T. A. (2016). Alcohol Decreases Organic Dust-Stimulated Airway Epithelial TNF-Alpha through a Nitric Oxide and Protein Kinase-Mediated Inhibition of TACE. Alcoholism: Clinical and Experimental Research, 40(2), 273-283. DOI: 10.1111/acer.12967

Jadhav, R**., Achutan**, C., **Haynatzki,** G., Rajaram, S., **Rautiainen**, R. (2017) Injury risk factors to farm and ranch operators in the Central United States. American journal of industrial medicine.

Karttunen, J. P., & **Rautiainen**, R. H.(2017) Recurrent musculoskeletal conditions among farmers: A path towards disability pension, Chemical Engineering Transactions VOL. 58, doi: 10.3303/CET1758003

Karttunen, J. P., & **Rautiainen**, R. H. (2016). 362 Gender differences in work tasks and injuries in agriculture. Injury Prevention, 22(Suppl 2), A132-A133.

Karttunen, J. P., **Rautiainen**, R. H., & Lunner-Kolstrup, C. (2016). Occupational health and safety of Finnish dairy farmers using automatic milking systems. Frontiers in public health, 4.

Kaustell, K. O., Mattila, T. E., & **Rautiainen**, R. H. (2016). Occupational injuries and diseases among commercial fishers in Finland 1996-2015. International maritime health, 67(3), 163-170.

LeVan, T.D., Smith, L.M., Heires, A.J., Mikuls, T.R., **Meza, .**J.L, Weissenburger-Moser, L.A., **Romberger**, D.J.(2017) Interaction of CD14 haplotypes and soluble CD14 on pulmonary function in agricultural workers. Respiratory research. 18(1):49.

Nordgren, T. M., & **Bailey, K. L.** (2016). Pulmonary health effects of agriculture. Current opinion in pulmonary medicine, 22(2), 144-149.

Patel, K., Watanabe-Galloway, S., Gofin, R**., Haynatzki**, G., & **Rautiainen**, R. (2017). Non-fatal agricultural injury surveillance in the United States: A review of national-level survey-based systems. American Journal of Industrial Medicine, 60(7), 599-620. DOI: 10.1002/ajim.22720

Ramaswamy, Sai K., **Mosher**, Gretchen, A. Approaching Safety through Quality: Factors Influencing College Student Perceptions. Journal of Agricultural Safety and Health.2016,22(2): 149-160 DOI 10.13031/jash.22.11426

Ramos, A.K., **Carlo**, G., **Grant**, K.M., **Trinidad**, N., & **Correa**, A. (2016). Stress, depression, and occupational injury among migrant farmworkers in Nebraska. Safety, 2(4), 23. DOI:10.3390/safety2040023

Ramos, A.K., **Fuentes**, A., & **Trinidad**, N. (2016). Perception of job-related risk, training, and use of personal protective equipment (PPE) among Latino immigrant hog CAFO workers in Missouri: A pilot study. Safety, 2(4), 25. DOI:10.3390/safety2040025

Ramos, A.K. (in-press). A human rights-based approach to farmworker health: An overarching framework to address the social determinants of health. Journal of Agromedicine.

Ramos, A.K. (in-press). The ghosts in our fields: Migrant farmworker health in Nebraska. Chapter for UNL Minority Health Disparities Initiative book. Anticipated release: January 2018**.**

Reyes, I., Ellis, T., **Yoder**, A., & Keifer, M. C. (2016). An evaluation tool for agricultural health and safety mobile applications. Journal of Agromedicine, 21(4), 301-309.

Sapkota, M., DeVasure, J. M., Kharbanda, K. K., & **Wyat**t, T. A. (2017). Malondialdehyde-acetaldehyde (MAA) adducted surfactant protein induced lung inflammation is mediated through scavenger receptor a (SR-A1). Respiratory Research, 18(1), [36]. DOI: 10.1186/s12931-017-**0517-x**

Schneberger, D., DeVasure, J. M., Bailey, K. L., Romberger, D. J., & Wyatt, T. A. (2017). Effect of low-level CO2 on innate inflammatory protein response to organic dust from swine confinement barns. Journal of Occupational Medicine and Toxicology, 12(1), [9]. DOI: 10.1186/s12995-017-0155-8

Smith, L. M., Weissenburger-Moser, L. A., Heires, A. J., **Baile**y, K. L., **Romberge**r, D. J., & **LeV**an, T. D. (2017). Epistatic effect of TLR-1, -6 and -10 polymorphisms on organic dust-mediated cytokine response. Genes and Immunity. DOI: 10.1038/gene.2016.51

Staab, E., Thiele, G. M., Clarey, D., **Wyatt**, T. A., **Romberger**, D. J., Wells, A. D., ... & Duryee, M. J. (2016). Toll-Like Receptor 4 Signaling Pathway Mediates Inhalant Organic Dust-Induced Bone Loss. PLoS One, 11(8), e0158735.

Warren K, **Wyatt**, TA, **Romberger**, DJ, Ailts I, West, WW, Nelson A, Nordgren TM, Staab E, Heires A,J **Poole JA**. Post-injury and resolution response to repetitive inhalation exposure to agriculture organic dust in mice. *Safety* 2017, *in press*

Weissenburger-Moser L, Meza J, Yu F, Shiyanbola O, **Romberge**r DJ, **LeVan** TD. (2017)A principal factor analysis to characterize agricultural exposures among Nebraska veterans. Journal of exposure science & environmental epidemiology. 27(2):214-20.

Wells Adam, **Romberger** Debra J., Thiele Geoffrey M., **Wyatt** Todd A., Staab Elizabeth, Heires Art J., Klassen Lynell W., Duryee Michael J., Mikuls Ted R., Dusad Anand, West William W., Wang Dong, and **Poole** Jill A.(2016)Systemic IL-6 Effector Response in Mediating Systemic Bone Loss Following Inhalation of Organic Dust. Journal of Interferon & Cytokine Research.

Wendl, M. **Cramer**, M. (In Press) Evaluating effective leadership and governance in a Midwestern agricultural safety and health coalition. Workplace Health and Safety.

Wyatt, T. A., Canady, K., Heires, A. J., **Poole**, J. A., **Baile**y, K. L., Nordgren, T. M., & **Romberger**, D. J. (2017). Alcohol Inhibits Organic Dust-Induced ICAM-1 Expression on Bronchial Epithelial Cells. Safety, 3(1), 5.

CS-CASH Member Activities September 1, 2016 – August 31, 2017

Activity Type	Activity #
Course/Curriculum (short course or training)	6
Material Distribution	13
Meeting/Conference	29
Training/Demonstration	41
Workshop	2
Subtotal	**91**
Article (peer reviewed)	33
Presentation (oral)	40
Presentation (poster)	6
Annual Report	4
Article/Report (non-peer reviewed)	5
Booklet/Brochure/Factsheet	2
Consultation	9
Interview (media/other)	9
Newsletter	12
Video/Multimedia Material	6
Subtotal	**126**
Evaluation Instrument/Tool	1
Grant Submission	6
Questionnaire/Survey/Checklist	7
Site Visit	5
Testing/Screening (clinical)	9
Subtotal	**28**
Total Database Activities	**245**