



Central States Center for Agricultural Safety and Health

Annual Report

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University of Nebraska Medical Center, College of Public Health

Section 1

Center Summary

The Central States Center for Agricultural Safety and Health (CS-CASH) was funded as one of nine NIOSH agricultural health and safety centers, starting September 2011. CS-CASH is based out of the University of Nebraska Medical Center, College of Public Health in Omaha, Nebraska. The Center serves seven states in the central United States: North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, and Missouri. CS-CASH is a partnership where public health, agricultural, and grass roots organizations contribute to a common goal of reducing injury and illness in agriculture by utilizing their strengths and regional presence. 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. Our mission is to work with the agricultural community in the Central States and beyond, conducting research, intervention, education, and outreach activities, with the aim of discovering the mechanisms of injury and illness, and developing, implementing and evaluating prevention strategies that measurably improve the health and safety of all members of the agricultural community.

Relevance

CS-CASH aims to improve the safety and health of farmers, ranchers, agricultural workers, and their families. The Center conducts research and translates findings into practical applications. Research teams from different states and institutions bring expertise and access to farm audiences in the Center's region. With strong public health, agriculture, and grassroots partnerships we can address local, regional and national issues. The Center research projects focus on injury prevention and surveillance, respiratory disorders, hearing loss, education, vulnerable workers, mental health and sleep deprivation. Information is disseminated through agricultural shows and events, school programs, agricultural medicine courses, presentations, articles, and messages in electronic and printed media.

Key Personnel

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Safety and Health Education for Non-Traditional Farm Families **Shari Burgus PI**

Changing farm demographics influence hazard exposure, prevention tactics, communication channel choices, and resource preferences. This project seeks information from traditional, retired, residential/lifestyle, and organic farmers to identify differences and similarities in information needs. Three data collection methods were used to collect data in the CS-CASH 7-state region: National Agricultural Statistics Service administered a survey to 1,038 farmers; Face to face interviews were completed with 511 farm family members; and five focus groups were conducted.

Data collected from each survey method were compiled and compared to identify the differences and similarities among the various farm groups. Mailed survey respondents identified a total of 38 farm hazards including machine/equipment. The top perceived hazards and need for safety information were power take off hazards, lawn mowers, tractors, machine shops, storage structures, confined spaces, animal handling, pesticide exposure, lifting heavy objects, hearing loss, musculoskeletal problems, respiratory disorders, and stress. Farm size and operator demographics were significant predictors of hazard perceptions and safety information needs among farmers in Central States region.

Topics and existing educational resources identified in the data collection process were pilot tested using mail surveys to farmers and at farm shows in the CS-CASH region. Farmers were asked about: preferences for farm safety educational resource content, graphics, format, and what encourages and discourages use. Information gathered from this testing will allow educators and safety professionals to produce outreach materials that are relevant and impactful for each farm demographic.



This research found that acceptance levels of farm safety and health resources vary according to a number of demographic variables. Gender, parental status, and part-time/full-time farmer status all influence what farm safety and health resources are utilized.

ADMA: A Novel Pathway in Organic Dust-mediated Allergic and Non-allergic Asthma Todd Wyatt PI

Organic dust exposure, like that experienced by agricultural workers in confined animal feeding operations, is known to cause pulmonary inflammation in some workers. Our studies are beginning to unveil how and why this occurs. Our long-term goal is to understand why some people exposed to confined animal dusts have more severe diseases of the lung and to examine the impact of combination exposures in the workplace when dust-exposed workers both smoke and drink alcohol.

We based our studies on earlier publications, by us and others, demonstrating that the endogenous nitric oxide synthase (NOS) inhibitor asymmetric dimethylarginine (ADMA) potentiates allergic inflammation and decreases pulmonary function. Lung and circulating ADMA levels are increased in allergic asthma models, although the mechanisms involved remain unclear. Expression of the enzyme that metabolizes ADMA, dimethylarginine dimethylaminohydrolase (DDAH), is significantly reduced in murine models of allergic and non-allergic inflammation suggesting a mechanism for elevated ADMA.

For this project, our studies have now established that airway epithelial PKA activation requires the functional production of nitric oxide. Furthermore, we found that enhancing the nitric oxide pathway by over-expressing a nitric oxide protective enzyme (DDAH) was protective against organic dust-stimulated PKC activity and inflammation in a mouse model. To further investigate the mechanisms of this pathway, we have recently found the following:

- Agents that enhance nitric oxide production decrease swine barn dust induced lung inflammation
- DDAH overexpression blocks endogenous nitric oxide synthesis inhibitors and is protective against swine barn dust-induced lung inflammation
- PKA activation results in the attenuation of tumor necrosis factor (TNF) converting enzyme activity, leading to the inhibition of swine barn dust-induced TNF alpha production in airway epithelium

Going forward, we will continue to explore bi-directional control of PKA and PKC in the context of nitric oxide production and manipulation and how that relates to dust-mediated pulmonary inflammation. We will also continue to include real-world co-exposures, cigarette smoke and alcohol consumption, in our animal studies. Our studies have now been advanced to examining the function and dysfunction produced by organic dust at the level of CD204 and IL-10 in altering the repair/homeostasis responses that otherwise lead to healing from injury.



Surveillance of Agricultural Injuries in the Central States Region Risto Rautiainen PI

The objective of this project is to improve the surveillance of injuries in agriculture by developing an innovative, cost-effective surveillance system using a combination of existing data sources. CS-CASH collaborates with the National Agricultural Statistics Service (NASS) to accomplish two specific aims: 1) to implement an annual injury survey, linked with existing data from the Census of Agriculture, and 2) to describe injuries, injured persons, rates of injury, and risk factors for injury.

Four rounds of data collection have been completed. The response rates have ranged from 29 to 37% of farms. The majority of the operators have been male (84%), and the majority spent more than half of their time working on a farm or ranch (52%). The incidence of injuries among farm operators (principal operator and up to two other operators per farm) was 7.64% in 2011, 7.44 in 2012, 6.11 in 2013 and 8.17 in 2014. The average direct out-of-pocket cost of injury has ranged from \$1712 to \$3495, and the average cost covered by insurance has ranged from \$7085 to \$7723. More than half of injuries (56%) required professional medical care, 9% resulted in hospitalization, and most injured operators lost work time ranging from less than half a day to 30 days or more. Frequently the injuries were sustained when working with machinery or livestock.

The injury surveillance also involves tracking injury cases through a press clipping service. In 2014, this system found 75 fatal (92 in 2012) and 90 non-fatal (102 in 2012) agricultural injury cases in the Center's seven-state region. Individual case information from the media can be helpful in understanding the circumstances resulting in injuries. Together these data sources provide valuable information for prevention of injuries in the region.



Surveillance data indicated that in the CS-CASH seven state region between 2012 and 2014 the average direct out-of-pocket cost of injury ranged from \$1712 to \$3495, and the average cost covered by insurance ranged from \$7085 to \$7723.

Outreach Program Debra Romberger Program Director

In year 4 we have continued a successful crowd sourcing approach directed at youth in farming by sponsoring a video contest for FFA chapters in our seven state region. The focus of the videos was - injury prevention when working with livestock. We chose this particular aspect of injury prevention as the CS-CASH surveillance project has demonstrated that injury related to livestock is the most frequent cause of injury in our region. The videos are posted on YouTube and are linked to the CS-CASH website (<http://www.unmc.edu/publichealth/cscash/news/video-contest.html>). Videos in this third annual FFA video contest received over 2600 votes. Traffic to the CS-CASH website increased substantially during the contest voting period. Several of the videos will continue as enduring resources on the U.S. Agricultural Safety and Health Centers YouTube channel, a NIOSH Agricultural Center collaborative Channel. CS-CASH has contributed respiratory and hearing protection videos as well as past FFA Video contest winners to this channel <http://www.youtube.com/user/USAgCenters>.

An evaluation was conducted of our previous FFA video contest on hearing protection as well as other aspects of hearing protection outreach. We observed that young farmers understand the advantages of wearing hearing protection (92%), but hold misperceptions such as wearing hearing protection increases accidents and the inability to hear other people (58%). Forgetting to wear protection (35%) was the most common barrier. The post-video evaluation of FFA students and advisors indicated increased knowledge regarding the use of hearing protection and a suggestion of behavior change. The previous professionally produced CS-CASH videos on respiratory and hearing protection have been viewed over 4100 times.

To promote awareness of injury prevention we continue to conduct demonstrations and trainings on proper use and choice of personal protective equipment (PPE) at venues throughout our seven state region. Ag workers have an opportunity to try out different types of respirators and hearing protection. They are sent home with an N95 respirator, earplugs and a health messaged and branded storage bag, along with information on the proper selection, fit and storage of these items.

Responding to the Avian Influenza emerging issue in the summer of 2015, CS-CASH, AgriSafe Network and two NIOSH agricultural centers, produced a two page document that outlines the proper choice and usage of PPE for each particular assigned task. This document was prepared in collaboration with an industrial hygienist and was vetted by NIOSH. The document was sent to over 1000 poultry producers across the U.S. The document is now an enduring resource on many agricultural safety and health websites as well as the NIOSH website. http://www.unmc.edu/publichealth/cscash/_images/Avian-Influenza-%20PPER.pdf

We used the Center's extensive 26,000 farmer database to distribute the following educational and evaluation materials: educational newsletters; information on emerging issues, youth related information to FFA advisors and students and surveys for evaluation of impact. We also use it to promote educational sessions such as "Agricultural Medicine: Occupational & Environmental Health for Rural Health Professionals - The Core Course" that occurred at UNMC July 14-17, 2015 with 15 rural health care providers and students in attendance. Center staff contributed to the successful 3 day Agricultural Safety short course that was attended by 24 Ag Safety and Health professionals held in conjunction with the 2015 ISASH conference.

We continue to expand our capacity to communicate agricultural safety and health information throughout our regional database, the Center website, and at a variety of events. The website serves as a base for providing information in more detail than can be done in short messages. There were 14,187 visits to the website from August 2014 through August 2015 a three fold increase from the previous year. We are beginning to get specific information from the Evaluation core that will help us modify processes to enhance communication of information that helps with prevention of agricultural associated injuries and ill health effects. Our networking with young farmers is growing and our video contests represent an exciting way to connect them to promoting safety and health in their communities.



Avian Influenza
Personal Protective Equipment (PPE) Guidelines

Avian Influenza Outbreak
The USDA and Rural Health Care Center (RHCC) reported Avian Influenza (AIV) cases on 10/11 for the first time in the United States. The virus is spread through contact with infected birds, wild and domestic. AIV is a highly contagious disease that can cause severe illness and death in humans. The disease is caused by a virus that is spread through contact with infected birds, wild and domestic. AIV is a highly contagious disease that can cause severe illness and death in humans. The disease is caused by a virus that is spread through contact with infected birds, wild and domestic.

Information provided is intended as general guidelines for caregivers.

Respiratory Equipment
Wear a respirator that is approved by the National Institute for Occupational Safety and Health (NIOSH) for protection against airborne particles. Do not use a cloth, paper, or plastic face mask. Do not use a respirator that is not approved by NIOSH. Do not use a respirator that is not approved by NIOSH. Do not use a respirator that is not approved by NIOSH.

Important Respirator Information

- Consult a health care provider before wearing a respirator if you have a history of heart or lung disease.
- Respirators must be worn in a well-ventilated area.
- Do not use a respirator that is not approved by NIOSH.
- Do not use a respirator that is not approved by NIOSH.
- Do not use a respirator that is not approved by NIOSH.

Availability of Personal Protective Equipment
Many types and sizes of PPE are available. Some types are more readily available than others. Some types are more readily available than others. Some types are more readily available than others.



Preventing Hearing Loss Among Farmers by Point-Source Hearing Protection Strategy Chandran Achutan PI

The overall objective of this study is to develop, implement and evaluate a novel point-source hearing protection strategy to increase the use of hearing protection devices (HPDs). This randomized controlled trial will test the effectiveness of this highly participatory intervention. To date, 51 farms are participating in this study. Participants in both the control and intervention group completed two questionnaires: the first questionnaire addressed participants' noise exposures and medical history related to hearing; the second questionnaire addressed participant beliefs and attitudes towards HPDs. We then assessed participants' hearing levels by administering hearing tests at their home or place of work.

All major sources of noise on the farm were assessed through interviews, visual observation, and spot noise measurements using a sound level meter. We collected personal full shift noise dosimetry. We developed a point-source intervention strategy consisting of earmuffs and earplugs placed in a weather-proof box and installed strategically in noisy areas of the farms.

Thirteen participants reported medical related hearing conditions including Meniere's disease, measles and/or mumps, tinnitus and hearing loss. Non-occupational noise exposures included music concerts, fire arms, car racing and industrial jobs. Approximately 25% of respondents reported not intending to wear HPDs. Interestingly, almost all participants agreed that wearing hearing protection can protect their hearing and that losing their hearing would impact their ability to communicate. Approximately 46% of intervention participants and 44% of control participants had moderate or profound hearing loss in at least one ear at the onset of the study.

More than 60% percent of the personal dosimetry measures exceeded the NIOSH recommended exposure limit. The noise levels ranged from 70.6 to 91.4 decibels. There were more than 292 tractors and 53 combines in the farms that we visited. There were also 113 portable augers and 75 riding mowers. We installed 92 point-source intervention boxes in the intervention farms, and nearly 90% of these boxes have been used at least once.

Our preliminary findings show that there is a need to educate farmers on the proper use and disposal of HPDs, hazards associated with noise, importance of noise control and use of HPDs. Interviews with farmers reveal a strong interest in protecting their hearing. Younger participants observed the hearing difficulties of their fathers and grandfathers and appeared motivated to use hearing protection. Participants acknowledged that having hearing protectors close to loud noise sources would give them the access to these protective devices when they are most needed.



Approximately 46% of intervention and 44% of control participants had moderate or profound hearing loss in at least one ear at the onset of the Point Source Hearing Protection Strategy study.

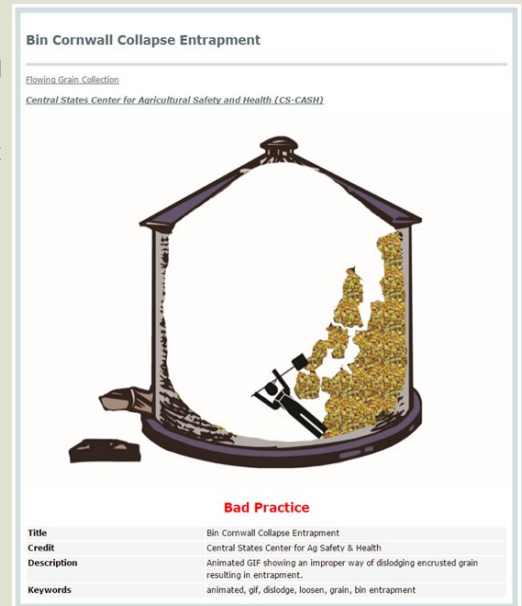
National Ag Safety Database Aaron Yoder PI

The National Ag Safety Database (NASD) is the most widely recognized and used Internet based assemblage of educational resources related to human health and safety in production agriculture. The goal of this project is to make audience targeted educational resources from NIOSH centers, researchers, educators, and standards accessible to end users in the agriculture, forestry, fishing, and hunting industry. To accomplish our goal, researchers identify, solicit and add new safety and health print materials; review materials on an ongoing basis for accuracy and usefulness; identify, solicit and add more on-line safety and health non-print materials; develop new original on-line training units for the NASD website; solicit and develop more multilingual resources and promote NASD and NIOSH safety and health efforts. Work on these goals will continue in year five. Additional consultants have been added to this project for the final year to help meet these goals.

Conceptual Arts, Inc. has recorded the site analytics for the NASD from September 2014 through August 2015. An average of 29,909 site visits per month with an average of 41,025 page views per month were recorded. Roughly 60 percent of the visits come from the United States, and the majority of the visits come from English speaking countries. Just over 60% of the visits were from desktop/laptop computers leaving less than 40% of the visits from mobile devices/tablets. Mobile device usage is growing based on the trends over the past few years. The most accessed document was related to fire safety, and one of the top 10 most accessed documents was written in Spanish. The infrastructure for an image database was established, and it is currently being populated with agricultural safety and health images that will be public domain.

Regular meetings were held with representatives from other NIOSH funded Agricultural Safety and Health Centers to present updates of the NASD and to encourage other Agricultural Safety and Health Centers to contribute materials to the NASD.

There are several options on the NASD Web site for users to ask questions, report problems, or recommend materials.



Education/Translation Core Aaron Yoder PI

Over 90 participants from across the US have taken the week long Agricultural Medicine course offered by CS-CASH since the first course was offered at the University of Nebraska College of Public Health in 2011.

The core course provides an overview of key health and safety issues specific to rural and agricultural workers.

The course is designed for professionals who work with or have an interest in agricultural health and safety including: physicians, physician assistants, nurses, advanced practice nurses, veterinarians, health educators, migrant health clinicians, physical therapists, Ag extension, insurance specialists, and NIOSH Ag Center personnel. Participants spend 32 hours in class and 4 hours of training at the University of Nebraska research farm in Mead Nebraska. Yearly course evaluations have been excellent.



Evaluation Program Mary Cramer PI

Over the last three years we have collected longitudinal data on outcomes and developed new models to assess our Center's end results and networking. In year four, the focus has been on scholarly publications related to the evaluation of the Center, which includes four manuscripts and two posters at national conferences (i.e., American Public Health Association Annual Conference in November, 2014 and the American Evaluation Association (AEA) Annual Conference in November 2015).

The evaluation team measured the effectiveness of our Center's governance and leadership using mixed methods. Quantitative data were collected using the ICE© survey (Cramer, Atwood, & Stoner, 2006) in October of 2014. Findings show that overall there is a high level of perceived organizational leadership effectiveness. The Center continues to have positive levels of effectiveness in each of the ICE's 6 conceptual constructs of successful coalitions. There is a strong sense of shared Social Vision and respondents rated collaborative Relations as a strength of the Center. Respondents view the Center as a learning environment, as evidenced by the higher ratings given to new Practices and Knowledge they have gained regarding agricultural safety and health. An area to strengthen is in Activities. Members rated Activities lower than other categories indicating that Center members may be less certain about the degree to which aims/goals and the work plan are implemented in its entirety and on a timely basis. The leadership team continues to address this need at monthly membership meetings and with email communication updates.

Qualitative data on Center governance and leadership was gathered through field visit interviews in July /August 2015 with 3 new pilot investigators and 3 fully funded project investigators. The outcome of this study revealed improved familiarity with Center organization and its mission accomplishments (i.e. response to bird flu epidemic, high level of Ag event participation, brought new partnership possibilities such as introduction to insurance companies). Two areas listed for further review are increased understanding of each member's core interest area and more detailed interaction at monthly member meetings about member projects.

The Evaluation Team meets with the Center Leadership to refine our CS-CASH Logic Model (LM) measures and indicators based on annual evaluation data. One of the new measures in year four was conducting a Social Network Analysis to measure the impact of our LM Activities with Stakeholders and End Users (i.e., LM Intermediate Outcomes). An analyst (Ozgun, Araz, PhD) was added to the team. Results were reviewed with Center participants for interpretation and implications for strategic planning.

The Evaluation Team tracks morbidity and cost data for self-reported hearing loss, respiratory disease, injury, and health care utilization through an annual random sample survey to measure the Center's End Results in the region (Link to LM on website). The Midwestern Farm Operators Respiratory and Hearing Health Survey was combined with the Center's Annual Injury Surveillance Survey. New questions in the survey that address economic impact include quality-adjusted life year (QALY) and health care utilization will be analyzed. The annual surveillance survey is coordinated through the National Agricultural Statistics Service (NASS) to a random sample of 7000 Ag operators in our 7-state region. Data will be analyzed and compared to earlier studies in order to assess changes in Midwest farmer's safety and health practices as well as the economic impact. Results will be disseminated through CS-CASH member meetings, annual national/international conferences and manuscript submissions.

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





Research conducted at the Central States Center for Agricultural Safety and Health has identified barriers to use and knowledge regarding choice, fit and appropriate use of personal protective equipment (PPE) by farmers. This information is currently being used to more effectively train and educate the farming community on the proper use of PPE.

Pilot and Emerging Issues Projects Eleanor Rogan Program Director

An essential program within CS-CASH is the Pilot/Feasibility Projects and Emerging Issues Program, which 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 26 pilot projects have been funded by CS-CASH.

- **Year 1 - 5 Pilot Projects funded with \$60,000 contributed by the UNMC Vice Chancellor of Research.**
- **Year 2 - 7 Pilot Projects funded with \$40,000 contributed by the UNMC Vice Chancellor of Research.**
- **Year 3 - 4 Pilot Projects funded.**
- **Year 4 - 5 Pilot Projects funded with \$40,000 contributed by the UNMC Vice Chancellor of Research.**
- **Year 5 - 5 Pilot Projects funded with \$40,000 contributed by the UNMC Vice Chancellor of Research.**

To date, Pilot Project data has been used to generate larger awards including: AgHealth Nebraska (\$100,000 Nebraska Research Initiative Grant) and Prevention and Treatment of Agricultural Respiratory Disorders: A Pilot Educational Program of Rural Health Care NPs and PAs (\$769,000 HRSA Grant).

A review of each funded pilot project follows.

Health and Job Hazards of Latino CAFO Workers in Missouri Athena Ramos

The Health & Job Hazards of Latino CAFO Workers in Missouri study was developed to systematically understand and describe occupational risks; CAFO job processes among the phases of hog production including: sows, nursery pigs, and finishing; and explore opportunities for safety and health educational interventions through the identification of perceptions and acceptance of occupational risk, health effects, healthcare needs, and health beliefs among CAFO workers and their families. We are conducting a prospective panel study with immigrant Latino hog CAFO workers and their families in Missouri and track them over the course of one year.



Trust was established with community members before data collection could begin. Team members met with participants, local pastors, and other service agencies.

We have worked to develop a survey (interview guide) to assess occupational health among immigrant hog farmworkers in Missouri. Specifically, the survey covers demographic information, health status, substance use, occupational health, perception of risk, use of personal protective equipment, depression, anxiety, and knowledge of local resources, acculturative stress, and training/prevention opportunities. We obtained IRB approval for the survey and translated all study materials into Spanish. To date, we have completed baseline data collection with 40 immigrant workers in Missouri and associated household members. Our sample comes from the following counties: Linn, Sullivan, and Audrain counties. We will complete the second round of data collection between June and September 2016. We have developed the focus group guide for the qualitative component of our study consisting of six focus groups, which will be implemented this fall. We have disseminated the booklet "Safety in Words" (Seguridad en Palabras), which was produced by Migrant Clinicians Network as a picture dictionary for agriculture to discuss appropriate personal protective equipment.

Best Practices for Range Bison Herd Workers Clayton Kelling PI

It is widely recognized that agriculture is one of the most hazardous occupations in the United States; livestock-handling is dangerous. Livestock-handling injuries are also among the most severe of all agricultural injuries. The bison industry is growing in the central states and handling bison is hazardous, especially on Indian reservations. The herds, free to roam in large pastures on reservations are gathered once each year and processed, which requires working the animals through alleys and restraining the bison in chutes. We have worked with these herds carrying out herd health practices for six years, so we have gained first hand, real world insight into the high occurrence of worker safety hazards and risks typically-associated with handling bison under these conditions.

In our ongoing pilot project, we have conducted preliminary studies to begin characterizing safety hazards and risks associated with bison herd management practices on reservations. During the fall of 2014, we conducted onsite observational audits of worker safety during roundup work on eight reservation herds in ND, SD, IA, NM and OK and three herds located off reservations in ND, SD and MT. This preliminary work confirmed common occurrence of worker safety risks, which were associated with use of high stress handling methods as well as with use of substandard facilities and equipment.

In additional preliminary work, tribal bison managers were surveyed and based on 25 responses, a widely-shared concern among respondents, consistent with our observations, is constant occurrence of bison worker safety issues associated with handling bison. This work has led to development of preliminary tribal outreach activities on bison handling and worker safety sponsored by Intertribal Buffalo Council through presentations (Annual membership meeting, December 12, 2014) as well as by conducting workshops at bison roundups (Taos Pueblo herd, Taos, NM, March 23-25, 2015). A worker safety barrier fence was installed on one reservation bison processing site to reduce bison worker safety risks.

Clearly, this preliminary work confirms the feasibility of assisting bison workers to implement One Health best practices to mitigate worker safety risks on reservations. We are now exceptionally well-positioned to successfully carry out up-scaled, broader ranged One Health activities on additional reservation sites. Therefore, we are now proposing to conduct a larger multi-year project to implement widespread awareness of One Health best management practices to enhance bison worker safety as our preliminary pilot work. Based on results of our preliminary work in our pilot project, the proposed expanded project is entirely feasible and there is very high probability of successful outcomes.

Kelsey Palm, Ellen Duysen, Risto Rautiainen and Clayton Kelling. Improving the Safety and Health of Bison Handlers. National Institutes of Occupational Safety and Health (NIOSH) Science Blog <http://blogs.cdc.gov/niosh-science-blog/2015/08/10/bison/>.



Vitamin D Supplementation Protects Against Bone Loss Following Inhalant Organic Dust and Lipopolysaccharide Exposures in Mice **Jill Poole PI**

Chronic inhalation of organic dusts from agricultural environments, which are enriched with microbial cell wall components, cause significant airway inflammatory diseases including asthma, bronchitis and chronic obstructive pulmonary disease (COPD). Work in agriculture is also associated with high lifetime prevalence (~90%) for musculoskeletal disorders. Whereas these 2 systems of respiratory disease and musculoskeletal health may appear unrelated, there is increasing evidence supporting that airway injury and inflammation significantly contributes to debilitating systemic skeletal diseases such as osteoporosis and fracture. Several risk factors for low bone mineral density including low body mass index, female sex, age, select medications such as glucocorticoids, sedentary lifestyle, cigarette smoking, and nutritional status are well defined. However, recent studies demonstrate that bone mineral density loss can occur independently of these established risk factors in patients with COPD and asthma, common airway diseases among agriculture workers. Moreover, this observation suggests a pathogenic association between lung injury and reduced bone mineralization; yet the underlying mechanisms to explain this relationship are not known. Understanding the mechanisms governing the lung-bone inflammatory axis might lead to novel preventative and/or therapeutic strategies to halt lung and bone disease in at-risk agriculture workers.

To provide mechanistic insights and develop future prophylactic and therapeutic strategies, we have utilized an animal inflammatory lung injury model to delineate the functional roles of specific components within complex organic dusts from large animal farm confinements. Our prior work has demonstrated that gram-positive bacterial peptidoglycan (PGN, a Toll-like receptor 2 [TLR2] agonist), as opposed to gram-negative lipopolysaccharide (LPS, a TLR4 agonist), is a predominant driver of lung inflammatory consequences. Importantly, we have expanded our studies to understand the systemic consequences of these inhalant exposures on bone homeostasis because of the high prevalence of musculoskeletal disease in agricultural workers. Using state-of-the-art micro-CT imaging, we recently uncovered significant bone loss in mice following inhalation treatments with organic dust extracts from swine confinement facilities and its critical components, LPS and PGN. This established, for the first time, an animal model connecting inhalant lung injury to bone loss. Because our preliminary studies demonstrate important roles for the TLR4 signaling pathway for regulating bone homeostasis, we sought in this project to further develop and delineate the potential mechanisms governing the crosstalk between the lung-bone inflammatory-axis to explain how lung injury induced following inhalation of potent environmental agriculture exposure agents mediate bone loss through focused efforts on key TLR2 and TLR4 signaling pathways. We hypothesized that TLR2- and TLR4-dependent pathways are central in regulating the crosstalk between lung injury and systemic bone loss induced by organic dust inhalant exposures. We proposed investigations in two Specific Aims: 1) Establish the role of TLR2 and TLR4 signaling pathways in promoting bone-resorbing osteoclasts induced by organic dust exposures; and 2) Determine the importance of TLR2 and TLR4 signaling in mediating concurrent airway inflammation and systemic bone loss following inhalant organic dust exposures in an established animal model.

Summary: Our investigations are demonstrating several novel aspects related to organic dust-induced inflammation with relevance to human airway disease. Overall, our findings are consistent with our central hypothesis that TLR-dependent pathways are central in regulating the crosstalk between lung injury and systemic bone loss induced by organic dust inhalant exposures. We demonstrated that TLR2 and TLR4 pathways mediate large animal confinement facility organic dust induced airway inflammation, but bone deterioration following inhalant organic dust treatment is strongly dependent upon TLR4. Inhalant ODE exposures significantly increased the number of bone-resorbing osteoclast precursor cells, which directly depends on the presence of TLR4. These observations suggest that manipulation of TLR4 signaling pathway could have implications for the future therapeutic and/or preventive strategic interventions.

Chronic inhalation of organic dusts from agricultural environments, which are enriched in microbial cell wall components, cause significant airway inflammatory diseases including asthma, bronchitis and chronic obstructive pulmonary disease (COPD).



Vision for a National Sustainable Certified Safe Farm Intervention Program

Kelley Donham PI

The Certified Safe Farm (CSF) is an evidence-based multimodal total worker health program that has resulted in long term reductions in medical costs, increased use of personal protective equipment (PPE), decreased occupational respiratory illnesses and remediation of farm hazards. Deriving in part from concepts originating in Scandinavia, the CSF was founded in Iowa, and now has been translated to Wisconsin, North Carolina and Nebraska. Currently no coordination exists among these programs. Our consultants from agribusinesses have advised us that to achieve national sustainability CSF must be consistent in programing and quality across state lines. Therefore, we envision developing a National Sustainable Model CSF Program by establishing a coalition of stakeholders active in CSF programing. We have establish a well working consortium committee representing seven states and have attained consistency, quality, and coordination across state lines. Further we have developed methods to account for regional/ local variances in CSF programs as necessary.

Specific Aim 1. Convene a coalition of CSF stakeholders for the following purposes: The core members of the coalition have been regular and important contributors in the process.

- From North Carolina Agromedicine Institute - Julia Storm MS, North Carolina Extension, is the principle representative from NC, and has been the associate director for the project, serving as managing meeting agenda, meeting notes and consulting with the PI on all aspects of the projects. Julia also has been the principal person developing the module for training auditors, as well as a primary advisor for the producer education module. LaMar Grafft is a primary committee member from the standpoint of the auditor training module. Robin Tutor MS, Director, Agromedicine Institute, and Greg Cope PhD, North Carolina Extension and Director NC CSF project, are in an advisory role for the project. From New York Center for Agricultural Medicine and Health - James Carrabba CIH, is a committee member for the project, and is a primary member working on the OSHA module. From Pennsylvania State University Extension - Dennis Murphy PhD is a member of the committee with the purpose of coordinating with the Penn State FARM-HATT program. From Nebraska Central States Center for Agricultural Safety and Health - Risto Rautiainen PhD, is a member of the committee, and is a major advisor on developing the electronic recording of audit and health results. Newer members of the committee include Marsha Salzwedel from Wisconsin, Carol Lehtola from Florida and Jeff Nelson and Brice Olion from the National Agricultural Safety Data Base.

Specific Aims 2 – 5 – Production of Modules for the CSF Program and Procedures Manual

- Producer safety and health training module. A final draft has been produced, and has been sent out to the committee as a whole for comment and input.
- The OSHA relevant module for CSF. The OSHA module has been completed in final draft form, and has been sent out to the committee as a whole for comment and input.
- We are in the process of reviewing, amending and updating the Auditor/Reviewer training manual.
- The General Operations Manual. A proposed outline and general principles document has been produced by Dr. Janssen, and has been circulated to the committee as a whole for comment and input.
- A new connection has been made with the National Agricultural Safety Database (NASD). This web page will have three different portals: a project management portal, a producer education portal and a CSF in practice module.

Specific Aim 6. Investigate integrating a self-assessment farm safety program (e.g. FARM- HAT, Pennsylvania State Extension) as a preliminary step to CSF audit. We are in the early process of designing a method to integrate FARM-HAT as a self-audit program for which the CSF third party auditor will follow-up to initiate the CSF identification.

Specific Aim 7. Investigate achieving incentives from insurances and agribusinesses for CSF farms.

Two important additions have been made to our national consortium group. These new members are representatives of the insurance industry. Mr. Lee Hipp, Loss Prevention Consultant at Agri-Services Agency, and Mr. Mike Keenan, Senior Ag Safety Consultant at Arthur J. Gallagher & Co.

Specific Aim 8. Establish a consensus process to determine future national leadership for CSF.

- We feel it essential to have a process that will assure leadership well into the future – beyond the term of this grant. We have discussed the following: 1) having a NIOSH or state funded agricultural health and safety center become the national manager for the program, 2) formation of a new CSF non-profit organization, 3) incorporate the activity within an existing organization (e.g. ASHCA, or the International Society for Agricultural Safety and health), or ally with an insurance company or other agribusiness business. These will all be discussed and we will find consensus on what appears to be the best position for CSF.

Lungs For Life Carolyn Sheridan PI

Lungs for Life, a concept developed by AgriSafe, is specifically designed to prevent chronic debilitating lung illness and disease by focusing on the respiratory health of the agricultural population. It is the intent of the Lungs for Life program to establish standards of clinical care for Ag producers working in high exposure respiratory settings based on applying principles of respiratory health monitoring (which is well established in other industries) and adapting those principles to the agricultural industry. A standard respiratory health program includes an agricultural occupational history and education on use of personal protective equipment (PPE). Use of baseline lung function screenings are appropriate in specific settings because of the air quality. The combination of the occupational history and baseline lung function test provides the health care provider with the information needed to make referrals to family practice physicians or specialists as necessary and the ability to provide respirator recommendations. Respirator fit testing ensures the mask provides adequate protection for specific hazards. All of these components are part of a comprehensive plan that can be adapted for those working in agriculture. Currently there are no established protocols or recommendations for baseline lung function testing specific to agriculture. The aim of this proposal is to design and pilot a respiratory health program that has intrinsic value to the farm community. AgriSafe is researching existing respiratory protocols and prevention standards of practice to apply that information to the agricultural sector.

Five health care providers are collaborating with AgriSafe throughout the grant and have experience and specialty areas in research, primary care, pulmonology, allergy and asthma and occupational health. The providers identified the lung function protocol they are currently using and the resources they look to for more information. Existing resources identified were research based articles and established practices and protocols for use of screening spirometry. Resources included the CDC, NIOSH, OSHA, American Thoracic Society, American Academy of Family Physicians and the American Association of Cardiovascular and Pulmonary Rehabilitation. Based on a standardized approach to review the existing literature and resources we developed the initial standards of practice draft to apply to the agricultural sector. Once the clinical protocol is reviewed and established, AgriSafe will complete phase two of this proposal. The second phase includes the development and testing of a Lungs for Life Toolkit for Ag producers. This toolkit will include an algorithm for screening spirometry in Ag, information on lung function tests, basic patient education, and PPE selection and fit testing. We are reviewing successful tool kit models and the development of design formats for educational and marketing materials to be included in the Lungs for Life Tool Kit. To ensure that this resource is practical and user friendly this proposal also includes collaborating with AgriSafe partners who will evaluate the Lungs for Life Tool Kit. Webinar based training will be offered to AgriSafe state affiliates who are interested in adapting the Tool Kit.

Hyperinflammatory Responses to Organic Dust Exposures in the Elderly Kristina Bailey PI

Nearly one third of working farmers are 65 or older. The aging of the agricultural work force leaves many workers more vulnerable to environmental exposures that are incurred in their daily work. For instance, aging farmers have more respiratory symptoms than their non-farming counterparts. To effectively serve this population, more needs to be known about how aging affects lung responses to agricultural exposures. In this proposal we will define how the inflammatory response to inhaled agricultural dusts changes as we age. Understanding these changes is the first step leading to better prevention and treatment of airway diseases in older individuals. In animal models, we have data that suggest that abnormal TLR2 and PKC ϵ signaling leads to a hyperinflammatory response. This proposal seeks to further increase the translatability of our work by gathering more human preliminary data. This will make us much more competitive for external funding.

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

One-third of Iowa occupational fatalities occur in the agricultural sector, which ranks highest in occupational fatalities in the state. The Iowa Fatality Assessment and Control Evaluation (FACE) Program's goal is to reduce injuries through surveillance, fatality investigation of root cause and contributing factors, and dissemination of prevention messages. Iowa FACE provides prevention messages through detailed case investigation reports, hazard alerts, and media articles. While these formats are widely used in other industry sectors, Iowa FACE products targeting the agricultural sector have not been evaluated by farmers.

This project will 1) use farmer focus groups to evaluate existing FACE products and dissemination methods; 2) develop new FACE products that incorporate farmer feedback and narrative texts gathered through interviews with decedents' survivors; and 3) use farmers to evaluate these new products. Project outcomes will inform FACE programs and agricultural safety outreach programs in best practices for disseminating injury prevention resources for farmers.

Cardiovascular Disease Risk and Physical Activity in Farmers

Paula Schulz PI

The state of Nebraska is predominately rural with cardiovascular disease (CVD) as the leading cause of death and hospitalization. Adults in rural Nebraska suffer from higher rates of heart attack, coronary heart disease, stroke, hypertension, hyperlipidemia and diabetes compared to overall state statistics. Rural residents often present for healthcare with more severe disease, and generally have poorer health habits (e.g. diet and activity). They are also less likely to get preventative health screenings because of the composition of the rural economy that is based on self-employment and small businesses. In the rural economic environment, rural nonadjacent (to urban areas) residents are responsible for nearly 22% more of their total health care costs (premiums and out-of-pocket costs) than urban or rural adjacent residents. In Nebraska, 45.3 million acres is declared as farm land worked by approximately 30,000 farmers. Typically, farming requires long hours during the season of planting and harvest (peak season) alternating with fewer activities during the winter months (off-season). Little is known about the physical activity levels and dietary habits of farmers in today's environment. Technological advances in machinery and farming activities have changed the typical work pattern in this occupation; however, no studies using objective measurement of physical activity in this population have been reported. Rural farming communities have high CVD risk with limited data available to understand the CVD risk reduction strategies most appropriate at different times of the year. This study will contribute to the science by providing information about CVD risk in farmers which can be used to develop tailored strategies for CVD risk reduction in this population.

This team of researchers has been working with several Nebraska Public Health Departments and Critical Access Hospitals to develop partnerships and prepare grant proposals. This proposed study will provide preliminary data for a future NIH R01 submission to reduce CVD risk in rural Nebraska communities. The primary purpose of this proposed study is to gather data about CVD risk, to better understand seasonal differences in physical activity and dietary patterns, and explore relationships between CVD risk and selected clinical and personal variables. These data will provide information needed to adapt an intervention used in the Community Outreach and Cardiovascular Health (COACH) trial that successfully applied cognitive behavioral strategies in urban, medically underserved, and predominantly African American sample to improve clinical outcomes for CVD risks. This study will help us tailor strategies to improve health and reduce CVD risk in farmers. The long-term goal is to foster sustainable interventions that will lead to reduced CVD in rural communities. This project will begin to fill this gap by contributing evidence that will be used in developing risk reduction strategies specific to the rural lifestyle and may serve as a paradigm for CVD risk reduction in other rural communities

The purpose of this exploratory descriptive study is to examine health behaviors (physical activity and dietary habits), quality of life, and overall CVD risk in rural residing adults (≥ 19 years) reporting farming as their major occupation. Specific aims of this pilot study are to:

1. Describe health behaviors (physical activity and dietary habits), quality of life, and CVD risk of farmers during peak farming season and off season.
2. Explore relationships between cardiovascular (CV) risk, and health behaviors (physical activity levels and dietary habits, personal (age, activation level) and quality of life variables).

Safety in Agricultural Work Camp Comic Book Development & Evaluation

Jill Kilanowski PI

Best evidence reports every three days one child dies and 38 children daily are injured in an agriculture-related incident. The National Institutes of Health have included comic books in public education campaigns since 1930. Comic books (graphic novels) have been evaluated for effectiveness in educating both children and adults in health promotion and can communicate knowledge, discuss alternatives or solutions, and critique issues. The purpose of this proposal is to develop a bilingual, culturally-specific comic book (graphic novel) to teach Latino migratory and seasonal agricultural worker (MSAWs) children and parents about safety working and living in agriculture; and to qualitatively pilot test the comic book for satisfaction and usability by the intended recipients. This is a multi-state multi-disciplinary team which will design, produce, pilot test, and then disseminate the agricultural safety comic book specifically designed to meet the linguistic, literacy, cultural, and situational needs of the MSAW child and family.

Specific Aim 1: Apply knowledge learned in the production of a graphic novel on healthy eating for MSAW to focus content on agricultural safety directed towards the children and families of MSAW.

Specific Aim 2: Analyze and integrate the perspectives of representative MASW children and parents to qualitatively and quantitatively critique the prototype of the agricultural safety graphic novel and determine appropriate responses.

Specific Aim 3: Disseminate the end product to extension institutions and MASW resources in education, agriculture, and health.

Low Stress Cattle Handling and Safety Arlan Tobyne and Nick Wells PIs

A low stress cattle handling safety program has been developed by Arlan Tobyne for the purpose of training safe stockmanship skills in a humane manner. Vision of the program would be to implement this training in the learning processes within an educational setting. Significant problems within the labor pool of the feedyard industry include aging employees and inexperienced livestock handlers. As Table 2 below indicates, 49% of the industry in Southwest Kansas are age 45 and above. Many workers leave this industry at approximately age 50, so nearly half of the region's workforce is prime to leave the industry in the near future.

Aim 1. The program at Dodge City Community College is set up as a 3 credit hour class, consisting of 1 credit hour of lecture, 2 credit hours of lab. The lab work consists of actual hands on exposure to cattle in a natural feedlot setting. The students are instructed about every facet of cattle handling including diagnosing sick cattle in the pens, removing these animals and taking them to the hospital in a safe and controlled manner. Teaching students to understand the flight zones and how to move them safely is a large part of the course. Students wear a headcam to collect footage demonstrating animal's behavior. Videos are analyzed and discussed during the lecture section of the class.

Aim 2. Introduce this concept by forming partnerships with industry management to provide additional funding and educational needs to train their workforce. Many feedyards perceive low stress handling differently, resulting in an increase in injuries, death and increased animal morbidity and mortality.

Aim 3. Train feedyards and management as to how these students have been trained so they have a better understanding of expected outcomes. Making the transition easier on not only the employee, but the employer as well.

This program is the missing link to tie educational feedyard programs together to develop curriculum in low stress cattle handling. In two semesters 14 students have graduated through this program at Dodge City Community College. Students indicate after completing the course, that they have a better understanding of how animals respond to stimuli enabling them to work smarter and safer in feedyard environments.



Effects of Sleep Deprivation on Balance, Stress and Recovery among Farmers Ka-Chun (Joseph) Siu PI

Working hours in agriculture are highly seasonal and fluctuate by weather. Spring planting and fall harvest involve extremely long workdays and farmers often have less sleep during those busy times. Sleep deprivation might cause balance instability contributing to slip, trip, loss of balance and fall injuries, which are common and serious among aging farmers. This project studied the performance longitudinally among farmers in repeated one-week observation periods before, during and after the busy spring planting and fall harvest seasons. Our pilot work has clearly indicated a strong relationship between sleep hours and instability in crop farmers. Increasing sleep loss can cause balance instability. We also found that our sample of six farmers were about seven times more likely to be unstable when they slept less than their average hours the night before the testing. These important data will allow us to develop a larger scale of research and ultimately provide more scientific basis to form better recommendations for farmers to self-regulate their sleep and working hours in prevention of agricultural injuries.

Emergent, Re-emergent, and Persistent Issues in Agricultural Safety and Health in the CS-CASH Region Murray Madsen PI

Quarterly summaries of current press clips related to agricultural injuries and fatalities are analyzed, coded, and entered into an accessible dataset. These help track the evolving, persistent experience of producers and highlight targets for continuing prevention-intervention work. In CY2013, press clips captured 86 fatal (versus 92 in 2012) and 92 non-fatal events (versus 102 in 2012); 73% of fatal and 68% of nonfatal events involved mobile machinery. Overturns and run-overs were almost half of the mobile machinery deaths; collisions between farm equipment and motor vehicles top the non-fatal injuries at 30% of the nonfatal injury events involving in the "Tractors and Mobile Machinery" category. These data were used to create media messages that were disseminated to newspapers and used in email blasts to 27,000 farmers and ranchers in the CS-CASH 7-states region. Work is underway analyzing relationships between nonfatal injury events in press clippings and injuries reported in survey work by CS-CASH with USDA NASS." These data were shared throughout the year with researchers, agricultural reporters and others who required statistics on injury and fatality rates.

AgHealth Nebraska: a novel preventive health services model for Nebraska Farm Families

Matthew Beacom PI

The AgHealth Nebraska model addresses the medical and farm safety education needs of farm families. The AgriSafe Network, Certified Safe Farm, and wellness concepts have been incorporated into modern rural clinical practice. It is the aim of the AgHealth model to detect serious health conditions at an early stage, identify and remove injury and illness hazards, set personal wellness goals, and provide incentives for farmers to manage their health and wellness. AgHealth is designed to be sustainable with client fees, insurance reimbursements and agribusiness support. It is anticipated that participants will improve their health behaviors and reduce health and safety hazards. In the long term, this model will reduce injuries, illnesses and related costs.

Ten farms in Nebraska participated in this study. An occupational nurse with a farming background was trained to perform the farm visits. The nurse performed both the health and farm safety assessments. Using a customizable iPad application (BioCheck™) the health screening data are safely stored and can be readily accessed by the clinic physician. Working in collaboration with a business consultant and the AgriSafe Network, a business model is currently being developed that will guide future studies and assure long term sustainability. This model will provide a financial platform to identify insurance and industry business partners.

Grain Dust Exposure in the Allergic Lung

Jane Schuh PI

Agricultural workers and farming communities are repeatedly exposed to grain dust during harvest, transport, and storage. The objectives of this study are to investigate the impact of repeated grain dust inhalation on normal lungs and to compare/contrast that with the effect on allergic lungs. Our intent is to characterize the occupational risk of dust inhalation to an individual who is sensitized to fungus in order that evidence-based decisions on personal protection can be implemented. Dust samples were collected from the rafters of commercial grain elevators dealing in each commodity. Three fungal species were identified in the corn dust sample while only 2 fungal species were identified in the soy bean dust sample. There were nearly 3.5 times as many colony-forming units per gram of dust in the soybean sample as compared to the corn sample.

Using an inhalation model of fungus-induced asthma that was developed in our laboratory, we used mice that had been sensitized to and challenged with *Aspergillus fumigatus* fungus to examine the effect of repeated exposure to corn or soybean dust. Interestingly, when compared to allergic animals that did not receive dust exposure, both IgA and IgE were significantly decreased in the blood of allergic animals after exposure to sterilized soybean dust. We speculate that it may be due to anti-inflammatory properties of the soybean itself. Although caution should be taken in extrapolating these data to a broader context, our work shows no deleterious link between fungal allergic asthma and increased morbidity after inhalation of grain dust from corn or soybean.

Stress and Mental Health Among Latino Farmworkers

Athena Ramos PI

The Migrant Farmworker Health Study was developed to gather baseline data on the health of Latino migrant farmworkers in Nebraska, to better understand the migratory pattern of these workers, and to develop recommendations to improve working and living conditions for migrant farmworkers. As part of the project, a Migrant Health Task Force was created and facilitated to engage a diverse group of community partners in the initiative. Members of the Migrant Health Task Force include: University of Nebraska Medical Center, Center for Reducing Health Disparities; Creighton University, Office of Multicultural Affairs; Nebraska Migrant Education Program; Justice for Our Neighbors-Nebraska; and El Centro de Las Americas. The Task Force developed a survey that consisted of 103-questions about demographics, current health status, stress, depression, and substance use. The research team held community meetings in towns where farmworkers lived to discuss the importance of the project and obtain their participation in the study. The team visited eight communities in five central Nebraska counties and had 200 people participate in the study. Participants were given a resource booklet on mental health, managing stress, substance use, and a listing of community health centers.

The team found that there were high levels of stress and depression among Latino migrant farmworkers with almost 46% of workers reporting symptoms of depression. There is a relationship between stress and depression. Among those who were stressed, over 70% were also depressed. The team developed categories of stress and a system to understand which stressors affect the feelings of depression. Almost 50% of stress was related to economics, living conditions, acculturation, and being socially isolated. Additionally, among those who were depressed, 24.5% reported that they had been injured on the job as compared to 12% among those who were not depressed. These results highlight the need for a comprehensive strategy to provide culturally, linguistically, and contextually relevant health education and interventions to improve mental and emotional health, occupational safety training, and access to appropriate social support services.

This project has had an impact by starting a discussion on migrant farmworker health in Nebraska. A relationship with the Consulate of Mexico in Omaha, Department of Labor, and Legal Aid of Nebraska has been established. There are a number of organizations across the state including the Center for Rural Affairs, Heartland Worker Center, and Justice for Our Neighbors-Nebraska among others who are now working to organize and educate Latino immigrants in rural areas, which may have implications for improving conditions for migrant farmworkers.

Chronic Bacterial Colonization, Agricultural Exposure and COPD **Tricia LeVan PI**

Chronic obstructive pulmonary disease (COPD) is the third leading cause of death and a major cause of morbidity among persons greater than 45 years of age. Farming has been associated with COPD. Among farmers, it has recently been estimated that the prevalence of COPD is 30% in smokers and as much as 17% in never smokers. This study provides an opportunity to examine the airway microbial structure and function. The central hypothesis is that the indigenous airway microbiome changes with airway obstruction and agricultural exposure. The cohort consisted of 20 COPD patients with or without agricultural dust exposure. Induced sputum samples were collected. These samples were analyzed by 454 pyrosequencing, the data have been downloaded and the initial analysis phase of the mega-dataset has begun. To facilitate successful collection of induced sputum, a high-pressure nebulizer was purchased. A VA Merit application has been submitted using preliminary data generated from the CS-CASH program. A grant application to NIH will be submitted in November. Breakthroughs in understanding the types of bacteria that infect the lungs of farmers and ranchers after exposure to agricultural dust will lead to better treatments and outcomes.

Imminent Hazards in English and Spanish **Jason Stratman PI**

A survey of 20 hazards common to agricultural sites was developed and distributed to agricultural workers in the central and western Nebraska regions. Surveys were distributed during agricultural training sessions and at regional farm and ranch shows. There were a total of 169 respondents, of which 69% were from feedlot operation and 31% were from harvest operations. An advisory committee was assembled to review the survey data and determine the final hazards to be depicted on pictograms. Members of the advisory group included: safety consultants, feedlot operation managers and a professional appraiser whose main focus is agricultural operations. The top 15 hazards were depicted into 10 pictograms as well as information on the dangers of talking and texting while driving.

The pictograms were developed in Microsoft PowerPoint. This is popular software and allows for easy modification. The intent of the pictograms is to bridge the growing English-Spanish communication gap; particularly for hazards that are imminent. Employers and employees can have free access to the materials for distribution. It is anticipated that they will be used as part of short training sessions and reference material. The pictograms have been added to the National Agricultural Safety Database (NASD) and are available on the CS-CASH website.

Pre-Professional Perceptions of Safety and Quality Concerns in Agricultural Work Environments **Gretchen Mosher PI**

A strong positive correlation between agricultural quality problems and increased occupational safety risk has been documented, yet no empirical evidence demonstrated that pre-professional college students in the field of agriculture were aware of the association between the two concepts. The objectives of this study were to determine if agricultural pre-professionals perceived a positive correlation between occupational safety and quality management in agricultural work environments. The secondary objective was to determine if their perceptions differed by gender, their academic discipline, their academic classification, their agricultural work experience, or their childhood environment (i.e. raised on a farm or raised in non-farm environment).

An existing safety instrument was modified to include quality management components. The instrument was administered to approximately 4,000 undergraduate students in Iowa State University's College of Agriculture and Life Sciences.

Students perceived a high importance of both safety and quality, but a lower level of awareness and experience with the two concepts in agriculture. Furthermore, students also perceived a high impact of quality management systems on reducing agricultural safety hazards, but they did not feel that the mitigation of quality issues would actually lower the number of incidents. Perceptions of students did not differ significantly by their discipline of study, their childhood environment, or their work experience in agriculture. Females perceived quality management systems to have a stronger mitigating influence on safety incidents and hazards than did male students. Quality management education represents an alternate method of reaching agricultural students regarding work-place safety issues before they enter the field of agriculture. For this reason, solidifying the perception of students on the interconnectedness of managing quality and safety in agriculture is critical.



Certified Safe Farm Pilot Program - AgHealth Nebraska Dennis Holtz PI

The Nebraska Safety Center in Kearney Nebraska partnered on an AgHealth Nebraska farm safety assessment project with CS-CASH and University of Nebraska Medical Center (UNMC) College of Nursing at Kearney. The assessments and health screenings took place in the Kearney area on farms that were randomly selected. The health screenings are conducted by first-year nursing students from the UNMC College of Nursing program in Kearney using a mobile lab brought to the farm sites. Farmers, their families and employees are screened on site for blood pressure, blood glucose levels, hearing loss, skin cancer and other health issues. This screening allows study participants to identify potential health issues, set personal wellness goals and provides help in managing their healthcare. In addition to health screenings, Nebraska Safety Center personnel conduct safety assessments that include identifying, removing or fixing injury hazards on farm properties. The health screenings and safety assessments were covered widely in the local news, increasing interest in this project.

In addition to training healthcare professionals and improving health outcomes this project aims to implement the Certified Safe Farm program and partner with insurance companies and other organizations so that agricultural workers are acknowledged for having effective farm safety awareness programs in place. It is anticipated that compliance leads to a better safety record and can give farmers a break in insurance costs.

Antelope Memorial Hospital Ag Safety Program PI Carol Anderson

Antelope Memorial Hospital (AMH) is a not-for-profit corporation located in Northeast Nebraska serving approximately 7,500 rural residents in 15 communities. Medical clinics are located in five communities in its service area of seven counties. Antelope Memorial Hospital and its providers address the overall health care and wellness of area farm families. However, there is not a specialized program currently available for educating farmers and ranchers of the occupational hazards of production agriculture. This project was designed to integrate a pilot evidence based primary prevention program geared toward the occupational health and safety of farm and ranch families. Wellness, Farm Safety Events, personal protective equipment demonstration and health screenings were designed as part of the sustainable hospital program to promote safety on the farm and ranch.

Community Driven Solutions to Address Farm Injuries PI Lea Pounds

Social marketing has been used as an approach to tackle many public health issues. In the agricultural sector social marketing has been used to improve campaign offerings as well as to identify effective communication and distribution channels to reach farm workers. Community Based Participatory Research (CBPR) has also been used to engage affected populations. Anecdotal evidence and limited empirical evidence suggests that farm women serve as the primary gatekeepers for their families when it comes to health seeking behaviors. This evidence formed the basis for the inclusion criteria of women farmers and farm wives as participants in this study that explored community driven solutions to address farm injuries. In this project the participants acted as a long-term focus group because a primary goal of the project was to solicit in-depth insight. This goal required that the Principal Investigator (PI) be able to interact one-on-one with participants as well as observe interactions between participants in order to analyze the effectiveness of the project in creating a sense of ownership of the process and the outcomes. This goal also required that the participants be comfortable enough with one another to engage in frank and open discussions about the process and decisions made.

The group met to examine existing data on farm injuries and discuss the impact of farm injuries. Working with the PI the women developed a matrix of ideas for a possible project focus by looking at high/low occurrence and high/low impact of various types of injuries. The study participants and the PI visited an equipment dealership and a local farm operated by a farmer who holds an engineering degree and also conducts safety training for employees of John Deere dealerships.

The study participants identified equipment safety as a key farm injury prevention strategy. They identified farmers themselves the priority group for the focus of the project and equipment dealers and repair technicians as a secondary group. Formative research to identify barriers and motivators consisted of previous and current discussions the study participants had with farmers within their social circles as well as their personal experience. Perception of time constraints was identified as the primary barrier to engaging in equipment injury prevention behaviors. Independence was identified as the primary motivator for engaging in equipment injury prevention behaviors.

The overall objective identified by the group focused on observing basic safety precautions around equipment. Two strategies were identified to achieve that objective: 1) a prompt in the form of a safety checklist that could be hung from the rearview mirror, and 2) a graphic safety label that could be used to supplement standard safety labels. The materials were pilot tested. The early finding that the participants felt knowing the cost of specific injury types would improve health communications is significant. The participants felt that showing that "X" injury results in "\$" medical cost and "T" lost work time would more clearly communicate the costs of risky activities.

Development of a Multi-State Capacity to Disseminate and Evaluate the Efficacy of a Web-Based Stress management Program for Agricultural Producers **Katherine Slama and Patrick Hart PIs**

In an effort to address the unmet needs for prevention of behavioral health problems in agricultural communities, a symposium was assembled to provide input on online Dealing with Stress (DWS) workshops and forming a consortium to disseminate and evaluate them. The symposium successfully engaged a variety of stakeholders from 4 states. Their input was most useful in setting out guidelines for further grant proposals.

Identification of critical stakeholders is an important outcome. These participants and their organizations are likely to form the core of the advisory boards involved in carrying out future grants. These participants and their organizations will be invaluable in the effort to obtain further grants, where the greater leveraged impact will occur. The qualitative output consists of the detailed comments and suggestions that symposium participants provided. Their sharing of information about rural behavioral health needs of the population in their respective states is a valuable outcome.

Beyond the dissemination and evaluation grant, there are any number of opportunities for additional research involving the DWS Workshops across geographic and ethnic populations and agricultural sectors. Research might also identify the parts of the workshops that best serve particular agricultural and rural people and whether the workshops can serve a purpose in clinical practice.

Feedlot New Hire Safety Orientation **PI Gordon Moore**

This pilot project was initiated by filming three feedlot employees and/or managers reading a safety orientation script written by Gordon Moore of Moore Ag Safety. The scripts were customized to each feedlot. The videography was done in much the same manner as a YouTube "How To" video. This was done in order to help with employee buy in for the project and to aid with the initial cost. Each yard was chosen for its number of employees, accessibility and proactive mindset towards safety. Each feedlot took a different approach to producing their video. One feedlot used all supervisors, another used only management level employees while yet another used a majority of entry level employees. The script was provided in English and Spanish in order to accommodate Spanish speaking workers. The intent was to limit the length of the video, but it was found in order to cover all the information pertinent to orientation the length needed to be extended. After the videos were completed each feedlot was given a copy to use as an orientation for new employees and/or continued training for existing employees.

During the production of these videos a Safety Management System was introduced within the industry. One of the Pilot Project orientation videos was added to this computer based training system. Although the use of this type of training is relatively new to the feedlot industry, this computer based training has been well received. The other two feedlots are using their videos for orientation without the computer based system. All feedlots were pleased with the finished product. A survey is underway at each feedlot in order to gather information about the number of employees using the videos, how the process was received and whether the use of a customizable video is viable in the feedlot industry. This information will be provided to CS-CASH after being evaluated by Moore Ag Safety.



Nebraska Pesticide Poisoning Surveillance Review and Outreach PI John Lowe

Nebraska Pesticide Poisoning Surveillance Review and Outreach Pilot project is a collaborative effort by the Nebraska Department of Health and Human Services, Nebraska Regional Poison Center and investigators at UNMC/CS-CASH. The primary focus of this pilot research is to analyze pesticide poisoning case data to improve the Nebraska pesticide surveillance program. In addition to data analysis the pilot project is also initiating various outreach efforts aimed at improving awareness and engagement to ultimately increase reporting of pesticide poisonings. The pilot project collaborators developed a coordinated messaging campaign delivering pesticide poisoning information, pesticide poisoning data, and reporting requirements to health care providers and public health departments throughout Nebraska. Additionally, project investigators have contracted with the Pesticide Safety Education Program at the University of Nebraska - Lincoln using pilot project funds and in-kind matching funds obtained by the Nebraska Department of Health and Human Services collaborator to develop public service announcements that will air on rural radio stations. Creation and delivery of Spanish language public service announcement through Spanish radio stations is also being explored through a potential collaboration with the CS-CASH Stress and Mental Health Among Latino Farmworkers pilot project.

Prevention and Treatment of Agricultural Respiratory Disorders: A Pilot Educational Program of Rural Health Care NPs and PAs Kathy Morris PI

Agricultural workers are exposed to an ever expanding number of potentially harmful agents that can affect the respiratory system. The prevention and treatment of acute and chronic illness related to agricultural respiratory disorders, is a necessary component in caring for the rural agricultural worker. In Nebraska, Nurse Practitioners (NPs) and Physician Assistants (PAs) provide care in rural areas of the state, however many have not had any formal education regarding agricultural-related respiratory diseases. This study evaluates the knowledge level of NPs and PAs regarding evaluation, diagnosis and treatment of agricultural respiratory diseases and pilots an innovative, evidence-based, continuing education program utilizing problem-based learning strategies.

Results from a survey sent to 631 NPs and PAs in Nebraska indicated that 71% were uncomfortable or somewhat uncomfortable recognizing and treating agricultural related illnesses. While 75% of the participants indicated that they would be interested in continuing education on respiratory-related disorders in agricultural workers. The knowledge portion of the survey indicated a need for education in a number of respiratory health topics. Educational programs and seminars for NPs and PAs are currently underway. The objectives for each session are for participants to be able to describe 5 common agricultural respiratory hazards, identify 4 respiratory conditions associated with agricultural dust and gas exposure and to determine when personal respirators are appropriate for use in the prevention of acute and chronic agricultural respiratory disease.

Data from this study were used in a grant application resulting in funding of a three year \$769,000 HRSA grant that will be used to launch a program that offers advanced education and training for family nurse practitioners who work in rural and underserved areas.



CS-CASH Core and Program Activities FY04

September 01, 2014– August 31, 2015 No. of Activities

Course/Curriculum (short course or training)	3
Material Distribution	22
Meeting/Conference	19
Training/Demonstration	31
Workshop	1

Total **76**

Article (peer reviewed)	20
Peer Review (grant/paper)	7
Presentation (oral)	44
Presentation (poster)	13
Abstract	2
Annual Report	1
Article/Report (non-peer reviewed)	5
Booklet/Brochure/Factsheet	3
Interview (media/other)	5
Newsletter	15
Video/Multimedia Material	3

Total **118**

Evaluation Instrument/Tool	5
Focus Group	2
Questionnaire/Survey/Checklist	6
Site Visit	1
Farm Safety Audit	10

Total **24**

Total CS-CASH Member Activities **218**

CS-CASH Peer-Reviewed Publications FY04 (9/1/14 — 8/31/15)

1. Bailey KL, Romberger DJ, Katafiasz DM, Heires AJ, Sisson JH, Wyatt TA, Burnham EL. TLR2 and TLR4 Expression and Inflammatory Cytokines are Altered in the Airway Epithelium of Those with Alcohol Use Disorders. *Alcohol Clin Exp Res*. 2015 Sep;39(9):1691-7. doi: 10.1111/acer.12803. Epub 2015 Jul 24. PubMed PMID:26208141.
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