



**CENTRAL STATES CENTER FOR AGRICULTURAL SAFETY AND HEALTH**  
 University of Nebraska Medical Center, College of Public Health  
 Annual Report – September 2016 - August 2017  
 NIOSH AFF Grant 5U54HO10162-06

**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). In years 6 and 7, thirteen additional projects were funded.

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

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

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).

### **Projects funded in 2017 (FY07) (N = 7)**

#### **Creating Enduring Resources for Farm Safety Education. PI Jana L. Davidson**

Goals: 1) Identify and recruit individuals that have created unique and effective props for use in farm safety and health education. We will create videos of these individuals assembling these props from start to finish. Videos will meet the needs of individuals with all learning types, including visual, auditory and kinesthetic.

2) Allow these videos to be readily available to all interested and currently involved with teaching farm safety. 3) To promote these resources, we will market the videos to Progressive Agriculture Safety Day® presenters, agriculture teachers and FFA advisors, 4-H educators and volunteer leaders and others invested in farm safety and health education. Since notification in November 2017, our focus has been sharing the details of the grant with our supporters, stakeholders and sponsors thus gathering buy-in. We discussed the project at all 2018 Progressive Agriculture Safety Day® Coordinator Trainings, which reached 479 lead and assistant coordinators, along with 12 guests. We utilized two in-house newsletters, the Safety Day Sentinel (December, 2017) and the Coordinator Connection (January, 2018) to share a summary of the project and identify needs of our stakeholders by asking questions to garner needs in the farm safety community. To highlight the partnership between the University of Nebraska Medical Center - Central States Center for Agricultural Safety and Health (CS-CASH) and the Progressive Agriculture Foundation (PAF), a feature story has been submitted for our 2017 PAF Annual Report. Plans are to complete the project in FY 20.

#### **Gathering Local Data and Building Ag Partnerships to Better Reach Ag Families. PI Chris Blanke**

Goals: 1) Obtain local data on the health and well-being of local farm families and Ag businesses and 2) Build capacity to support the health, safety, and wellbeing of local farm families, through Ag business partnerships. We will have local data about farm families and Ag businesses for at least 2 of the 4 counties in the District and will partner with AgriSafe Network to utilize their existing health and safety survey customized to our specific needs. We have begun meeting weekly to enhance communication. Questions will be added that help us measure physical activity, eating habits, alcohol and tobacco use, mental health, and access to care. The data from this survey will be compared to similar questions used for in town businesses. A planning group will be incorporated with ag-related partners to devise a plan on how to reach Ag families. Once the survey is ready, we will discuss with local partners the best ways to engage participation with the survey. The work with Frontier Cooperative will be evaluated and used. Next reporting period plans: Engaging other Ag businesses. We are looking at worksite cultures and how they are shifting toward better being able to support health changes. Evaluation with Frontier Cooperative is in the beginning stages. The one-year anniversary of working with them is in April. Complete the project in FY 20.

**Project Blue Ribbon Outreach. PI Julie Rother**

Goals: 1) Strengthen perception of NNPHD as a trusted, reliable source of occupational health and informational resources that improve quality of life. 2) Research preferences and effectiveness of information technology methods to communicate health, safety, and disaster preparedness information to all agricultural sectors in NNPHD's four-county service area. 3) Increase NNPHD's capacity to influence Knowledge, Practice, Attitudes among those we serve. 4) Disseminate findings to other public health and agricultural worker-related fields. The PI began outreach to potential partners. An Ag appreciation ad was sent to the four legal papers in the health district and the NNPHD Director of Operations, Kim Schultz, attended the Wayne Ag Day Seminar sponsored by Wayne Area Economic Development. PI provided an announcement of the upcoming Blue Ribbon Outreach project to the attendees of which there were approximately 100. Advertising for a Co-Investigator was initiated: a) Ads were sent to the legal papers in each of the four counties and to Wayne State College partners in an effort to identify a class or students interested in the project. The first interview was conducted and a co-investigator was hired. Work began on drafting a survey tool to gather communication preferences for the Ag population. Surveys used by the agency in the past were collected as well as surveys used by other organizations for possible question sources. Survey tools were collected from neighboring health districts, past survey activities at Northeast Nebraska Public Health Department (NNPHD), the Nebraska Association of Local Health Directors, and a local hospital. Resource tools, that will be provided to the Ag community whom we have contact with through this project, were identified. It was researched and determined that the most cost effective method of reproduction of the tools is in-house printing. During the next reporting period, NNPHD plans to complete the survey tool and use a variety of electronic formats: Poll Everywhere, NNPHD website, Facebook, and outreach at partner events. It will be promoted and assistance offered to Ag community members with completion of the survey as needed. Complete the project in FY 20.

**Identifying the sources of stress and prevalence of anxiety and depression symptoms among young farmers and ranchers in the upper and western Midwest. PI Josie Rudolphi**

Goals: 1) Identify sources of stress among young farmers and ranchers in the upper and western Midwest. 2) Estimate the prevalence of symptoms of self-reported anxiety and depression among young farmers and ranchers in the upper and western Midwest. 3) Evaluate the association between work stress and anxiety and depression among young farmers and ranchers in the upper and western Midwest. Relationships with young adult farm organizations in four Midwestern states were established. An online questionnaire was developed to identify sources of stress and the prevalence of anxiety and depression among young adult farmers in four states. The online questionnaire was sent to young adults in the four participating states via the young adult farm organizations. Data collection is currently underway and analyses should begin mid-April. During the next reporting period, we will complete data collection and survey results will be analyzed. Results will be prepared for dissemination. Reports will be made to reflect the survey responses of the four states enrolled in the study and shared with the partnering organization in each respective state. Complete the project in FY 20

**Agricultural and Occupational Exposures in U.S. Veterans with Rheumatoid Arthritis and Associations with Disease Severity. PI Bryant England**

Goals:1) Characterize the associations between agricultural and occupational exposures with RA autoantibody and inflammatory cytokine expression in RA patients, stratifying by genetic background.

2) Determine the association between agricultural and occupational exposures with disease severity and extra-articular disease features in RA patients. An agricultural and occupational survey was built into a scan able form and underwent pilot testing. We have been querying VA electronic medical record data to identify non-deceased VARA participants from participating sites who will be the recipients of the agricultural and occupational exposure questionnaire. We will begin mailing agricultural and occupational exposure surveys to non-deceased VARA participants from participating sites as IRB approval is received at each site. Mailings will be followed by a subsequent mailing 2 weeks later if no response is received. Once responses have been received we will begin data analysis including assessing data quality, accuracy, and performing any data cleaning. Once the data have been sufficiently cleaned, we will proceed with testing the hypotheses within each goal/specific aim. Complete the project in FY 20

**ATV AWARE: AN ALL-TERRAIN VEHICLE RESEARCH AND SAFETY PROGRAM. PI Susan Harris-Broomfield**

This pilot project's goals are to gather data from Nebraska youth regarding their behaviors while operating or riding ATVs. After implementation of a short session to teach proper behaviors and laws, the same youth take surveys to determine if they have learned appropriate behaviors and Nebraska laws, and have intentions to change their behaviors. Four to six months later, another survey will determine if those learned behaviors have changed their actual riding habits. The ultimate goal of the project is to reduce injury and death rates in Nebraska due to ATV use.

Aim 1: Gather demographic, knowledge, and behavioral outcomes related to ATV use using a sample of youth in Nebraska. Youth have been recruited from local Nebraska chapters of National FFA Organization to participate in the ATV Aware intervention program, utilizing the innovative ATV simulator. Youth are asked to provide baseline information regarding their general perceptions and use of ATVs prior to the start of the intervention. Information gathered pre-intervention will help researchers better understand youths' general perceptions and use of ATVs.

Aim 2: Influence behavioral intentions of the individuals participating in ATV Aware education. Following the ATV Aware educational intervention, participants are given a follow-up post-survey about intended ATV use. Post-programming outcomes are collected immediately following the intervention so it will not be possible to measure direct change, thus behavioral intent, will be used to provide a baseline for participants planned behavior. Qualitative interviews will also be conducted with a select group of youth to understand the quality of the ATV Aware programming and further explore their perceptions of ATV safety.

Aim 3: Influence actual behaviors of participants who complete the ATV Aware educational programming. A four-to-six month follow-up survey will be provided to youth to measure actual behavior following the ATV Aware intervention. Data obtained from the follow up will be compared with their initial and intended behavior to evaluate the degree to which participants changed their actual behaviors following the intervention. Throughout this pilot project experience, the goal when working with FFA members is to solicit feedback about how they would implement the educational program to have the most impact on other youth and even adults. Data collected will aid in further developing the curriculum for this program. Once tested,

the educational material refined for the ATV Aware can be used on a wide scale with multiple audiences. Thus, the long-term goal of this project is to extend training beyond FFA settings to increase ATV safety education, outreach, and prevention by educating grade school students, peers, and adults.

The major goals have not changed. All dates in the timeline have been 100% on target. Specific Aims have remained as originally planned. To date, 178 participants' data from seven FFA chapters have been collected and roughly documented. Because of results from this data, we are seeing trends in behaviors and already have an idea for the next project. More importantly, there was a definite result of knowledge gained post-intervention.

#### Major activities

- Communication with FFA Advisor and a visit to each site with ATV simulator
- Each session began with the T1 survey, followed by a team competition involving approximately 4-5 students per team. Each team was asked the same questions regarding ATV proper behavior and Nebraska laws. A designated team writer would write their answer on a white board and all teams would show their answers at the same time. One point was awarded per correct answer. At the end, the team with the most points was awarded with double treats, while other teams would also get a treat for participating.
- The students would then go to the simulator for lessons on center of gravity and talking about why all of the laws and behaviors are necessary. At that point, it was asked of them if they have been in an accident or if anyone they know has been in an accident. Cost of healthcare was discussed.
- The T2 survey was administered at the end to determine what was learned and what suggestions there were for future ATV Aware education. It was also an option to give contact information for a follow-up survey.
- Potential interview participants have been contacted for follow-up interviews.

Although we do have very new preliminary data, the data collection is on-going and has not been tested. Based on casual observance of survey responses to this type of learning, the majority of participants enjoyed it and felt it was useful. Two popular suggestions were to include photos or videos of actual consequences (more scare tactics if we are wanting them to change behaviors), and to offer this program to a younger audience for more chance of changing habits before they start.

Preliminary findings are that participants have learned correct responses to knowledge questions (as shown below), and most enjoyed competing while learning and participated with enthusiasm, although there were some who were not going to be convinced of any change no matter what was learned. A preliminary conclusion drawn from this is that we must intervene at a younger age, but we hope the interviews with participants will help shed light into potential future actions.

Significant results will be shared in the next reporting period.

#### **Development of ion channel blockers for Influenza D Virus. PI Hideaki Moriyama**

Goal: Development of mathematical models for the behavior of D type M2 protein based on the experimental results. I proposed to establish a mathematical model that is the basis of the start of federal level development of an ion channel blocker for influenza viruses using artificial intelligence (AI) to improve agricultural safety in Central States. The proposed research will be



the foundation of quantitative structure–activity relationship models (QSAR models) in the antibiotics design. To achieve the goal, I performed three major and one minor activities as described in the following.

1) Determination of the reversal potential of the DM2. *Xenopus* oocytes injected by each of DM2 and influenza C virus M2 protein (CM2) were subjected to the two-electrode voltage-clamp method. The gating voltages represented by The midpoint ( $V_{mid}$ ) values ( $V_{mid}$ ) in Boltzmann charge-voltage approximation for CM2 and DM2 were  $-141$  and  $-146$  mV, respectively. The reversal potentials observed in ND96 for CM2 and DM2 were  $-21$  and  $-22$  mV, respectively.

2) Cross-checking the DM2 performance with Drs. Kiran Sapkota and Daniel Monaghan at the University of Nebraska Medical Center (UNMC). We provided synthesized RNAs encoding M2 ion channel from Influenza C and D to Monaghan lab at UNMC. They offered their own *Xenopus* oocytes, buffers, and equipment. Dr. K. Sapkota performed experiments. The crosscheck confirmed DM2 has inward ion channel activity.

3) Modelling of the performance of DM2. This portion of the work is still under development, mainly because the opening and closing of the ion channel is a stochastic process. At this time point, two parameters were used to describe the DM2 ion channel activity, including the  $V_{mid}$  and the reversal potential as reported above.

To conclude the project and to shift the next step, I will work the following items. 1) QSAR models for M2 ion channels. By accumulating more electrophysiological data, adding the M2 protein from Influenza A virus, and introducing the molecular dynamics, the relation between the gating activity and the structures are modeled. 2) Epistasis of virus and host components. Investigated protein-protein interactions between M2 protein and other virus component by in silico approaches with taking co-evolution into the account. 3) RO1 proposal. Taking all together compile a grand proposal to Program Officer, Influenza, SARS, & Related Viral Respiratory Diseases, NIAID. The officer contacting is Dr. Teresa Marie Hauguel and my advisor are Drs. Eric Weaver (SBS UNL) and Ruben Donis (CDC). Complete the project in FY 20.

Publications include:

Wan Y, Kang G, Sreenivasan C, Daharsh L, Zhang J, Fan W, Wang D, Moriyama H, Li F, Li Q. A DNA vaccine expressing consensus hemagglutinin-esterase fusion protein protected guinea pigs from infection by two lineages of influenza D virus. *J Virol*. 2018. doi: 10.1128/JVI.00110-18. PubMed PMID: 29514906.

## **Results and Accomplishments of the FY 6 Pilot Projects (N = 7)**

### **Development of a mobile application for agricultural safety, PI Dr. Joseph Siu**

We successfully developed the mobile application, Aghealth. This mobile application contains two parts:

1) the latest news of agricultural safety, the website link to CS-CASH, NIOSH, and UNMC Environment (Figure 1); and 2) the balance tests (Figure 2). An accelerometer combined with gyroscope is able to measure the linear acceleration of the human movement. The sample rate is at 50Hz and acceleration values. The body sway will be quantified by analyzing the power spectrum density of acceleration data in three axes. We used this AgHealth to collect 7 healthy young, 7 healthy older adults, and 20 patients with Orthostatic tremor. These subjects performed 20-sec standing, four different walking conditions – normal walk, tandem walk, walk on T-bar, and walk and step over a shoebox. We already completed the Aim #1 to develop the AgHealth mobile application and collected the balance data during standing and walking in

healthy young, older, and patients with balance problems (e.g. orthostatic tremor). We are ready for completing the Aim #2. The significant results of this study has two-folds: 1) the results validate the AgHealth mobile application, which can be used to measure the balance control in normal and pathological populations; and 2) the subjects with balance problems (e.g. orthostatic tremor) affects the balance not only in standing but also in walking conditions, and this results were effectively captured by AgHealth. The AgHealth could be used to self-evaluate balance in farmers. We plan to implement the AgHealth mobile application to the farmers in the field and evaluate their balance between work season and off-season.

The AgHealth mobile application will be eventually available for download under the CS-CASH website after this pilot grant is completed.

### **Building Capacity for Nurse Practitioners to Advance Total Farmer Health. PI Natalie Roy**

The AgriSafe Network prepared Nurses Practitioners working in rural communities to meet the occupational health needs of farmers, ranchers and agricultural workers. Nurse Practitioners (NPs) received technical assistance, clinical training and resources in the field of agricultural occupational health. AgriSafe developed the Nurse Scholar program as an outgrowth of this pilot program. Known as the AgriSafe Nurse Scholar, AgriSafe applied “lessons learned” from the work with nurse practitioners to design an 18 credit hour course designed for Nurse Practitioners and nurses. The nurse scholar program has been well received and will fill all 35 seats in time for the course launch in May 2018. AgriSafe was also successful in securing several partnerships to advance the work with NPs. For example, Northeast Iowa Community College will provide the continuing education credits for the Nurse Scholar program. Abstracts have been submitted and accepted for both the American Association of Occupational Health Nurses (AAOHN) and the Rural Nurses Association.

Results from the webinars trainings indicate that the competency of NPs to serve the unique health care needs of the agricultural population was significantly improved. Phase 3 is the final phase of the project and includes refinement of the NPs curriculums before they are shared during the Nurse Scholar exchange. AgriSafe will be able to measure the quality of the Nurse Scholar trainings/resources for the 35 students (which induces changes in knowledge, skills, and confidence treating farm families). The findings will be shared through a journal submission to the Journal of Agromedicine.

### **Navigating Cancer Prevention, Education and Detection for the Ag Worker. PI Jamie Arens**

Avera Cancer Institute Navigation Center’s (ACINC) aim was development and delivery of outreach- related information to farm families at a minimum of five established farm shows in South Dakota and Minnesota. Utilizing educational materials and screening intake documents, navigators will offer personalized cancer screening recommendations. The IRB approval and data compiling along with anecdotal feedback related to this work will allow ACINC to learn overall impact of attending these events, the education provided, barriers overcome and number of people connected to screening services to determine long term outreach. ACINC participated in seven outreach programs. The following are the events and communities the navigators went to as well as the number of people in attendance: KCCR Farm and Home Show, Pierre, SD (15,000), Farmfest, Redwood Falls, MN (30,000), Dakotafest, Mitchell, SD (29,000), Indian Health Services Health Fair, Fort Thompson, SD (339), SD Women in Ag Day, Faulkton, SD (230), Brown County Fair, Aberdeen, SD (279,451), Dakota Farm Show, Vermillion, SD (25,000). The total number in attendance at these events is 379,020. The overall findings of this CA-CASH grant research shows that the largest barrier to cancer screening is lack of referral or recommendation.

**United Support for Agricultural Workplace Fatalities. PI Tonya Ford**

USMWF aims to reach out to those that have been affected by agriculture incidents offering them support, guidance and resources. We have posted approximately 407 articles regarding agriculture issues such as entrapments, suffocations, falls, fires, tractor accidents and more. Highlighting safety training conferences and tips on multiple social media pages reaching out to now over 3,500 followers. The articles have gained attention across the Midwest and have allowed our followers to share, comment and connect with others in the agriculture industry. Results and Accomplishments: This April will mark the second year that USMWF has been able to include those affected by an agriculture incident after the loss of a loved one at Nebraska's Workers' Memorial Day Events on April 28. Gaining attention to incidents that have occurred also in the Agriculture incident that may not get the attention it deserves. The CS-CASH grant has enabled USMWF to include farm/agriculture incidents in their research. We extensively research daily farm/agricultural incidents that injured or killed local Midwest agriculture workers. We collect who, what, when and where of each farm incident. USMWF has reached out to over 100 next-of-kins offering support and guidance, helping them turn something negative into something positive, gaining attention and preventing similar farm incident.

**Creating Healthier Agricultural Communities Creating Healthier Agricultural Communities. PI Laura McDougall**

Completed in October of 2017. The goal of this project is to support the health and safety of the Ag community within the Nebraska Four Corners District through establishing stronger agricultural partnerships in the local public health system. Key partners include a local hospital and clinic, U of NE Extension, and UNMC. Partners helped equip Four Corners staff to build a new relationship with Frontier Cooperative. This Ag 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. Accomplishments include 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. 100% of those who completed the post-assessment improved in at least one area. Future efforts will be committed to engaging the multiple sites, delivering programs other than on-line, and piloting service delivery collaborations with other LHD's.

**MAPPER Immersion: Developing an Augmented Reality prototype to Protect Lives and Increase Emergency Responder Effectiveness. PI Dr. Bryan Weichert**

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. Results and Accomplishments: The AR MAPPER system will continue on 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. The app prototype is now available via iOS (for Apple users) and through Android. Installation instructions for testing and demo videos are available on our website - <http://www.marshfieldresearch.org/nfmc/farm-mapper>