Great Plains Center for Agricultural Health
2016 Annual Report

September 30, 2016

*CDC/NIOSH Grant U54 OH007548*

The Great Plains Center for Agricultural Health is located within the Occupational and Environmental Health Department at the University of Iowa College of Public Health.

145 N Riverside Drive
Iowa City, IA 52426
SECTION I

CENTER SUMMARY

The Great Plains Center for Agricultural Health (GPCAH) at The University of Iowa is a nationally recognized resource with an established record of developing and implementing programs of research, intervention, translation, education, and outreach to prevent occupational injury and illness among agricultural workers and their families. The Center addresses the health and safety needs of agricultural workers in America’s most agriculturally intensive region (Figure 1). A full list of GPCAH program outputs is available in Appendix A.

The overall goals of the Great Plains Center for Agricultural Health are to:

1. Conduct multidisciplinary research targeting national priorities for agricultural health and safety.
2. Develop and evaluate educational, outreach, and intervention programs to prevent disease, injury, and hazardous exposures among agricultural workers.
3. Serve as a national resource for delivery of agricultural health knowledge and expertise to industrial hygienists, epidemiologists, ergonomists, veterinarians, and physicians to enhance the national capacity to meet the agricultural health and safety needs.
4. Provide agricultural health and safety technical assistance and consultation to health and safety professionals, community-based agricultural health organizations, and agricultural producers.
5. Maintain and strengthen linkages with health professionals in academic institutions, state and federal agencies, and international organizations to promote agricultural health and safety efforts.

RELEVANCE

Agricultural workers experience high rates of fatal and nonfatal occupational injury and illness when compared to other employed groups. As the region’s most well established agricultural health and safety resource, GPCAH activities are highly relevant to agricultural workers and their families, health department officials, community organizations, public health scientists, physicians, and researchers committed to protecting the health and safety of all persons engaged in agricultural work. We describe relevance by each project, below in Section III.
SECTION II: KEY PERSONNEL

Principal Investigator: T. Renée Anthony, PhD
renee-anthony@uiowa.edu

Deputy Director: Fred Gerr, MD
fred-gerr@uiowa.edu

Center Coordinator: Jenna Gibbs, MPH, PhD
jenna-gibbs@uiowa.edu

<table>
<thead>
<tr>
<th>Key Personnel</th>
<th>Role in Center</th>
<th>Email Address</th>
<th>Phone</th>
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<tr>
<td>Fethke, Nathan</td>
<td>Project Leader</td>
<td><a href="mailto:nathan-fethke@uiowa.edu">nathan-fethke@uiowa.edu</a></td>
<td>319-467-4563</td>
</tr>
<tr>
<td>Parker, Edith</td>
<td>Project Leader</td>
<td><a href="mailto:edith-parker@uiowa.edu">edith-parker@uiowa.edu</a></td>
<td>319-384-1472</td>
</tr>
<tr>
<td>Peek-Asa, Corinne</td>
<td>Co-investigator</td>
<td><a href="mailto:corinne-peek-asa@uiowa.edu">corinne-peek-asa@uiowa.edu</a></td>
<td>319-335-4895</td>
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<td>Project Leader</td>
<td><a href="mailto:marizen-ramirez@uiowa.edu">marizen-ramirez@uiowa.edu</a></td>
<td>319-335-4425</td>
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<td>Rohlman, Diane</td>
<td>Project Leader</td>
<td><a href="mailto:diane-rohlman@uiowa.edu">diane-rohlman@uiowa.edu</a></td>
<td>319-384-4007</td>
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<td>Cheyney, Marsha</td>
<td>Evaluation Coordinator</td>
<td><a href="mailto:marsha-cheyney@uiowa.edu">marsha-cheyney@uiowa.edu</a></td>
<td>319-384-4337</td>
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Find us online:

Center Web Page: www.gpcah.org

Center Social Media: Facebook.com/gpcah
Twitter.com/gpcah
SECTION III: Program Highlights and Impact

Intervention to Reduce Aerosol Exposures in Confined Animal Feeding Operations (T. R. Anthony)

The focus of this project is to improve the air quality of swine production buildings using standard mechanical ventilation methods that are typical of industries other than agriculture. One high impact accomplishment in 2015-16 was the multi-room comparison of the contribution of heater combustion products on air quality in the intervention building. The other accomplishment was development of outreach material summarizing the five-year study findings, with specific targeting to livestock producers and building designers.

Over the five-year study period, the major air quality contaminants in the swine farrowing building we evaluated were dust, ammonia (NH₃), and carbon dioxide (CO₂). The intervention system originally focused on removing dust. The recirculating ventilation system (1000 cfm) with dust control equipment to remove dust contamination identified that both the filtration unit (Shaker Dust Collector, model SDC-140-3, United Air Specialists) and the cyclone (Model 16, Donaldson Inc.) reduced room concentrations of inhalable dusts by 30 to 32%. The cyclone was less effective at reducing respirable dust (19%) compared to the filtration unit (32%).

In addition, field measurements and simulation studies identified that heaters were a potentially significant source of high CO₂ concentrations in the study room. New vented heaters were installed in the test room in fall 2014, with monitoring conducted over the following two winters. Comparing concentrations between years in the same test room revealed an 800 ppm decrease in CO₂ was attributable to the heater. The additional 200 ppm decrease between-years was associated with temperature and piglet housing differences between the two study years. In 2015-16, we conducted additional evaluation of CO₂ and ultrafine particle concentrations by measuring concentrations in multiple rooms. Although this allowed matched concentrations by outside temperature for rooms with the different heaters, the number of piglets and sows varied between test rooms according to production needs. In the final study year, we confirmed that room CO₂ was reduced by 760 ppm with the new heater. The CO₂ was significantly higher (p<0.001) one-meter away from the old, unvented heater (mean 2050 ppm) compared to one-meter away from the new, vented heater (mean 1404 ppm). In addition, ultrafine particles averaged seven times higher near the old heater (p=0.009) compared to the unvented heater. Concentrations of larger respirable particles did not differ between the test rooms. We found that changing the heaters used in these livestock production buildings may be an economical way to reduce one of the three main components of poor air quality within livestock production buildings, particularly in farrowing rooms.

Figure 2: Room averaged concentrations of CO₂ were lower when the room was heated with ventilated gas fired heaters.
The GPCA
t surveillance team continues to identify that transportation is the leading cause of fatality in the Midwest agricultural industry. The focus of this project is to advance knowledge on trends of farm equipment crashes in the nine-state region and assess whether state safety policies on lighting and marking help prevent crashes. To date, the study has examined several factors linked to more than 7,000 crashes involving farm equipment over five years. One notable finding was that increased lighting and marking on farm equipment reduces roadway crash rates.

In 2015-16, we focused on outreach activities translating study findings. We generated display and handout materials for both farmers and agricultural educators (Fig. 3). At three regional farm shows in South Dakota, Iowa, and Nebraska, we provided farmer-focused displays communicating general driving safety tips. Following a review by the American Society of Agricultural and Biological Engineers (ASABE), the display included an interactive panel used at these shows to educate and reinforce marking and lighting recommendations for implements pulled behind tractors. We asked visitors to the booth, (children and adults) to identify proper locations of lighting, marking, and the SMV emblem on an image of a large grain cart using magnets. We learned that although many farmers and youth were familiar with the SMV, they were unfamiliar with locations of yellow and orange retroreflective materials.

To increase awareness, we attracted farmer to booths by distributing 250 “lighting and marking kits” at farm shows in conjunction with the display. We will distribute the remaining 50 kits at the upcoming farmer Health and Safety Expo in Sioux Center, IA. Recipients received information on optimal lightning and marking of their vehicles and implements and, in return, provided information on where they will use their new kits, and why they use these implements on the roads (Fig. 4).

“IT is easy to say that we can’t really control what the other drivers do, but we need to do everything we can to make sure that drivers see us when we are on the roads. This information will help my boys know what needs to be replaced.”
- Farmer (Mother of 4), South Dakota
Musculoskeletal Symptoms among Agricultural Workers
(N. Fethke)

The focus of this project is to examine musculoskeletal pain among agricultural workers in the nine-state region. The study provides new information about the physical demands experienced by agricultural workers while performing common tasks. In contrast to all prior studies of this major agricultural health problem, we are capturing information about exposure to risk factors on participants’ farms using direct measurement techniques. At this time, all data collection activities have been completed and final data analyses are ongoing.

High impact accomplishments include data analysis of self-report surveys (518 farmers) and field measurements (55 farmers) performing common agricultural activities, including using an agricultural vehicle, milking animals, and repairing equipment. We computed seasonal time-weighted average exposure estimates by combining self-reported task duration with field measurements to identify associations to reported pain. Figure 5 illustrates the observed association between increasing levels of whole-body vibration and back pain, adjusted for several important co-factors, such as body mass index and stress.

Analysis of vibration measurements across 112 agricultural vehicles suggests that daily exposure guidelines may be reached in as little as two hours of operating a farm vehicle. Because variation of vibration between and within categories of farm vehicle types (e.g., combines, tractors, heavy utility vehicles, and all-terrain vehicles) was large, vibration data may not be generalizable. However, we identified that all-terrain vehicles (ATVs) had the greatest acceleration levels (mean = 1.1 m/s²) and combines had the lowest (mean = 0.4 m/s²). Combine seats also performed most favorably in minimizing exposure, reducing, on average, 50% of the vibration energy present at the vehicle floor, as compared to 23-39% for other vehicle types.

We have developed information on whole body vibration (Fig. 6) to disseminate to farmers along with the final study results. This includes a broad discussion of what is whole body vibration, its sources, and significant health effects associated with increased exposure. Additional details on best practices are also included in this pamphlet.
Advancing Research to Practice through Community Partners (R2P)  
(F. Gerr)

The goal of the Research-to-Practice (R2P) project is to strengthen regional safety and health organizations by translating agricultural health and safety research into useful resources to put into practice. A board of regional advisors participates in quarterly calls and annual meetings to identify emerging hazards, needed expertise, and materials and guidance to protect the health and safety of agricultural workers. Based on input from advisors, significant contributions to this R2P project included:

- Communicating research and translational findings to regional partners via regional agricultural safety and health conferences, specifically:
  - The Midwest Rural Agricultural Safety and Health (MRASH) in Decorah, IA
  - The Annual Occupational Health & Safety Research Conference in Iowa City, IA
- Generating Safety Watch columns for a regional weekly farm-publication (online and print)
- GPCAH On-The-Go activities, which develop and disseminate research, intervention, and surveillance project findings directly to farmers

R2P: Regional Agricultural Health and Safety Conferences

Midwest Rural Agricultural Safety and Health Conference (MRASH)
The 14th Annual MRASH Conference: Working Together for a Safer Tomorrow was held November 17-18, 2015 in Decorah, IA. This year’s conference included a celebration of the 25th anniversaries of ICASH and the GPCAH (the co-sponsoring organizations). The conference provides continuing education and networking opportunities for farmers and farm workers, healthcare providers, agricultural safety and health professionals, researchers, policy makers, and agribusiness representatives. The keynote topics included “What We Learned from the Avian Flu Outbreak” and “Farmers & Researchers Working Together to Improve Ag Safety and Health.” We hosted eighteen breakout sessions on topics important to the region, with seven of these presented on Center research or Pilot Grant recipient studies. There were 82 attendees, and feedback surveys identified that the conference was a valuable use of their time where attendees had learned something at the conference that would change how they functioned in their agricultural safety and health role.

University of Iowa Occupational Health & Safety Research Conference
In April 2016, GPCAH partnered with other federally-funded safety and health focused Centers at the University of Iowa (i.e., Heartland Center for Occupational Safety and Health, the Healthier Workforce Center for Excellence, and the Injury Prevention Research Center) to host the first annual Occupational Health & Safety Research Conference. This conference highlighted the research being conducted by graduate and post-doctoral students in the field of occupational safety and health. This event featured David Douphrate as a keynote speaker. Dr. Douphrate is a dairy safety researcher affiliated with both the Southwest (Texas) and the High Plains (Colorado) agricultural health and safety centers. The keynote event was followed by several platform presentations and a poster session. More than 60 researchers, staff, and students attended the event.
R2P: ‘Safety Watch’ News Column for IFT Publications

GPCAH outreach staff Stephanie Leonard and I-CASH director Brandi Janssen partner with IFT Publications to produce ‘Safety Watch’, a monthly feature in *Iowa Farmer Today, Missouri Farmer Today, Illinois Farmer Today*, and *Midwest Marketer* (weekly publications with online content and print circulation of 146,900 households) and CattleSeller.com (reaching 500,000 Midwest producers). Eighteen articles have been published through this mechanism since March 2015 (Fig. 7 contains links to stories). Safety Watch articles share timely and practical safety messages based on actual injury cases and farmer experiences and perspectives. Content focuses on recent events, seasonal hazards, and is coordinated with editorial calendars.

![Figure 7: Safety Watch Articles](image)

Articles addressing working alone, roadway safety, and respiratory protection also reached more than 1,000 people on GPCAH social media who do not necessarily subscribe to IFT Publications. Key to the success of these articles has been the incorporation of personal anecdotes and case stories to share and illustrate safety messaging. The Sept. 2016 article features a story of personal injury experiences of a farmer Rick Friday, who created a cartoon to illustrate the risk and injury that followed (Fig. 8).

In 2015-16 several of articles have been picked up by other media outlets, including the Iowa agriculture secretary’s ‘Ags and Bacon’ (list of informative articles for farmers) and Growingiowa.com (features agricultural news headlines). Safety Watch articles are widely disseminated on GPCAH and publications’ websites and social media platforms, including other NIOSH agricultural centers, AgriSafe Network, Extension, and other agricultural trade media.

![Figure 8: One of the most popular Safety Watch articles incorporated a cartoon by Rick Friday, a farmer who drew it based on his own experience with taking a short cut and working alone.](image)
R2P: GPCACH On-The-Go

GPCAH On-The-Go activities bring translated agricultural health and safety research findings directly to farmers. In this project year, prevention guidance to farmers included hearing conservation, gas monitor use in livestock buildings, and farm equipment roadway safety. Topics were selected based on target audiences at events and with input from center advisors.

Farm Equipment Roadway Safety
Farmers were coached on ways to improve the visibility of their tractors and implements to reduce their risk of roadway crashes (detailed in the Farm Equipment Crash Study, page 5). Infographics and materials developed for this outreach activity were reviewed and revised based on feedback from our regional advisors during a quarterly conference call to maximize the impact of the messaging to farmers.

Gas Monitors in Agriculture
In conjunction with investigators on the air quality in swine CAFO project team, information to increase the knowledge of hazardous manure gases and to explain the availability and use of low-cost direct reading monitors was conducted throughout the summer/fall farm shows (Fig. 10). Information and hands-on demonstration of seven monitors were provided to livestock producers (Fig. 11). Seventy-five show attendees provided feedback on monitor features, including display, price, power, and ease of use. More importantly, livestock producers learned about the hazards of hydrogen sulfide, when risks are elevated, and how to prevent fatalities. We awarded give-away monitors to randomly selected survey participants (with funds from a local industry sponsor) and six monitors have been sent to participants from the summer shows. After learning of the risk and relative ease of identifying the hazard, many participants indicated they would get a monitor on their own if they did not win one. All participants received information on these and other gas monitors useful to the farm, along with current prices and available on-line locations to purchase monitors.
**Hearing Conservation**

GPCAH collaborated with audiology students and the UISAFE (University of Iowa Sound Awareness for Everyone) program to create a visual display of the effects of Noise-Induced Hearing Loss (NIHL). The display incorporated data on the activities of daily living and parts of human speech that are most impacted by NIHL and tinnitus. The visual display was presented at the ISASH conference and shared with high school and community college agriculture and science teachers. Additional infographics were generated to assist in farmer selection and use of HPD (Fig. 12). Three farm supply stores have agreed to customized displays near their personal protective equipment sales area beginning during the 2016 National Farm Safety and Health Week. The perception and usefulness of these brochures at the point of sale will determine whether working with these stores at a regional level is beneficial to communicate with farming and rural communities.

**Emerging Issue: Mosquito-borne diseases**

Early in the summer, Midwest farmers began contacting the GPCA with questions on Zika. While the region is currently a low-risk for Zika-carrying mosquitoes, we developed materials and displays for summer farm shows to identify the proper use of mosquito repellants for outdoor workers, following CDC recommendations and were ready to discuss Zika with concerned farmers.

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![Hearing protection infographic](image)

**Figure 12:** Additional infographics were generated for formable and push in style ear plugs, and were disseminated in stores

“I don’t really think about the Noise Reduction when selecting earmuffs. I had assumed they were all the same.”

- 55 year old male grain farmer, Washington, IA

“I thought the ear muffs with the radio were more expensive because they were more protective. I didn’t know what the noise ratings meant, and I think I may change what I wear now.”

-48 year old male hog producer, Harlan, IA
Building Capacity of Agricultural Safety and Health Specialists

(D. Rohlman)

The goal of the Building Capacity of Agricultural Safety and Health Specialists project is to enhance competence in the primary, secondary, and tertiary prevention of agricultural injury and illness among the agricultural safety and health workforce. The centerpiece of the project is the Agricultural Medicine Core Course. This course has been the national model of effective agricultural safety and health education since 1987. The focus is to provide a strong foundation in the principles of occupational/ agricultural safety and health for agricultural enterprise safety managers, human resource specialist, public health students, nurses, physicians, veterinarians, and anyone interested in the special health and safety needs of agricultural communities. During the current center funding cycle, (i) the Core Course curriculum and associated training materials were revised and modernized, (ii) the course was delivered annually at the University of Iowa, and (iii) Great Plains Center faculty and staff facilitated delivery of the course at multiple distant sites.

The annual delivery of the course at the University of Iowa was available for graduate college credit or Continuing Medical and Continuing Nursing Education Units. In addition, the Core Course, with assistance from GPCAH faculty and staff, has now been delivered in Vermont, Nebraska, North Carolina, North Dakota, Wisconsin, Alabama, Texas, and Australia. Delivery of the course in each location included the development of regionally specific agricultural health and safety content.

In September 2016, we hosted a two-day workshop at the University of Iowa which brought together partners offering the course in other states as well as educators from agricultural safety and health organizations who have developed complimentary training, including NIOSH AFF Center educators. The goal was to nurture a national collaboration among agricultural safety and health educators, foster cooperation among national centers of agricultural safety and health, and minimize across-center duplication of effort. All agricultural health educational materials developed by Building Capacity personnel were disseminated to all workshop participants and will soon be available to agricultural educators online. In response to our stakeholder needs, we have initiated a large-scale project to develop online self-paced agricultural safety and health training modules to increase distance learning opportunities.
Evaluation Program
(E. Parker)

The 2015-16 evaluation focused on GPCAH leadership and administration and was conducted in two phases: in-depth interviews with the Internal Advisory Committee and individual surveys of the Regional Advisory Committee members. Information from these evaluation activities helped to prioritize outreach and dissemination needs for Center research projects, which led to the development of new displays and interactive presentations to guide interactions with farmers during summer outreach events (described on pages 9-10). It also helped Center leadership to understand the needs and allocate resources to project as they approached closure. The monthly on-line output reporting tool continues to be used by investigators and staff from all NIOSH-funded Centers at the University of Iowa (GPCAH, Heartland Center for Occupational Safety and Health, Healthier Workforce Center for Excellence) to track outputs. The tool has improved collaboration among these NIOSH centers.

Increased emphasis of social media and web platforms in the past year has been effective in demonstrating outreach throughout the region. Top posts on our Facebook page have been promotion of monthly Safety Watch articles: Choosing and using the right respirator (March 2016) reached >1000 individuals, rural roadway safety (July 2016) reached 686, and lessons learned about working alone on the farm (September 2015) reached >1000 individuals. This may demonstrate that the strength of the news media (a trusted source of information for GPCAH farmers) may be multiplied via new social media platforms. The GPCAH website has been visited over 4400 times in a six-month period, with over 10,200 page-views. Most viewers use a home computer, but mobile access now accounts for 13% of all visits. The most popular web pages were the home page (which is updated monthly), the Agricultural Medicine Core Course page, the GPCAH pilot grant program, and resource pages on hearing conservation, tractor overturns, and grain engulfment information.

The evaluation team shares evaluation results with the Center administration and investigators to inform Center-wide activities that can have impactful activities throughout the project period. This year, the following were used to inform high impact activities:

- Results from the 2014 Farm Health and Safety Concerns Survey and information from Internal Advisory Committee interviews led to the development new outreach focused on roadway safety and use of gas monitors (detailed in R2P activities).
- Input from the Regional Advisory Committee members identified the need to innovate translation materials from projects, leading to developing and piloting visual data infographics (illustrated in Figs. 6 and 11, for example).
- In response to 2015 interviews with the Regional Advisory Committee, GPCAH collaborated with other NIOSH AFF centers in five collaborative outreach events, with topic coordination, under a banner of “US Agricultural Safety and Health Centers.” These events include (partners):
  - The National Association of County Agricultural Agents Annual Meeting and Exposition (Southwest Center for Agricultural Health and Injury Prevention)
  - Minnesota Farmfest (Central States and Upper Midwest Centers for Agricultural Safety and Health)
  - Dakotafest (Upper Midwest Centers for Agricultural Safety and Health)
  - Farm Progress Show (Central States and Upper Midwest Centers for Agricultural Safety and Health along with the Iowa Center for Agricultural Health and the Iowa Department of Public Health), and
  - Husker Harvest Days (Central States and Upper Midwest Centers for Agricultural Safety and Health, Fig. 15, following page)
Figure 15: A crew of educators from several Centers operated the Ag safety and health outreach booth during Husker Harvest Days, September 2016 in Wood River, Nebraska. Photo courtesy of CS CASH.

The Center contributes to multi-center evaluation activities within the NIOSH umbrella. Key contributions include leading the US Ag Centers YouTube channel evaluation process (M. Cheyney, GPCAH Evaluation Coordinator) and the newly appointed role of the AFF Evaluation/Coordinator/Outreach (ECO) group coordinator (J. Gibbs, GPCAH Center Coordinator, starting August 2016).
Surveillance Program (C. Peek-Asa)

The primary focus of the surveillance core has been to examine fatal and non-fatal traumatic injury trends. Mortality data have come from the Census of Fatal Occupational Injuries (CFOI) of the Bureau of Labor Statistics, with which we have examined the 11 Midwestern States. Non-fatal injury data were evaluated using the Iowa State Trauma Registry, which designates both work status and relation to agriculture. The Center has worked to translate these surveillance findings into useful communication tools that can inform farmers and health and safety partners (Fig. 16). Significant findings include:

- The estimated rate of fatal injury was higher in crop production than in animal production (15.9 vs. 10.8 per 100,000 workers).
- Fatal injuries among young and elderly agricultural workers were significantly associated with crop production compared to animal production.
- We have examined payer source for traumatic injuries, with a focus on worker’s compensation. Our preliminary results indicate that fewer than 15% of work-related agricultural injuries used worker’s compensation as the payer source, as compared to 65% for other non-agricultural work-related injuries. Work-related agricultural injuries were far more likely to use non-health private insurance as coverage (including property and vehicle insurance).

**Figure 16:** Visual data were developed to translate surveillance studies into clear and practical information that can inform farmers.
Pilot Feasibility/Emerging Issues Program
(F. Gerr)

The pilot project program is an incubator for new research, prevention, intervention, outreach, education, evaluation, and translation activities. In addition, it provides a mechanism for quick responses to emerging issues in agricultural health and safety. Highlights of these pilot project activities include research addressing increased and improved use of hearing protection equipment, surveys of vulnerable and unique agricultural populations, improving emergency response and first aid in case of agricultural traumatic injury, and expanding an existing training program for grain bin rescue and safety to include hands-on demonstrations to row-crop farmers throughout the region. In addition, a 2014-2015 pilot project examining livestock worker’s exposures to *Staphylococcus aureus* has now been completed.

Five pilot grants were supported in the standard October 2015-September 2016 funding period (9 submissions). Remaining funds for this project were used to fund two additional community-based pilot grants in early 2016 (6 submissions). Table 1 identifies the seven projects that were funded in this current project year. Four successful applications were from graduate students, two from medical centers, one from UI OEH staff, and one from an agricultural safety center. Proposals that were unsuccessful included those from students (1), faculty from academic institutions (5), and community/non-profit organizations (3).

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<tr>
<td>Grain Bin Safety and Emergency Prevention</td>
<td>D. Neenan, NECAS</td>
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<td>Occupational Hearing Conservation for Farmers: Noise Induced Hearing Loss Simulation and Hearing Protection Device Fit Testing</td>
<td>J. Gibbs &amp; M. Cheyney, University of Iowa Occupational and Environmental Health</td>
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<td>Increasing the Use of Hearing Protection among Young Adult Swine Building Workers</td>
<td>J. Rudolphi (Student), University of Iowa Occupational and Environmental Health</td>
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<td>M. Ramasawamy (Student), University of Iowa Occupational and Environmental Health</td>
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<td>Safety and Health Prevention among Migrant and Seasonal Farmworkers in Iowa</td>
<td>Ashlee Johannes (Student), University of Iowa Occupational and Environmental Health</td>
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<td>Metagenomics and <em>Staphylococcus aureus</em> colonization in livestock workers</td>
<td>A. Kates (Student), University of Iowa Department of Epidemiology</td>
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<td>M. Gale, Avera St. Benedict Health Center (July 2016-March 2017)</td>
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<td>Gove County Farm Safety and Health Fairs: ATV Safety, Emergency Response, and Educational Displays to Prevent Agricultural Injury and Fatality in Northwest Kansas</td>
<td>C. Nelson, Gove County Medical Center (July 2016-March 2017)</td>
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Pilot grants submissions are ranked on the quality of the explanation of their study design or outreach program, using standard grant scoring mechanisms. The range of topics covered this year include hearing conservation (2), vulnerable populations (3, specifically young farmers, migrant workers, Leut), ergonomics (1), safety education directly to farmers (2), and fundamental research (1).

Appendix B contains details on the significance, outcomes, and impact from all these pilot projects.
**APPENDIX A**
**GPCAH PROGRAM OUTPUTS (OCTOBER 2011 THROUGH SEPTEMBER 2016)**

The number of outputs over the 5-year project period are summarized in the table below. Details on current project year outputs follow.

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*In 2016, the evaluation metrics for these lectures, seminars, and workshops was adjusted so that one output was given per academic course rather than counting individual lectures within the course.*

**Manuscripts**


**Abstracts/Presentations Accepted for Scientific Meetings**


Lectures or Seminars Delivered in Academic Settings
1. Anthony, TR. (2015) “Gas monitors and swine barns” lecture to 18 students at Kirkwood Community College. (1 hour)
2. Anthony, TR. (2016) “Conducting Noise Exposure Assessments” lecture to 35 Occupational Safety and Health Practitioners. (1.5 hour)
3. Anthony, TR. (2016) “Occupational Safety” to 20 graduate students (32 lectures)
5. Anthony, TR. (2016) “Occupational Safety and Health in Agriculture” lectures to 23 adults in the Agricultural Medicine Core Course. (1 hour)
6. Anthony, TR. (2016) “Transportation Hazards in Agriculture” to 23 adults in the Agricultural Medicine Core Course. (2.25 hours)
7. Fethke N. (2015) “Musculoskeletal pain among agricultural workers: lessons from an ongoing prospective study.” Seminar delivered to graduate students (n=15) and faculty affiliated with the Southwest Center for Occupational and Environmental Health, University of Texas, School of Public Health, Houston/San Antonio, TX. October 2, 2015
10. Gerr F. (2016) “Musculoskeletal Disorders Among Agricultural Workers” to 23 adults in the Agricultural Medicine Core Course. (1.25 hours)
12. Gibbs JL. (2016). “Pesticide Drift in the United States” to 40 graduate students and Iowa Department of Natural Resources field staff in the Occupational and Environmental Health Seminar. (1 hour)
13. Janssen B. (2016) “Hazards associated with Livestock” to 23 adults in the Agricultural Medicine Core Course. (1.5 hours)
15. Nonnenmann M. (2016) “Influenza Virus Aerosol Measurement and Occupational Exposure in Swine Production.” University of Iowa, Human Toxicology and Environmental Health Sciences Research Center, Iowa City, IA. (1 hour)
18. Nonnenmann M (9/2016). “Hearing and Noise Measurement” Occupational Hearing, College of Nursing, Iowa City, Iowa. (1.5 hours)
21. Rohlman DS. (2016) “Behavioral Health in Agricultural Populations and Total Worker Health” to 23 adults in the Agricultural Medicine Core Course. (1.75 hours)
22. Rohlman DS. (2016) “Pesticides” to 23 adults in the Agricultural Medicine Core Course. (0.5 hour)
24. Rohlman DS. (2016) “Case studies: Youth in Agriculture and Global Agricultural Safety and Health” to 23 adults in the Agricultural Medicine Core Course. (1.25 hours)

Workshops, Seminars, Lectures Conducted by GPCAH Personnel in the Agricultural Community
2. Anthony TR. (2016) “GPCAH Updates to Iowa Extension Field Specialists” to 14 ISU Extension agents at their fall regional meeting. (September 28, 2016)
3. Cheyney M. (2016) “Safety Signs” to 96 elementary students at the Garrison EMS Services Agricultural Safety Day in Garrison, IA. (July 9, 2016)
4. Cheyney M. (2016) “Safety Signs” to 220 elementary and high school students at Progressive Ag Safety Days at the National Education Center for Agricultural Safety in Peosta, IA. (June 9 and July 7, 2016)

Consultation or Information Exchange
5. Cheyney M (2015). Provided information about grain bin engulfment resources to Travis Algren of Consolidated Grain & Barge, Cincinnati, OH. (Oct 2015)
8. Gibbs JL (2016). Provided technical assistance to the University of Utrecht; TNO Netherlands about pesticide drift monitoring in the Netherlands. (May 2016)
9. Peek-Asa, C. Information exchange with Maria Perez of the Naples Daily News (Naples, FL) about migrant workers’ access to worker’s compensation insurance. (July 2016)
Information Provided to Policy Makers

Press Releases and Media Stories

Grant Proposals Submitted and/or Funded
2. Gibbs JL, Hornbuckle K. Passive sampling for outdoor airborne herbicides 2,4-D, acetochlor, atrazine, and glyphosate at Iowa farm households. Environmental Health and Safety Research Center (EHSRC), University of Iowa, National Institute of Environmental Health Sciences (NIEHS).
3. Nonnenmann MW. Comparison of Bioaerosol Samplers and Media for the Collection of Aerosolized Norovirus. CDC/NIOSH, via The Heartland Center for Occupational Health and Safety Research Center (ERC) Pilot Program.
5. Peek-Asa, C. The University of Iowa Injury Prevention Research Center (IPRC). 5 R49 CE002108-04 CDC/NCIPC.
6. Peek-Asa, C. *International Collaborative Trauma and Injury Research and Training Program (ICTIRT)*. NIH/Fogarty 5 D43 TW007261-10.

7. Peek-Asa, C. *Evaluation of the Department of Transportation Enhanced Medical Referral and Evaluation Management System*. Department of Transportation


10. Rohlman, DS. *Expanding Agricultural Safety and Health Training and Research to Argentina (Part 1: Argentina to Iowa)*. Faculty Development Grant for Global Public Health Research, College of Public Health, University of Iowa.

11. Rohlman DS. *Expanding Agricultural Safety and Health Training and Research to Argentina (Part 2: Iowa to Argentina)*. Faculty Development Grant for Global Public Health Research, College of Public Health, University of Iowa.


13. Ramaswamy M, Rohlman D. *Identifying Occupational Demands and Health Outcomes among Indian Tea Workers*. Student Global Public Health Travel Grant, College of Public Health, University of Iowa.

APPENDIX B GPCAH Pilot Project Descriptions

Grain Bin Safety and Emergency Prevention

D. Neenan, NECAS (October 2015- September 2016)

NECAS has developed a unique training program that has modified OSHA approved Confined Space/Grain Bin entry training to more effectively target rural populations, including family farmers and volunteer emergency medical services personnel. In addition to learning about grain bin ‘best practices’ and rescue procedures, participants of the training learn about lock-out-tag-out procedures, how to tie off and use an attendant, personal protective equipment, how to treat a patient with crushing injuries, and how to make cuts into the grain bin panel for full engulfment rescue. Until 2015, a large proportion of NECAS’s training has been focused within the states of Iowa, Nebraska, and Illinois. GPCAH funded NECAS to expand the training program to other states in the Center’s region, including Missouri, South Dakota, and North Dakota. As of September, more than 200 farmers and rural emergency responders in these new states have been trained. The trainings have been well received, as 46% of training attendees included family farmers. Participants who completed the programs were given a Likert scale evaluation at the end of the program, and NECAS is mailing the tier three evaluations to students which will effectively track whether or not they have made changes to their practices after taking the program. The grain bin safety trainings and rescue programs have been one of GPCAH’s most successful pilot grant efforts, resulted directly in nine saved lives nationwide. Pilot project funding has led to direct requests from local agricultural businesses, emergency response services, and additional grant funding from the OSHA Susan Harwood Grant Training Program.

Figure B1: Grain Bin Rescue Training with the Boone County Fire Department at the Farm Progress Show in Boone, IA.
This project built collaborations between the Departments of OEH and Audiology. Two distinct phases of this project have been implemented: the development and testing of a hearing loss simulator and the evaluation of hearing protection selection and insertion.

The Noise Induced Hearing Loss Simulation phase adopted a Hearing Loss and Prosthesis Simulator (HELPs V2, Sensimeetrics) to be used as an interactive educational tool for young farmers. The simulator shows how real-life farm situations may or may not be affected by mild to severe NIHL and tinnitus. More than 50 audio recordings (e.g., persons talking, radio reports, equipment/tools, grain transfer systems, and animals) were collected on the farm along with measures of sound level (dB) and frequencies (Hz). These recordings were used to create 'life-like' agricultural scenarios for both grain and livestock production that were incorporated into the HELP software for the simulator scenarios. Audio files were exported into HELPs software, and common NIHL types were simulated using current audiology literature on hearing loss progression from increase length of exposure, represented as mild, moderate, moderately-severe, severe hearing losses and tinnitus. Each recorded sound was adjusted for perceived loudness level. Final conversion of these files for use in touch-screen devices is under way.

The Hearing Protection Device Fit Testing phase of this project aimed to learn hearing protection devices preference and actual fit. Sixty farmers have been tested with the E-A-Rfit™ validation kit [3M, St. Paul MN, 2015] using four models of earplug inserts (Fig. B2). Preliminary fit test data show that although formable ear plugs like the 3M ‘Classic’ and ‘EARsoft’ brands have higher manufacturer reported Noise Reduction Ratings (NRRs), most farmers achieved better personal attenuation using the ‘Push-In’ plugs. In addition, 126 farmers and non-farmers identified initial preference of hearing protection, were informed about differences between types, and then were asked to identify what they now thought was the preferred hearing protection. Preliminary data from this study show that only 29% of participants changed their original choice of hearing protection after participating in the educational activity. In comparison, a much greater percentage of farmers (55%) of farmers who had participated in the E-A-Rfit™ validation test changed their first choice to select plugs with better protection. These results show that the test was an effective outreach activity. The most important factors for their original selection was comfort (31%), best fit (25%), and easy/quick to use (16%). Data analysis on this project continues, with information about personal attenuation ratings and age, sex, and farm type will be compared.

Figure B2: E A Rfit™ validation test at the Farm Progress Show in Boone, IA.
Increasing the Use of Hearing Protection among Young Adult Swine Building Workers

J. Rudolphi (Student), University of Iowa Occupational and Environmental Health (October 2015- March 2017)

Young adult agricultural workers often work in noisy environments and report symptoms of noise-induced hearing loss, yet they report inconsistent use of hearing protection. Behavioral tracking (i.e., self-monitoring, logging) was identified as an effective tool to modify health related behavior. Smartphone apps are may be effective in facilitating behavioral tracking, leading to improved health behavior change in young adults. However, it is unknown if this technology will be accepted among young adult agricultural workers or is an effective tool in modifying behavior. This study aimed to determine the impact of behavioral tracking on safety and health behaviors among young adult swine confinement workers.

For this intervention study, 76 young adult swine production workers (78.7% male, 21.3% female) from the Midwest were recruited and randomized into 3 study groups (two intervention groups and a control group). The three groups did not vary significantly on age (mean = 24 yrs, SD = 5.6), race, hours a week spent in a swine building (mean = 24.7 hr, SD = 14.7), or baseline reported use of hearing protection. At baseline, participants reported wearing hearing protection 19.1% of the time they were in a swine building. After completing the baseline survey all participants were mailed hearing protection kits. Instructions for downloading and using a smartphone app to log behaviors was sent to participants in the two intervention groups. These individuals logged their hearing protection use in swine buildings for 60 days. After the behavioral tracking period, we emailed all study participants a post-intervention survey. A final follow-up survey is currently being sent in September 2016. Changes in hearing protection use from baseline, to post-intervention, and follow-up will be calculated and compared between groups.
Identifying Job Demands and Health Outcomes among Midwest Beginning Farmers

*M. Ramasawamy (Student), University of Iowa Occupational and Environmental Health (October 2015- September 2016)*

The majority of farmers in the US are established farmers, people who are on average about 58 years old and have farmed for over 30 years. As these farmers age and retire, it is important to understand who will take their place. This project focused on learning more about beginning farmer characteristics, job demands, and health outcomes—in order to more appropriately design and develop future health and safety interventions. The project involved an online survey to understand the health, activities, and demographics of beginning farmers around the country. We recruited survey participants from several regional organizations, including Practical Farmers of Iowa (PFI), ISU Extension’s Beginning Farmer Center, the Farm Bureau’s Young Farmer and Ranchers program, and the Department of Natural Resources.

Preliminary data show that beginning farmers tend to be younger than established farmers (63% of farmers were less than 40 years old), and survey respondents were more likely to be women (63%). Interestingly, the majority of beginning farmers (90%) experience some form of musculoskeletal pain. Data analysis is ongoing, specifically to understand more specific locations and potential causes of this pain.

*Figure B3: Over half of beginning farmer health survey respondents were women farmers (63%)*
This project examined the injuries and illnesses, healthcare-seeking behavior, and use of prevention measures among migrant and seasonal farmworkers in Iowa. This population is at an increased risk for several occupational and non-occupational health problems due to multiple barriers and genetics. Furthermore, these farmworkers also experience multiple vulnerabilities including cultural, language barriers, and low socioeconomic status. We worked with Proteus, Inc., a nonprofit organization that provides primary care to more than 4,000 Iowan farmworkers, to administer a survey (in a face-to-face interview setting, with Spanish translation as necessary). The survey aimed to characterize farmworkers’ occupational and non-occupational health conditions, their healthcare-seeking behavior, and their use of preventive measures and health education. A total of 72 farmworkers were invited to participate in the survey, and 54 participated (75%).

Study results indicate more than 60% of the population did not receive information on any prevalent health problem from their doctor, employer, or other sources. However, more than 60% of the population sought healthcare for diabetes, high blood pressure, muscle and joint pain, or eye injury. Farmworker participants requested more information covering prevention, management, and treatment for these health outcomes. The results of this study will be disseminated to employers of migrant and seasonal farmworkers and health providers to address the gaps in providing preventive education and care to the transient, migrant and seasonal farmworker population.

**Figure B4:** Number of farmworkers seeking care for health conditions, and source of information about the condition. Top occupational health conditions included muscle and/or joint pain and eye injury.
Metagenomics and Staphylococcus aureus colonization in livestock workers
A. Kates (Student), University of Iowa Department of Epidemiology (October 2014-September 2016)

There are approximately 619,000 cattle farms and 73,000 hog farms in the United States. Despite this, there are limited studies assessing the epidemiology of *Staphylococcus aureus* (*S. aureus*) colonization in livestock workers, and no studies have assessed the microbiomes of livestock workers. The aims of this project were to establish the nasal and oropharyngeal bacterial metagenomes of individuals who have contact with livestock in Iowa. In addition, we measured to see if *S. aureus* was present in the homes of livestock workers and compared these results to homes of non-livestock workers.

This study enrolled 59 agricultural workers (33 non-livestock workers and 26 livestock workers; 18 of which work with swine, 11 cattle, 3 poultry, and 6 another animal type). Collection of nasal and oropharyngeal swabs from all participants has been completed. The 16s rRNA sequencing and *spa* typing has also been completed, and data are currently under analysis.

![Figure B5: Scanning electron microscope image of *S. aureus*.](Wiki Commons, CDC/MJ Arduino CRPH, 2000)
Safe Farming, Safe Living, CPR Outreach to the Leut
M. Gale, Avera St. Benedict Health Center (July 2016-March 2017)

The Safe Farming, Safe Living program will present certification-level educational information and outreach to eight Hutterite colonies (100 members per colony) in southeastern South Dakota in order to improve health outcomes of possible farm-related accident or injury. Many of the colonies are 50 miles from the nearest hospital, and response times for ambulances to get to colonies is significant. Classes will be held for colony members who work in the colony agricultural sector, ages 14 and up, and content training will focus on contacting emergency response personnel, cardiopulmonary resuscitation (CPR), automated external defibrillator (AED), and basic first aid. The training will involve verbal instruction and hands-on practice instruction by American Red Cross Certified Instructors from the local area. Evaluation of the program will include Hutterite participant feedback, internal experience, number of individuals obtaining CPR certification, and examination of Emergency Room hospital records to see if the trainings improve health outcomes for this population during traumatic injuries.

Gove County Farm Safety and Health Fairs: ATV Safety, Emergency Response, and Educational Displays to Prevent Agricultural Injury and Fatality in Northwest Kansas
C. Nelson, Gove County Medical Center (July 2016-March 2017)

In Western Kansas, many farmers live 30 or more miles away from a Critical Access Hospital. When an accident occurs, a 911 dispatcher immediately direct emergency personnel to the scene. However, in inclement weather (muddy gravel roads, snow pack/icy conditions), it can take much longer. There is a need to train farm family members in basic first aid skills and for families to have and recognize appropriate first aid supplies. The Gove County Medical Center, Health Department, and Ambulance Service is working with the local Farm Bureau and Kansas State Extension personnel to host a Farm Safety and Health Fair in Gove County, Kansas in March 2017. The purpose of the fair is to a) increase safety awareness among farmers and farm youth about ATV use, handling grain and farm chemicals, and dangers associated with common harvesting activities; and b) increase knowledge about basic first aid/emergency response to help farm families respond quickly and effectively to reduce fatality rates. Evaluation will include participant feedback, surveys, and number of individuals attending the fair.