



Great Plains Center for Agricultural Health 2016-17 Annual Report

September 30th, 2017

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CDC/NIOSH Grant U54 OH007548

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The Great Plains Center for Agricultural Health is located within the Department of Occupational and Environmental Health at the University of Iowa, College of Public Health, at 145 N Riverside Drive in Iowa City, IA, 52246.

SECTION I: CENTER SUMMARY

The Great Plains Center for Agricultural Health and Safety (GPCAH) is a nationally recognized public health resource that develops and implements programs of research, intervention, translation, education, and outreach with the long-term goal of preventing occupational injury and illness among agricultural workers and their families. The Center serves a nine-state region: Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, and Wisconsin. The Center addresses the health and safety needs of agricultural workers in America's most agriculturally intensive region, which has a significant burden of severe agricultural injuries and illnesses compared to other regions and industries. A full list of GPCAH program outputs in 2016-2017 is in Appendix A.

OVERALL GOALS

The overall goals of the GPCAH are to:

1. Serve as a regional and national resource for agricultural health and safety.
2. Conduct relevant and translatable research that provides evidence-based strategies to improve the health and safety of agricultural workers.
3. Develop and evaluate educational, outreach, and intervention programs to prevent disease, injury, and hazardous exposure among agricultural workers and their families.
4. Provide relevant and evidence-based assistance (*e.g.*, methods, training, and interventions) to health and safety professionals and community-based agricultural health organizations to enhance regional expertise to prevent agricultural injuries and illnesses.
5. Maintain and expand networks to promote agricultural health and safety research, training, and prevention programs and to track emerging issues that may put agricultural workers at increased risk of illnesses or injuries.

Our Center includes three research projects aimed at reducing the burden of injury and illness throughout our region and has an outreach core to build the expertise in health and safety throughout the community, for professionals, community advocates, intermediaries, and directly to farmers.

RELEVANCE

Agricultural workers experience high rates of occupational injury (including fatal injury) and illness when compared to other employed groups. As the region's most well-established agricultural health and safety resource in the nation's most agriculturally intensive region, the Center is highly relevant to agricultural workers, physicians, and researchers committed to protecting the health and safety of agricultural workers. We describe relevance for each project and activity in Section III.

SECTION II: KEY PERSONNEL

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Evaluation and Outreach Coordinator: Marsha Cheyney, MPH marsha-cheyney@uiowa.edu

Farm Vehicle Roadway Study Project Leader: Cori Peek-Asa, PhD corinne-peek-asa@uiowa.edu

Air Quality Improvements Project Leader: Matt Nonnenmann, PhD matthew-nonnenmann@uiowa.edu

Surveillance of Injuries and Risk Factors Project Leader: Marizen Ramirez, PhD mramirez@umn.edu

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SECTION III: PROGRAM HIGHLIGHTS AND IMPACT

Planning and Evaluation Core

(T.R. Anthony)

The Planning and Evaluation (P&E) Core comprises ongoing activities that:

- (1) Ensure the efficient and effective management of center *resources*;
- (2) Identify health and safety *needs* throughout the region;
- (3) Coordinate *communication* between Center personnel and advisory committees and stakeholders;
- (4) Develop and implement an evaluation program, and respond to improvement recommendations, to maximize the impact of our programs and projects on agricultural worker protection; and
- (5) Identify and respond to *emerging issues* that threaten the health and safety of agricultural workers throughout the region.

Three high impact outcomes reported here address collaboration between AFF Centers, impact assessment methods for outreach, and efforts to respond to manure gas hazards.

Enhance AFF Evaluation, Communication and Outreach (ECO) Activities and Impact

In 2016-17, the GPCAH Coordinator (Gibbs) organized national AFF Evaluation, Communication and Outreach (ECO) activity meetings. The goal of this group is to enhance the skills of and improve collaboration among the ten NIOSH-funded AFF centers. Dr. Gibbs organized and hosted bi-monthly conference calls, coordinating 2017 training on Alternative Metrics (Feb.), Social Media Analytics (May), Contribution Analysis (June), and Cost Analysis for Evaluation (Aug.). These calls provided a forum to share program methods and expertise among center personnel. Participation included representatives from all AFF centers, averaging 30 participants per call. The GPCAH coordinated the revision of the All-Center AFF Evaluation documents, soliciting input from all AFF centers to use in the June 2017 NIOSH State of the Science meeting (available at: <https://www.public-health.uiowa.edu/gpcah/niosh-state-of-science-2017/>). Additionally, the GPCAH coordinated a survey of all ECO and AFF Center Directors to prioritize topics for a national outreach campaign to which all AFF Centers could contribute. This survey identified heat illness as the top national priority. Finally, the GPCAH participated in all three national campaigns: National Farm Safety and Health Week (September 2016), American Farm Bureau's Ag Safety Awareness Week (March 2017), and the NIOSH/CDC "Beat the Heat" Summer Campaign (June-August 2017, Figure 1). Our Evaluation Coordinator (Cheyney) provided assistance to the evaluation efforts to assess impact of the ECO team efforts across multiple centers and to the assessment of GPCAH impact for these campaigns.



Figure 1: AFF ECO team members at 2017 Minnesota Farm Fest collaborating on the Beat the Heat campaign. From left to right: Karen Thornton (GPCAH), Diane Kampa (UMASH), Marsha Cheyney (GPCAH), Ellen Duysen (CS-CASH), Michelle Paquette (UMASH), and Carol Peterson (UMASH).

Impact Assessments

To assess the impact of these activities on protecting agricultural workers, emphasis throughout year 1 of this project focused on evaluating the reach of these campaign efforts. In the March 2017 campaign, the GPCAH reached more than 4,000 individuals over social media and the AFF Centers' YouTube page experienced a 113% increase in minutes watched and an 84% increase in views. Promotion included sharing a story that focused on manure gas safety (produced by RFD-TV), featuring GPCAH outreach and emerging issue personnel (Leonard). The GPCAH coordinated messages through multiple outlets (newsletters, social media, web page, and farm shows) for the national "Beat the Heat" campaign, reaching more than 3,500 individuals over social media alone. The GPCAH issued a press release for this campaign, which resulted in eight local media outlets or newsletters covering prevention messages. The GPCAH coordinator will examine the impact and effectiveness of this national campaign across all centers in fall 2017.

To assess the impact of Center-level activities performed by the P&E core, the Center solicited external guidance on our social media strategy. In March 2017, we collaborated with the University of Iowa Tippie College of Business marketing program, where we served as a client for a student team's class project. With guidance from this team, we formalized goals: expand the reach of GPCAH, actively share relevant information to target prevention of agricultural injury and illness, and to engage with key stakeholders (other researchers, producers, and safety and health advocates).

The Center adopted specific recommendations, including: leveraging synergy between multiple social media platforms; established both frequency and brevity of posts; and tagging message topics on consistent days of the week (e.g., "Manure Mondays"). These actions have resulted in a doubling of social media followers on Twitter and Facebook over a 10-month periods. From October 2016 to July 2017, the Center has reached more than 60,000 and engaged more than 6,000 individuals on Facebook and Twitter. Materials have been shared via social media more than 300 times-- by farmers, producer groups, safety managers, risk management firms, other NIOSH AFF Centers and extramural programs, as well safety organizations such as the National Ag Safety Database and the National Educational Center for Agricultural Safety.

The most engaging topics among social media followers (Fig. 2) have been incident reports (11% engagement), agrochemicals (9% engagement), and livestock operations/air quality (9% engagement). We identified that Facebook promotions had redirected more than 200 views to the GPCAH website for information about the Agricultural Safety and Health Core Course (Outreach Core), and more than 3,900 individuals to the *Iowa/Illinois/Missouri Farmer Today* magazine website for *Safety Watch* articles authored by GPCAH outreach personnel.

$$\text{Engagement Rate} = \frac{(\text{Number of clicks, shares, comments, etc.})}{(\text{Number reached})} \times 100\%$$

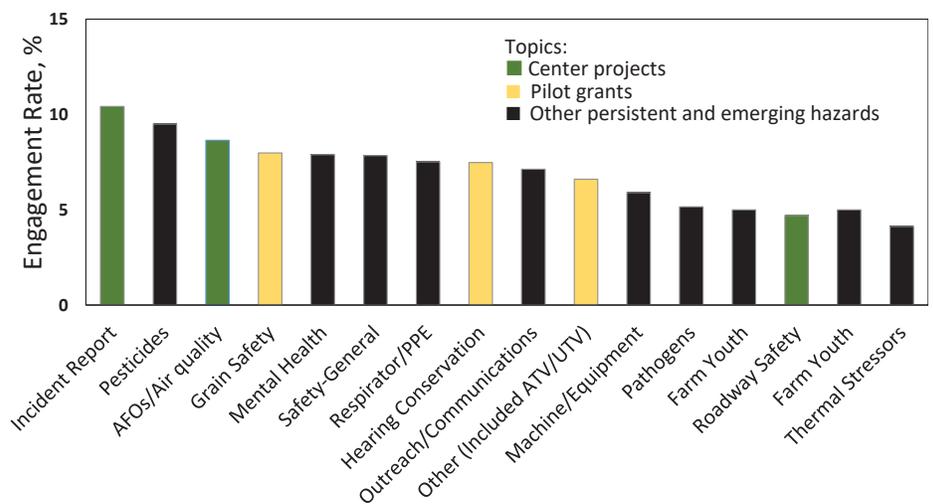


Figure 2: Engagement rates in social media activities, 2016-17

Emerging Issues: Manure Gas

Members of an Eastern Iowa community contacted GPCAH in October 2016 in response to multiple cattle deaths during manure pumping from a deep pit outdoor confinement building. In the same season, multiple cattle deaths occurred in other sites in Iowa, Illinois, and Wisconsin, alerting producers and commercial applicators to the potential for dangerous hydrogen sulfide (H₂S) release from stored liquid manure. A farmer and 16 cattle died during agitation of stored manure at an open lagoon in Wisconsin, the first known fatality in an open manure pit in the region. The GPCAH used its *Emerging Issues* funding to respond to community requests for assistance, gathering information and building partnerships to provide evidence-based recommendations throughout livestock production operations.

First, the Center responded to the Eastern Iowa community by providing personnel and direct-reading monitors to help identify risks to workers. Center personnel conducted monitoring during manure pumping operations and provided personal H₂S monitors for workers to use throughout the season to indicate risks in real time. Within days of the event, members of this local community organized a meeting to discuss manure gas hazards and prevention strategies. Center personnel participated in this meeting, along with a local veterinarian, representatives from Iowa State Extension, and equipment suppliers. We provided attendees with information on the risks of H₂S release and the selection and use of gas monitors to mitigate this risk. Over 80 cattle producers and manure haulers/applicators attended this 2-hour evening event to understand the risks and determine how to prevent future occurrences; approximately 20 participants returned to a follow-up meeting in spring 2017.

Throughout 2016-17, GPCAH provided hands-on education to cattle producers and collaborated with Iowa and Wisconsin extension personnel to inform producers on best practices, including the use of monitoring equipment to protect personnel and livestock. GPCAH personnel authored media articles published in the *Safety Watch* series (see outputs) and to *Iowa Cattlemen*. We provided the following technical guidance and support to farmers and their safety advocates via:

- Live interview for RFD-TV during National Farm Safety Awareness Week (Leonard, March 2017),
- Partnership with Iowa State Extension to provide manure handling safety presentation to approximately 25 workers at the Eastern Iowa Feedlot Conference (August 2017, Welton, IA), and
- Partnered with Wisconsin Extension and the National Farm Medicine Center to present a one-day safety seminar for approximately 12 cattle feeders and commercial applicators (April 2017, Plover, WI).

These activities have led to new partnerships that has enabled the development and dissemination of best practices that incorporate modern production concerns in conjunction with health and safety protection. The GPCAH will revise and make available materials through the web and through partner organizations.



Figure 3: Manure gas monitoring during cattle manure pumping field response.

Instrumented Farm Vehicle Roadway Study (C. Peek-Asa)

Transportation is a leading cause of agricultural death, and crashes with farm equipment contribute to high crash rates among rural roadway drivers. This research study focuses on vehicle interactions with farm equipment that contribute to crashes involving rear-end collisions and passing maneuvers, which comprise the majority of farm equipment crashes. Phase 1 aims to develop and refine a device mounted on the rear of farm equipment that 1) measures farm equipment exposure to the roadway and the frequency with which cars approach the farm equipment and 2) measures the behavior of vehicle drivers as they approach the equipment. During Phase 2, we will implement a farm equipment roadway safety program at the community level.

Development of the data collection device is a collaboration with faculty, staff, and students in the UI College of Public Health, the Department of Electrical Engineering, and the National Advanced Driving Simulator. The device is housed in a rugged, weather resistant case that contains a camera, data processor, GPS, and power supply. Video and data recording is triggered when the vehicle speed exceeds a threshold value that can be customized for each piece of equipment. We completed two design iterations for the device this year, and a third is in progress. Roadway pilot tests with non-farm equipment have been conducted and resulted in good performance. Through cooperation with several partners in the agricultural industry, pilot testing on farm equipment is underway.



Figure 4: Rugged case containing camera, GPS, and power supply mounted to the rear of a grain wagon



Figure 5: Camera view from the device mounted to the rear of a grain wagon as an approaching vehicle prepares to pass the farm equipment

Air Quality Improvements in Livestock Production Buildings (M. Nonnenmann)

Swine workers experience an elevated rate of lung disease, pulmonary symptoms, and decreased pulmonary function compared to workers in other industries. Bioaerosols in swine production contribute to exposure burden and disease transmission among both animals and workers. Our preliminary data demonstrated that two engineering technologies can improve the air quality in a small-scale swine farrowing rooms: a recirculating ventilation system with air filtration technology and a gas-fired heating system that vents to the outside. Modifications using proven disinfection technologies (*e.g.*, ultraviolet light [UVC]) within the ductwork of this system may be effective to reduce the burden of disease in both pigs and workers. Our long-term goal is to develop engineering guidelines for the swine industry that will be adopted by builders and swine producers to reduce occupational exposures, thereby reducing lung disease and infection in this working population. In Aim 1, we will evaluate engineering system effectiveness to improve air quality in commercial operations. In Aim 2, we will optimize bioaerosol control for commercial swine production using filtration and UVC light. In Aim 3, we will evaluate a bioaerosol treatment system on reducing airborne concentrations of bioaerosol in a commercial swine farrowing building. Dust and carbon dioxide engineering intervention systems will be tested in commercial swine farrowing as the bioaerosol engineering intervention system is simultaneously optimized in the laboratory. We expect that this work will result in novel engineering solutions to decrease dust, carbon dioxide and bioaerosol concentrations and subsequently agricultural worker exposure in swine production. This contribution is significant because successful demonstration and adoption of an engineering control would demonstrate a paradigm shift from the current approach to control inhalation hazards.

High impact accomplishments for Year 1 include the recruitment of a large commercial swine farm as a study site. The site includes all aspects of swine production (*i.e.*, gestation, farrowing, nursery and finishing). The site is representative of commercial swine production.

A second accomplishment was completing the baseline contaminant assessments of the test site for dust, carbon dioxide (CO₂) and bioaerosols, necessary to determine if concentrations are sufficient to evaluate the effectiveness of our prototype dust / bioaerosol treatment system. We performed baseline monitoring at a commercial swine farrowing facility (*i.e.*, 360 sows) in the winter of 2016-2017. The monitoring included fixed station and mobile sampling of contaminant concentrations in farrowing rooms. We measured dust, ammonia (NH₃), hydrogen sulfide (H₂S), carbon monoxide (CO), CO₂, and total bacteria (colony forming units-CFUs). Contaminant concentrations of dust and CO₂ were below regulatory and consensus recommendations for occupational exposure limits but exceeded swine industry guidelines, which are set to account for simultaneous exposures to multiple hazards in swine production buildings. These findings were presented at the 2017 American Industrial Hygiene Conference and Exposition (available at <https://www.public-health.uiowa.edu/gpcah/indoor-air-quality/>). Airborne concentrations of total bacteria were above recommended concentrations of 1000 CFU.

The third high impact achievement from Year 1 is the design and development of a prototype dust / bioaerosol treatment system to be deployed at the test site. We collaborated with design partners at the University of Iowa, College of Engineering to build a prototype dust / bioaerosol system. The system is unique as it a combination of filtration and ultraviolet light disinfection (UVC) to remove dust and bioaerosols from farrowing barn air. The system is optimized to treat and return the air in a farrowing room five times per hour, which was found to be effective in previous studies by Drs. Anthony and Peters. The system is designed in an enclosed mobile platform. The design maintains farm biosecurity and allows for easy deployment and maintenance. The prototype mobile system will be completed in October 2017.

Surveillance of Injuries and Risk Factors in Using Worker's Compensation Data (M. Ramirez)

The goal of this project is to improve the science of agricultural injury surveillance through a partnership with Nationwide Insurance. Worker's Compensation claims are subject to underutilization, underreporting, and misclassification. However, it can be a valuable source of data for injury diagnoses, mechanisms, costs, and lost days. This project includes two distinct studies. For Study 1, we will analyze agricultural injuries captured in two overlapping datasets: Iowa's Statewide Trauma System and Nationwide's Iowa-based WC program during a ten-year study period (2005-2015). The aims of the first study are:

- 1a) Estimate the incidence of agricultural injury in Iowa reported through two sources: the Iowa Trauma Registry, and Nationwide Insurance's Worker's Compensation program, and
- 1b) Compare agricultural injuries by severity, type, mechanism and demographics reported by farm operations in the Nationwide WC claims database with those reported in the Iowa Trauma registry.

We will calculate injury incidence in both datasets and compare characteristics of these injuries and the demographics of the injured workers.

For Study 2, we will evaluate a new agricultural hazard surveillance tool to be developed by Nationwide Insurance over the next year. The tool is scheduled to be implemented longitudinally with a cohort of farm operations throughout the U.S. The specific aim for Study 2 is to evaluate the effectiveness of the Agricultural Hazard Surveillance tool in predicting agricultural injuries reported to Nationwide's WC program. This project represents a unique academic-industry partnership, and has promise to improve surveillance of both agricultural injuries and risk factors.

Year 1 administrative outputs include human subjects approval, data sharing agreements (Nationwide and University of Minnesota, and Nationwide and University of Iowa), and access to claims data from Nationwide Insurance. For this project, the research team has established ongoing conference calls (approximately bi-monthly) with Nationwide Insurance collaborators, Mr. Doug Becker, Director of Risk Management Services for Agribusinesses, and George DeGraaf, Director of Risk Management. For the secondary analysis of WC claims data (Study 1), claims data from 2010-2016 were transferred to the research team for preliminary analysis. For the development and evaluation of an agricultural hazard surveillance assessment tool (Study 2), Drs. Ramirez, Casteel, and Gerr collaborated with GPCAH personnel to develop the hazard surveillance assessment tool. This tool is currently being reviewed by Nationwide Insurance for future implementation in approximately 200 farms across the country. We anticipate the tool to be finalized in year 2 of the study.

Preliminary processing of 2010-2016 Nationwide Insurance Claims Data. The team is currently processing 1,066 claims from 662 agricultural policy holders from AR, AZ, GA, IA, IN, KS, MD, MI, MN, MO, MS, NE, NH, NY, PA, SC, SD, TN, TX, VA, and WI. The claims data include information about date of loss, reported date, state, injury type, body part injured, cause of injury, days off work, and expenses paid. The most frequent claim type was medical claims (66.4% of all claims filed), followed by temporary disability (21.7%), permanent disability (11.2%), and death (0.7%). The variables are being cleaned and categorized before progressing to comprehensive data analyses of risk factors and outcomes.

Outreach Core

(B. Janssen, D. Rohlman)

The goals of the Outreach Core are to *educate, translate, and communicate* agricultural safety and health information and prevention strategies to rural and agricultural communities in the nine-state region. The high impact outputs and activities are presented for each of these outreach goals.

Educate: The *Agricultural Safety and Health: Core Course* was offered at the University of Iowa June 12-16. Thirty-three trainees participated, including veterinarians, health care providers, safety professionals, pharmacists, graduate students, and producers. Trainees came from nine U.S. states and from British Columbia, Canada and Entre Rios Province, Argentina. Ricardo Di Carli participated with support from the University of Iowa, College of Public Health Global Initiative and his employer, The National Institute of Agricultural Technology (INTA), which provides extension services to Argentine farmers. The course was also offered in Nebraska, North Carolina, Vermont, and Texas, who trained 58 attendees. Course materials are publicly available at www.gpcah.org/asheducation and have been provided to other AFF centers, community colleges, and agricultural education programs. Online educational modules are being developed using existing course materials as the foundation, but with innovative technology to maintain attendee attention and engagement. Two modules are complete and are under external review (*Occupational Diseases of the Lung in Agricultural Settings, Physical Agents*). The following additional modules are under development: *Introduction to Agricultural Safety and Health, Personal Protective Equipment, Transportation, Skin Disease, Behavioral Health, and Livestock Handling*.

Translate: The Center is translating research findings from current and past projects to communicate best practices to diverse audiences. For example, multi-media materials related to Whole Body Vibration have been developed based on the findings from the 2011-17 “Musculoskeletal Symptoms among Agricultural Workers” project (Fethke). These include a display and handouts (Fig. 6) to present at conferences and farm shows, incorporate into print media stories, and to incorporate into curricula for *Agricultural Safety and Health: The Core Course*. Other translated topics include sun safety / skin cancer prevention, heat illness, and surveillance of agricultural injuries and illnesses.

Outreach specialists from the GPCAH and neighboring Midwest Agricultural Centers – the Central States Center for Agricultural Safety and Health (CS-CASH) and the Upper Midwest Agricultural Safety and Health Center

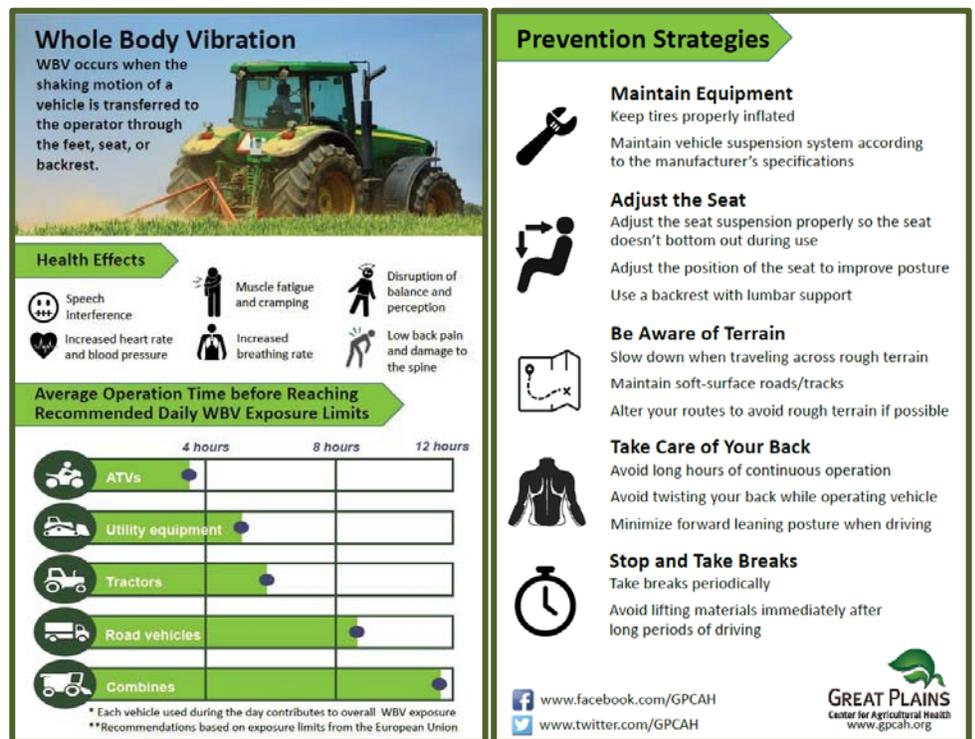


Figure 6: Two-sided card provided to farmers, explaining whole body vibration and its risks and providing tips to minimize the risk of developing low back pain when operating farm vehicles.

(UMASH) - are collaborating on a new translation activity to convey the story of agricultural safety. *Telling the Story (TTS)* creates injury prevention messages to highlight personal stories based on first-hand experiences with agricultural injuries. *Telling the Story's* initial interviews and stories focus on a persistent, under-recognized hazard that continues to claim both human and livestock lives in the Midwest: hydrogen sulfide gas released during agitation or transfer of stored manure. The topic leverages response activities and expertise gained in Emerging Issues investigations (see Planning and Evaluation Core), where GPCAH assisted in responding to a 2016 dairy farmer fatality that occurred near an open-air lagoon. Storytellers include farmers, agricultural workers, and family and community members affected by injuries, fatalities, or close calls. A dedicated website is under development to house multi-media articles that include video interviews, prevention resources, contact and feedback information, and press kits for agricultural communicators, the media, agricultural educators, and employers (see <http://tellingthestoryproject.org/>).

Communicate: GPCAH outreach uses multiple formats to reach the diverse farming population across our nine-state region – traditional newsprint, in-person interactions, and online (stories, fact sheets, posters). In the first year, we have written 12 monthly *Safety Watch* columns, now a standard feature in *Iowa Farmer Today*, *Missouri Farmer Today*, *Illinois Farmer Today*, and *Midwest Marketer*. These weekly publications have a print circulation of 146,900 households and have online presence. Recent *Safety Watch* articles have been the top read articles for this publication group. In addition, CattleSeller.com carries articles that reach 500,000 Midwest producers. Topics have included farming while diabetic, manure gas management, farmer suicides, winter repair hazards, whole body vibration, and general safety for beginning farmers. Outreach personnel have attended nine farm shows and producer conferences, providing educational and prevention messages to farmers and attendees at shows including the Iowa Pork Congress, Minnesota Farm Fest, Western Farm Show (Kansas), and the International Society for Agricultural Safety and Health Conference. The GPCAH has collaborated at outreach events with Nebraska and Minnesota AFF Centers and at the Marshfield Clinic in Wisconsin, with the goal of enhancing the awareness of safety and health as integral to the agricultural industry. In collaboration with Iowa's Center for Agricultural Safety and Health, four issues of *The Farm Families Alive and Well Newsletter* have been generated and distributed, in print and electronically, to over 3000 recipients (available at: <https://www.public-health.uiowa.edu/gpcah/alive-and-well/>). The updated Outreach Core website highlights the depth of resources developed by GPCAH over the past cycles. For example, all fact sheets, handouts, posters, curricula, media, and pilot research devoted to *Hearing Loss Prevention* are available to provide easy access to the full archive of GPCAH products (<https://www.public-health.uiowa.edu/gpcah/outreach-2/topics/>).

APPENDIX A: GPCAH PROGRAM OUTPUTS

(October 2016 through August 2017)

A full list of GPCAH outputs in year 1 are listed below.

Published Manuscripts

1. Anthony TR, Yang AY, Peters TM: [2017] Assessment of Recirculating Ventilation with Dust Control and Heater Replacement to Improve Air Quality in Livestock Buildings. *ASABE, Journal of Agricultural Safety and Health*. (In press)
2. Brumby S, Rudolphi JM, Rohlman DS, Donham KJ: [2017] Translating agricultural health and medicine education across the Pacific: a United States and Australian comparison study. *Journal of Rural and Remote Health*. (In press)
3. Ischer S, Farnell M, Tabler T, O'Shaughnessy P, Nonnenmann MW: [2017] Evaluation of a Sprinkler Cooling System on Inhalable Dust and Ammonia Concentrations in Broiler Chicken Production. *Journal of Occupational and Environmental Hygiene* 14(1): 40-48.
4. Janssen B, Nonnenmann MW: [2017] New Institutional Theory and a Culture of Safety in Agriculture. *Journal of Agromedicine* 22(1): 47-55.
5. Nonnenmann MW, Gimeno DRP, Levin J, Douphrate D, Boggaram V, Schaffer J, Gallagher M, Hornick M, Reynolds S: [2017] Pulmonary function and airway inflammation among dairy parlor workers after exposure to inhalable aerosols. *American Journal of Industrial Medicine* 60(3):255-263.

Abstracts/Presentations Accepted for Scientific Meetings

1. Anthony TR, Peters TM: [2017] Improving Air Quality in Swine Farrowing Operations: Engineering Intervention Results, oral presentation, American Society of Agricultural and Biological Engineers Annual Meeting; Spokane, WA, July 17, 2017.
2. Gibbs J, Faust K, Cheyney M, Ramirez M: [2017] Distributing ASABE Best Practices for Lighting and Marking Farm Equipment: GPCAH Farm Equipment Crash Study Outreach Project, poster presentation, American Society of Agricultural and Biological Engineers Annual Meeting; Spokane, WA, July 17, 2017
3. Anthony TR, Peters TM: [2017] Improving Air Quality in Swine Farrowing Operations: Results of Engineering Interventions, poster presentation, 2017 Expanding Research Partnerships: State of the Science, National Institute of Occupational Safety and Health; Aurora, CO, June 22, 2017.
4. Gibbs J, De Vito C, Anthony TR: [2017] Personal Attenuation Ratings (PAR) of Agricultural Workers: How Well Do Earplugs Really Fit, poster presentation, 2017 Expanding Research Partnerships: State of the Science, National Institute of Occupational Safety and Health; Aurora, CO, June 22, 2017.
5. Gibbs J, Cheyney M, Gerr F: [2017] Self-reported hearing device protection use and noise-induced hearing loss symptoms among 699 Midwestern farmers, oral presentation, International Society for Agricultural Safety and Health Conference, ISASH; Logan UT, June 2017.
6. Rudolphi J, Rohlman D: [2017] Family vs. non-family farms: a comparison of organizational factors and safety policies, poster presentation, International Society for Agricultural Safety and Health Conference, ISASH; Logan, UT, June 2017.
7. Ricchio J, Gibbs J, Anthony TR: [2017] Pesticide drift in the Midwest: Database development for tracking events and contributing factors, poster presentation, American Industrial Hygiene Conference and Exposition, American Industrial Hygiene Association; Seattle, WA, June 7, 2017.
8. De Vito C, Gibbs J, Anthony TR: [2017] Evaluating Personal Attenuation Ratings of Midwest Agricultural and Industrial Workers, poster presentation, American Industrial Hygiene Conference and Exposition, American Industrial Hygiene Association; Seattle, WA, June 7, 2017. (received two awards)

9. Knight K, Anthony T, Peters TM, Altmaier R, Gibbs J, Ramirez A, Nonnenmann M: [2017] Air Quality in Livestock Production Buildings: Developing a Sampling Strategy for Measuring Concentrations of CO₂ and Dust in a Commercial Swine Farrowing Building, poster presentation, American Industrial Hygiene Conference and Exposition, American Industrial Hygiene Association; Seattle, WA, June 7, 2017.
10. De Vito C, Gibbs J, Anthony TR: [2016] Personal Attenuation Ratings of Farmers: How Well Do Earplugs Really Fit? poster presentation, Midwest Rural Agricultural Safety and Health Conference, Great Plains Center for Agricultural Health (GPCAH) and Iowa Center for Agricultural Health and Safety (ICASH); Sioux Center, IA, November 15, 2016.
11. Janssen B, Nonnenmann M: [2016] Perceptions of public health science among broiler chicken growers, a qualitative approach, poster presentation, Midwest Rural Agricultural Safety and Health Conference, Sioux Center, IA, November 15, 2016.
12. De Vito C, Gibbs J, Anthony TR: [2016] Personal Attenuation Ratings of Farmers: How Well Do Earplugs Really Fit? poster presentation, Midwest Rural Agricultural Safety and Health Conference; Sioux Center, IA, November 15, 2016.
13. Scott-Harp D, Johannes A, Janssen B: [2016] Addressing Health and Safety Concerns Regarding Volunteer Labor on Small Farms: Grow Johnson County, poster presentation, Midwest Rural Agricultural Safety and Health Conference; Sioux Center, IA, November 15, 2016.
14. Trenkamp E, Altmaier R, Anthony TR: [2016] Evaluation of Heaters on Air Quality in a Swine Farrowing Barn, poster presentation, Midwest Rural Agricultural Safety and Health Conference; Sioux Center, IA, November 15, 2016.

Lectures or Seminars Delivered in Academic Settings

1. Casteel C: [2017] "Introduction to Injury Epidemiology" lecture given to 8 graduate and undergraduate students in Injury and Violence Prevention course (75 min).
2. Cheyney M: [2017] "Agricultural Injury and Illness Prevention", 60 undergraduate students, Fundamentals of Public Health, University of Iowa, College of Public Health, May 2017 (60 min).
3. Janssen B: [2017] (5.1.17) Food, Farming, and Health. Health Work and the Environment, 24 public health undergraduates, University of Iowa, College of Public Health, May 13, 2017 (50 min).
4. Janssen B: [2017] "Agriculture, Anthropology, and Public Health, Contemporary World Problems," 300 anthropology undergraduates, University of Iowa, College of Public Health, April 13, 2017 (50 min).
5. Janssen B: [2017] "Livestock Handling Safety", Agricultural Medicine Course, 7 graduate students, University of Iowa, College of Public Health, February 27, 2017 (90 min).
6. Anthony T: [2017] "Special Occupations: Agriculture and Construction", Occupational Health, 18 graduate students, University of Iowa, College of Public Health, November 30, 2016 (75 min).
7. Cheyney M: [2016] Agricultural Injury and Illness Prevention, 130 undergraduate students, Fundamentals of Public Health, University of Iowa, December 2016.

Workshops, Seminars, Lectures Conducted by GPCAH Personnel in the Agricultural Community

1. Agricultural Safety and Health Core Course, June 12-16, 2017, Iowa City, IA. The 40-hour course completed by 33 attendees. Instruction provided by multiple GPCAH faculty and staff along with regional advisors (Sheridan, Neenan) and veterinary expertise from Iowa State (Bickett-Weddle).
2. Midwest Rural Agricultural Safety and Health (MRASH) Conference: *Safeguarding Farm Livelihoods*. Sioux Center, IA, November 15-16, 2017. Attended by 55 participants from 7 states and an additional 20 undergraduate agriculture students from nearby Dordt College. Evaluation summary available at <https://www.public-health.uiowa.edu/gpcah/mrash/>
3. Cheyney, M: [2017] "Safety signs" presented to:

100 students, K-6 grades, at NECAS Ag Safety Day, July 2017,
120 students, K-6 grades, at NECAS Ag Safety Day, June 2017,
254 students, K-6 grades, at Poweshiek County Ag Safety Day, April 2017, and
100 students, K-6 grades, at Garrison Ag Safety Day, April 2017.

4. Gibbs JL, Cheyney M: [2017] "Social Media Analytics in Agriculture." Zoom Meeting, University of Iowa College of Public Health. May 17th, 2017. [36 attendees]

Consultation or Information Exchange

1. Gibbs J: [2017] AFF Center Evaluation, Prepared by the NIOSH AFF Center Evaluation, Communications, and Outreach Group, presented at the NIOSH State of the Science Conference, Denver, CO, June 2017.
2. Anthony TR: [2017] GPCAH: Pit Gases and Testing Equipment, Presented to the Ag Cooperative Safety Directors of Iowa Quarterly Meeting, Story City, IA. March 15, 2017. (Community requested presentation).
3. Gibbs J, Leinenkugel K: [2017] analyzed survey data and prepared Farmer's Coffee Corner Survey Results for the Iowa Department of Public Health farmer feedback survey at 2016 Farm Progress Show.
4. Gibbs J: [2017] Data analysis assistance requested by Iowa Department of Public Health. January 2017.
5. Gibbs J: [2017] Adaptive Telephone Equipment for Farmers with Hearing Loss, Sprint Accessibility. (Director contacted us for research results and advice on outreach).
6. Gibbs J: [2017] Request for materials in Spanish language and training on noise induced hearing loss and use of Hearing Protection Devices (HPD) for medical staff and medical aides at Proteus clinics.
7. Leonard S: [2017] Cattle feeders and commercial manure applicators safety seminar, in partnership with University of WI Extension and National Farm Medicine Center, Plover, WI; April 2017
8. Leonard S: [2017] Manure gas hazard follow up. Community meeting with 20 producers and manure handlers, Andover, IA; March 2017.
9. Leonard S: [2016] Manure gas hazards / Response to cattle fatalities. Community meeting with 80 cattle producers and manure handlers, Andover, IA; October 2016.

Information Provided to Policy Makers

1. Anthony TR: [2017] Discussions with Floyd County, IA supervisor on recommendations to change the county's Master Matrix (scoring system for approval for livestock confinement operation siting); provided letter of support with documentation on health and safety impact of including three manure management practices. (April 3, 2017)
2. Leonard S: [2017] Discussions with Floyd County, IA supervisor on recommendations on manure management safety recommendations to be incorporated into a proposed revision to the County Master Matrix. (March 2017)

Student Thesis/Dissertation

1. Beswick- Honn J: [2017] Evaluation of low-cost H₂S monitors for agricultural use, M.S. Thesis, University of Iowa.
2. Dausman T: [2017] Low-cost monitors in agriculture, M.S. Thesis, University of Iowa.
3. DeVito C: [2017] Hearing protection fit assessment using personal attenuation rating measures for agricultural and manufacturing workers, M.S. Thesis, University of Iowa.

Press Releases and Media Stories

News Releases and Columns

1. [Farmer's Ordeal Began with an ATV Rollover](#), Stephanie Leonard, *Iowa Farmer Today*, September 2017
2. [Long Hours May Have Hidden Consequences](#), Brandi Janssen, *Iowa Farmer Today*, August 2017

3. [Simple Mistake Means Shortcut to ER](#), Stephanie Leonard, *Iowa Farmer Today*, July 2017
4. [Expect the Unexpected When Handling Livestock](#), Brandi Janssen, *Iowa Farmer Today*, June 2017
5. [Safe Travel Means Busting Some Myths](#), Stephanie Leonard, *Iowa Farmer Today*, May 2017
6. [Standard Expands Respiratory Protection](#), Brandi Janssen, *Iowa Farmer Today*, April 2017
7. [Plan Now for Safe Manure Handling](#), Stephanie Leonard, *Iowa Farmer Today*, March 2017
8. [Small Steps Affect Beginning Farmers' Safety](#), Brandi Janssen, *Iowa Farmer Today*, February 2017
9. [Winter Repair Work Presents Stability Risks](#), Stephanie Leonard, *Iowa Farmer Today*, January 2017
10. [Suicide Rate among Farmers at Historic High](#), Brandi Janssen, *Iowa Farmer Today*, December 2016
11. [Producers Respond to H2S Deaths](#), Stephanie Leonard, *Iowa Farmer Today*, November 2016
12. [Safety Watch: Farming with Diabetes Requires Balancing Act](#), Brandi Janssen, *Iowa Farmer Today*, October 2016.

Media Stories following Beat the Heat Press Release

Gibbs JL: [2017] Heat illness can be deadly. With education and preparedness, you can save lives. Press Release, June 5, 2017. Regional press following the release included:

1. KTTN News Radio, June 17, 2017 (Trenton, MO) – Agriculture workers 20 Times more likely to die from the heat (link no longer accessible).
2. Democrat Newspaper June 21st, 2017 (Columbia, MO) – Ag workers at high risk of heat illness http://dailyjournalonline.com/democrat-news/news/ag-workers-at-high-risk-of-heat-illnesses/article_cebac9fb-9410-5858-9071-ba4b661e039c.html
3. KMOX CBS News, June 12th 2017 (St. Louis, MO) – Mobile App Measures Risk of Heat Related Illness <http://stlouis.cbslocal.com/2017/06/12/mobile-app-measures-risk-of-heat-related-illness/>
4. Newsleader Newspaper July 22nd, 2017 (Springfield, MO) – Ag workers at high risk of heat illness and skin cancer <http://www.news-leader.com/story/news/business/2017/07/22/ag-workers-high-risk-heat-illness-and-skin-cancer/491927001/>
5. Waukon Standard, July 23, 2017 (Allamakee County, IA) – Safety tips to help agricultural workers beat the heat this summer <https://www.waukonstandard.com/articles/2014/07/23/safety-tips-help-agricultural-workers-beat-heat-summer>
6. Ag Notes for Newspress Now July 18, 2017 (St. Joseph, MO) – http://www.newspressnow.com/news/business/ag-notes-for-july/article_0c63a8d8-a0b9-5daf-ba9f-82ce6519890f.html
7. Newsletter: Agricultural Safety and Health Council of America (ASHCA) Safety Lines Newsletter– June 2017, Heat Illness Awareness.
8. Newsletter: Heemstra J: [2017] eXtension Newsletter Round-Up, July 2017

Media Stories following Ag Safety Awareness Program Press Release

Gibbs JL: [2017] Explore your safe space during Ag Safety Awareness Program Week, March 5-11. Regional press following the release included:

1. Smith R: [2017] “The importance of agriculture safety awareness in Missouri”, March 3rd, 2017. Buffalo Reflex (Buffalo, MO).
2. Leonard S: [2017] “Manure Gas Safety.” Interview with S. Leonard from the University of Iowa. March 11th, 2017. RFD-TV.

Additional Media Stories with GPCAH Collaboration

1. WNAX Radio 570 AM, October 2016. Farmer Suicides. www.wnax.com.
2. “The importance of agriculture safety awareness in Missouri.”, March 3rd, 2017. R Smith. Buffalo

Reflex. Buffalo, MO.

3. "Manure Gas Safety." Interview with S. Leonard from the University of Iowa. March 11th, 2017. RFD-TV.
4. Des Moines Register, April 2017. Rural Roadway Safety. Des Moines, IA.
5. "Iowa: Operating Agricultural Equipment May Have Hidden Physical Consequences for Farmers". ASPPH Member Research and Reports. Nathan Fethke, Aug 24, 2017.