

A. COVER PAGE

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B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Goal 1: Serve as a regional and national resource for agricultural health and safety.

Goal 2: Conduct relevant and translatable research that provides evidence-based strategies to improve the health and safety of agricultural workers.

Goal 3: Develop and evaluate educational, outreach, and intervention programs to prevent disease, injury, and hazardous exposure among agricultural workers and their families.

Goal 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.

Goal 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.

B.2. What did you accomplish under these goals?

MAJOR ACTIVITIES

The Great Plains Center for Agricultural Health (GPCAH) has demonstrated continued growth and impact throughout this project period (2016-2021+). The Center served our traditional nine-state region (IA, IL, KS, MN, MO, NE, ND, SD, WI), and reached out to IN and OH, currently unserved by NIOSH Ag Centers. Our research investigators were located at the University of Iowa and the University of Minnesota, and our engaged advisory committees, with representatives from every state we serve, provided regular feedback on our activities and products.

The structure of the Center in this project period had three cores. The Planning & Evaluation Core administered and evaluated all Center activities. The Outreach Core served to educate, translate, and communicate agricultural safety and health information across the region. The Research Core conducted studies that (1) investigated risk factors of roadway crashes between ag equipment and non-farming vehicles, (2) developed and evaluated the effectiveness of a new filtration and UV disinfection aimed to improve air quality in livestock operations, and (3) evaluated existing data sets and a new safety checklist to improve our understanding of farm injury surveillance. Beginning in 2017, we were also funded to include a pilot/feasibility project program in our Research Core, which funded 16 projects focused on a diverse range of short-term but impactful projects. The P&E Core also coordinated activities and projects to respond to timely hazards and concerns in the region, using *emerging issues* funds. These short-term projects included responses to manure gas hazards, pesticide drift analysis, mental health awareness, and COVID-19 response and communication.

The Great Plains Center for Agricultural Health activities answered important questions to help protect farm workers in our region, including at-risk driving behaviors, technology development to improve livestock air quality, and limitations and benefits of existing surveillance data sets to improve our understanding of hazards and their impacts. A multi-component needs assessment identified (1) the burden of injuries and, with surveillance data, the costs of these injuries; (2) hazards that are both significant sources of injury and that farmers are concerned about, increasing the likelihood of farmer engagement and adoption of solutions; and (3) healthcare provider concerns regarding their farming patients. Our research projects proposed in our new funding request were selected to close data gaps needed to identify best practices to protect farmers while increasing the likelihood of uptake and impact upon completion of these research projects. Our activities across all Cores – research, pilot grant, outreach, and evaluation and planning – demonstrate our success in designing, implementing, evaluating, and translating evidence-based practices throughout the region and beyond, impacting the health, safety, and well-being of our region's farmers. Our experienced and interdisciplinary team is committed to continuing to generate new knowledge and dissemination of best practices. Our record of research that addresses important hazards associated with our region of intensive

commodity production and of cross-core collaborations among the Center and with partners across the region demonstrate our ability to successfully perform the research to improve the health and safety of farmers across our region.

KEY FINDINGS AND ACHIEVEMENTS

Our key findings and achievements across the Center are organized into (1) Surveillance Findings, (2) GPCAH Partnerships, (3) Key Developments from Research, and (4) Outreach and Best Practice for Translation.

1. Surveillance Findings: Our systematic approach to gathering center-level data on injury risks, stressors, and health & safety needs have provided a comprehensive assessment of hazards that farmers and advocates that allowed the development of priority areas to focus on throughout the region (Goals 2, 3, 4). Below highlights key outcomes.

Farmer Survey: The Center conducted a formal survey to understand the perceived needs of and current stressors felt by our region's farmers. This survey, coordinated by the Evaluation team in 2018, with input from regional advisors and Center personnel, was used to examine whether needs identified by farmers changed since the previous funding cycle. The previous 2014 top "farmer needs," identified from farmer surveys at regional farm shows, were dominated by concerns about machine/ equipment/ tractor safety (67% of respondents), hearing protection (34%), chemical (28%) and dust (11%) hazards, and livestock safety (19%) [from top three concerns; does not sum to 100]. In 2018, a formal process using both mailed and in-person surveys identified shifting priority topics, the top four being chemical hazards (42%), equipment/tools (42%), health outcomes (36%), and general farm safety (26%). Tractor safety dropped from the top concern to number 6 (17%), indicating shifting priorities and new opportunities to build farmer support for a broader range of hazards they face. A new question was included in the 2018 survey to identify "stressors" that are important to farmers, and financial, weather, and workload / management were the top three categories reported. The survey also identified family / relationship concerns affecting farmers as an important additional factor. Information learned about stressors from this survey was shared across mental health networks in 2019, when economic pressures began to affect the profitability of farms and regional mental health concerns became a national concern. Information from the needs assessment survey were communicated to the scientific community [*Journal of Agricultural Safety and Health*, 26(1):45-58] and to a variety of stakeholders through our media and advisory committee channels to reach those involved in protecting farmers and rural communities.

Rural Healthcare Provider Survey: The Center also conducted a survey of healthcare providers (HCPs) to assess what they perceive as the needs of their farmer patients along with questions on what content and format we could share to help them improve communications with their farming patients. The COVID pandemic interrupted this mailed survey, but responses from 72 rural HCPs in IA, OH, and MO were received and analyzed. Responses to open-ended questions were categorized, and HCPs reported that they considered that musculoskeletal (38%) and mental health (24%) conditions were *most likely to affect a farmer's ability to farm* and that musculoskeletal (47%) followed by "acute" injuries (32%, including 7% lacerations, 6% sprains/strains, and 3% foreign body in the eye) were the *most common injuries* that HCPs were *treating* farmer patients. Preferred modes of education were shared with the Outreach Core to develop dissemination plans to optimize the way we reach HCPs, for which responses ranged from providing periodic updates of emerging issues (57%) and receiving printed materials (54%) to attending training courses (26%).

Injury Surveillance: In addition to the studies performed by the *Surveillance* project, the P&E Core also examined traumatic injury data from Iowa Trauma Registry (ITR), a database coordinated by the Iowa Department of Public Health, which includes a single identifier that indicates the injured patient was "Farmer." Data from 2014-17 yielded 1981 farmer/on farm injury cases, which were examined to identify causes and outcomes of these traumatic injuries resulting in seeking emergency medical care. *Falls* accounted for 22% of traumatic injuries, and the number of falls increased with farmer age. Transportation events accounted for another 20% of all injuries, which were dominated by non-traffic (189) and animal

riding (106) events. Results from this trauma registry data analysis were presented at the 2019 joint meeting of the Midwest Rural Agriculture Safety and Health (MRASH) and the Iowa Rural Health Association. Results were also shared with Regional Advisors (Sept 2019), which includes CS-CASH (Nebraska AgFF Center) and UMASH (MN AgFF Center) and were summarized in the March 2020 *Alive and Well* newsletter. A complete report is available online. Information from this report was shared with other public health groups, such as the Iowa Injury and Violence Prevention Advisory Committee, which brought attention to needed fall prevention intervention efforts for agricultural exposures in addition to the regional emphasis on elderly falls in the home.

Integration of the above Findings into Center Activities: As components of the needs assessment were generated, findings were communicated to all project investigators. The Outreach Core used this information to identify priority topics to include in educational material revisions and development for the Core Course and for the development of outreach brochures, posters, and toolkits for dissemination. The Pilot /Feasibility program adjusted its priority topics used in proposal requests in 2018 (mental health, chemical safety), 2019 (slips, trip/fall prevention), and 2020 (machine safety) to address the region's needs. These priority topics have also been integrated into research project proposal concepts for the next funding cycle.

2. GPCAH Partnerships: To meet our mission of protecting the health and safety of our region's farmworkers, a robust collaborative network was needed. We worked with intermediary organizations that are trusted by farmers to provide information directly to their farming constituents, critical to expand our reach to farmers across the region and invited members to participate in center and project advisory activities to guide our work and to improve the diffusion of best practices into agricultural practices. (Goals 2, 3, 4, 5)

The Center established advisory committees at the regional level (regional advisory committee [**RAC**]) and national level (external advisory committee [**EAC**]). Our **RAC** members have provided feedback on outreach materials, which improved content messaging and format, and identified priority train-the-trainer toolkit topics for our development to assist their organizations in conducting outreach on new topics. They also provided reviews on both structure and content of the roadway safety, gas monitor safety, and hearing protection outreach kits, suggesting we: include both *overview* and *in-depth* guidance, spell out instructions for how outreach personnel could use the materials provided, and develop *scripts* to guide others to how to structure field demonstrations on the topics in our kits. The **RAC** has provided ongoing feedback of our work products to ensure they are culturally, linguistically, and educationally appropriate for the diverse audiences that they serve, to streamline RAC member adoption of these products. The RAC also guided strategic activities, including needs assessments, provided input to project investigators, and identified critical hazards developing in the regions/populations they serve. The **EAC** provided technical support, introduced national and international emerging issues, and provided feedback on project performance and new directions throughout the project period. We have successfully replaced half of our EAC with new, vibrant membership over this project period.

Research Projects included members of relevant intermediary groups in key roles. The *Air Quality* project relied on producers and educators for access to deploy and assess the performance of new engineering controls, and progress is shared with the National Pork Board as well as county-level organizations to maintain interest and support for the technological solutions being developed. The *Surveillance* project had support from Nationwide Insurance to share workers' compensation data; although the company determined that they would be unable to deploy the safety checklist at their client farms in support of this project's Aim 2, they continued to provide feedback on the tool under development and continue their support of the concept. Agreements with the Iowa Department of Public Health and with the Iowa Department of Labor to access traumatic injury data and state-level workers' compensation data, respectively, was essential to the work of the surveillance project. The *Roadway team* engaged local community leaders to develop and deploy the roadway safety campaign, incorporating local banks, businesses, insurance agents, local FFA members, and the local high school in the promotional campaigns to protect everyone on the road.

NIOSH/CDC Funded Centers The Great Plains Center for Agricultural Health has partnered with other CDC/NIOSH centers funded at the University of Iowa [Healthier Workforce Center (HWC), Heartland ERC, and Injury Prevention Research Center] and nationally [the National Children's Center for Rural and Agricultural Health and Safety (NCCRAHS)] and with the other Ag Centers. This has allowed us to engage in conferences and other joint activities that support the missions and promote the goals of multiple centers. Collaborations across other NIOSH Ag Centers were facilitated through active involvement in the ECO (Evaluators, Coordinators and Outreach) group as well as NORA initiative activities. Details of activities and their impacts are briefly highlighted here:

- GPCAH ECO members participated in national *Awareness* campaigns, including the annual Farm Bureau Ag Safety Awareness Week (March) and the National Farm Health and Safety Week (September) events.
- The GPCAH coordinated the development and dissemination of media kits for the 2018 Beat the Heat campaign and for the 2019 Mental Health Month activities, hosting all AgFF center products.
- Center *Outreach* and *Evaluation* efforts have contributed to the U.S. AgCenter YouTube channel, providing formal technical reviews for educational videos and analyzing the impact of this channel, which resulted in two publications (channel development; time-series analysis).
- GPCAH investigators contributed to NORA working groups formed around mental health, the aging farmer, and COVID vaccination hesitancy.
- Investigators participated in AgFF working group on injury surveillance, including NIOSH gap analysis on ag surveillance in response to National Academies recommendation to improve NIOSH surveillance program for AgFF.

Development of New Investigators Connections with other regional occupational health and safety centers informs and facilitates training opportunities within GPCAH projects, allowing our Center to provide agricultural safety and health education to trainees across multiple disciplines. Over this project period, 19 undergraduate students (primarily in public health and engineering) have participated in project activities including equipment design and testing, creating outreach materials, and evaluating impacts. In this same period, 44 graduate students and four postdocs have also participated in Center projects, which provided them with opportunities to develop practical skills in their programs of study (e.g., biostatistics, community & behavioral health, education psychology, engineering, epidemiology, geographic information system mapping, industrial hygiene, and injury prevention) while increasing regional understanding of hazards facing agricultural workers. Several former trainees are now conducting research in the field, a few of which are highlighted here:

- Dr. Sousan is an Assistant Professor and Research Faculty at the North Carolina Agromedicine Institute at Easter Carolina University (*Air Quality* project)
- Dr. Baidwan is a PostDoc at the University of Alabama at Birmingham's Lakeshore Research Collaborative (*Surveillance* project)
- Dr. Rudolphi is an Assistant Professor at the University of Illinois Urbana-Champaign in the Agricultural & Biological Engineering Department and directs the Agricultural Safety and Health program for the Great Lakes ERC (*Outreach Core*)
- Dr. Missikpode is now a postdoctoral research associate at the University of Illinois Department of Medicine (*Roadway* project)
- Dr. Maya Ramaswamy is now a Health Scientist with the Emergency Response and Recovery Branch with the CDC, after starting as an EIS Officer in Anchorage in 2018 (*Pilot* recipient, 2015-6)

Additional Collaborations Participation in events with external organizations have been essential to establishing networks for dissemination and building partnerships to evaluate the effectiveness of translated information. Examples are briefly detailed:

- Co-sponsorship and participation in the annual Midwest Rural and Agricultural Safety and Health (MRASH) conference provides a forum to bring together collaborators across the region to progress and threats to farmer health and safety. Staff from Nebraska (CS-CASH) and Minnesota (UMASH) worked alongside our Center staff and I-CASH staff on the planning committee, bringing their regional partners to the table.

- Coordinating presentations with our neighboring NIOSH centers (CS-CASH, UMASH) at “health and safety tents” at events targeting farmers (e.g., FarmFest; Farm Progress Show), has magnified the presence of safety advocacy at these events. High-demand topics for our Center presenters has led to the development of Outreach Tool Kits (Outreach Core) to allow others to provide similar training (e.g., Ag Safety and Health Alliance [AgHSA] presentations used GPCAH gas monitor tools at pesticide applicator conferences), extending our reach.
- Additional long-term collaborations with the AgHSA provide a direct conduit to educate students in agricultural programs, where curricula now include Center materials. Our Center Evaluators aided development of surveys for these educational programs and collaborated with AgHSA in preparation of manuscripts to communicate lessons learned from their *Gear up for Safety* training for younger ag workers (e.g., *Safety*, 2021, 7(2):44, open access).
- Co-sponsor of *Pesticides and Public Health* meeting (May 2018), gathering 34 researchers, educators and public health professionals for a holistic discussion on collaborations, information needs, and dissemination networks (*Emerging Issues*), building relationships with pesticide applicator trainers.
- Manure gas roundtable at the National Pork Board producers’ meeting (*Emerging Issues*, Oct. 2018)
- Connections with the local Crisis Center (with national hotline contracts) resulted in Center staff providing in-service training for crisis counselor volunteers, with limited rural/farming experiences, to better understand rural farmer stressors who may be seeking assistance (2019 in-service training; materials provided to sustain future information exchanges).

Thus, partnerships across projects and cores have been developed and nurtured to provide skills development, leadership, and increased capacity to address local, regional, and national agricultural hazards. The collaborative approach across the region has contributed to improved knowledge, sharing of tools, and adoption of educational programs, which has helped a wide range of partners enhance the sustainability of outreach efforts throughout this project period.

3. Key Developments from Research: Over this project period, the Great Plains Center for Agricultural Health has conducted 3 projects in the Research Core and supported 16 *Pilot* projects and 5 *Emerging Issues* projects. The *Emerging Issues program* (P&E Core, Anthony) performed short-term research to answer urgent questions during the project period, including those associated with (1) hydrogen sulfide fatality prevention during manure handling, (2) patterns and communicating risks associated with pesticide application and its drift in the Midwest, (3) farmer mental health, (4) COVID response, and (5) avian influenza and respiratory protection preparedness. Key contributions for the formal Research Core activities are identified as follows, referencing the previous key *2008 NORA AF goals*, which were targets at the start of the project period. (GPCAH Goals 2, 5)

The *Roadway* project (PI: Peek-Asa, Hamann) developed, modified, and deployed a new *SaferTrek* device to collect information on behaviors of vehicle operators interacting with ag machines on roadways. They also developed a community campaign, with the assistance of a community advisory group, to reduce collisions with farm vehicles in one rural community. This work developed new methods to collect information on roadway interactions, miles driven, etc. to help analyze roadway risks and has generated videos to use in future outreach efforts to inform communities of risky behaviors, which can be integrated into future campaigns. The study focused on the NORA Goals to reduce the number and rate of fatal and non-fatal injuries in production agriculture involving field and farmstead equipment (NORA 2008 AF goals #4.3, 4.5), particularly by using information from the data collection activities to facilitate the development of public awareness campaigns to reduce the high priority injuries associated with farm vehicle crashes (NORA action step #3.3.3). New technology was developed and validated to quantify algorithms for parameter extraction including vehicle detection (98.5%) and passenger distances necessary to extract driving behaviors. Community campaigns identified a 9% increase in safety messages.

The *Air Quality* project (PI: Nonnenmann) developed custom units to reduce exposures to dust and infectious agents in swine production buildings. Prototypes were deployed outside production rooms, designed to minimize production interference during the development and testing stages of this research, which built on initial studies in the previous funding period. For this work, both lab (dosing efficiency studies;

virus aerosolization; viral characterization method development, including viability from air samples) and field activities (2 winters at farrowing production operations with intervention/control rooms; 2 winters at finishing research operation) were undertaken to develop bacterial and viral disinfection protocols and to optimize field sampling protocols. Findings demonstrated effectiveness of controls and optimal dosing regimens, but *smaller units suitable for integration into production buildings are needed* for this technology to be adopted by producers. Outreach has identified willing communities to participate in future field studies, critical to moving toward adoption by producers. This research focused on facility and equipment design to reduce employee exposure to respiratory disease-causing agents (NORA action step #5.2.2), with the long-term goal of reducing illness and disease due to environmental and infectious exposures in agriculture (NORA goal #5.4).

The *Surveillance* project (PI: Ramirez, Casteel) has used data from company workers' compensation claims (Nationwide data for agricultural operations, 2010-16) to identify the cost of injury claims and severity of outcomes across 14 states (GPCAH region plus AR, GA, PA, IN, MD), providing evidence for cost of injury by type (falling/flying objects and collisions were the *most expensive* and the *most common* causes of compensable injury claims). The team has identified the limited linkage between trauma records (hospital visit) and workers' compensation claims, indicating the need to *use multiple data sets* to understand the full range of injury outcomes for workers on the farm. This team also developed and deployed a primary data collection tool to examine the relationship between observable risk factors on the farm and injury outcomes, as identified by farm managers. Studies identified gaps in individual surveillance data sources used for ag surveillance (NORA action #1.2.10) and examined strategies to improve surveillance by creating new partnerships with industry and examined a new surveillance system (NORA #1.1.10, 1.1.13).

The Pilot/Feasibility Program (PI: Gerr, Fethke) received 69 pilot grant applications (34 academic-track, 35 community-track), many of which supported the NORA goal to identify practical and proven occupational safety and health interventions and encouraging new studies where proven strategies do not exist (NORA goal #3.2). Many proposals *submitted* focused on mental health (37%), safety (23%), and chemical hazards (19%), and seven focused specifically on vulnerable populations. Panels scored projects, and 16 were funded (9 academic-track, 7 community-track). Most applications received focused on mental health (37%), safety (23%), and chemical hazards (19%), and seven applications focused specifically on vulnerable agricultural populations. Many funded pilot projects examined mental health, with topics including opioid overdose prevention, the effectiveness of a text messaging intervention, development of a mental health farm podcast, using state surveillance to develop risk metrics, examining the effect of cooperatives in reducing mental health stressors, and leveraging data from the National Violent Death Reporting System to examine differences in suicide rates across farming, forestry, and fishing occupations. One project targeting vulnerable workers (H-2A visa holders in Ohio) was funded. Over this project period, pilot grant activities have resulted in 14 peer-reviewed publications. Of the nine academic-track pilot grant awardees, four were to junior faculty (IL, IA, MN) and two were to graduate (IA, OH) and one to undergraduate (IN) students. The program also supported one mid-career faculty with no prior history of ASH-related research (Michigan State University) and one state epidemiologist (Minnesota Department of Health).

4. Outreach and Best-Practice Translation: The Outreach Core worked closely with all Center investigators to translate research into practice, to communicate and disseminate evidence-based practices and resources through multiple communication channels to speed implementation and adoption, and to enhance educational opportunities for farmers and the communities that serve them. (Goals 3, 4, 5)

The cornerstone of the Outreach Core was the training program, now called the *Agricultural Safety and Health Core Course*. It has been offered annually at the University of Iowa (home institution) and with partners offering it in Nebraska, North Carolina, Vermont, and Texas. New partnerships have formed after visiting faculty attended the course: new partners who adopted the *Core Course* content have include the pharmacy program at the University of Missouri (Kansas City, MO) and at Dalhousie University (Nova Scotia, Canada). Faculty at Dordt University (Sioux Center, IA) are adopting course materials for their students. Course materials used for classes (live and virtual) are available as PowerPoint for use by *any* agricultural instructors. Throughout this project period, *asynchronous self-directed course content* was

developed, with assessment materials integrated (pre, post, and throughout the sessions) for nine topics, available through a training portal.

In addition to *Core Course* activities and related educational products, the Outreach Core, often in conjunction with the P&E Core, was engaged in multiple activities to translate and communicate results from research efforts to share information directly with farmers and organizations that serve them. A few impactful products include:

- *Telling the Story*, a collaboration between our Center and UMASH (MN), CS-CASH (NE), the National Children's Center (WI) was developed and promoted this project period. The web site was developed and maintained by our Center, and many of the 11 investigations used as stories on this site were conducted by GPCAH staff, S. Leonard.
- Monthly *Safety Watch* articles were written for and published by Lee Agri-Media throughout the project period sharing timely stories of hazards and prevention (72 articles).
- Press releases and engagement with the media on GPCAH research and outreach activities resulted in 265 media stories covering Center outputs.
- Best-practice materials were developed in Spanish, now hosted on our website (<https://gpcah.public-health.uiowa.edu/recursos-en-espanol/>), where independent reviews for language and agricultural appropriateness were coordinated with multiple partners.
- Center investigators/staff disseminated and translated findings by publishing 56 peer-reviewed publications, making 116 presentations at professional meetings, and providing 203 lectures, seminars, or workshops related to agricultural health and safety.
- Engaging electronic platforms to share information via newsletters (*Alive and Well*, 1512 subscribers) and social media (642 Facebook followers, 370 Twitter followers). The website (gpcah.org) had switched host platforms during the project period, and routine revisions were made to organize outreach and educational materials, using insights and feedback from advisors.
- Developed an innovative *FarmSafe* podcast during the pandemic to examine new ways of reaching farmers. The format was designed to present the voices and perspectives of both farmers and topic experts across the region. This project period produced 23 bi-weekly episodes in Season 1, starting in Aug. 2021, which aired 5 hours & 48 minutes of first-hand stories and real-life tips for making safer and healthier decisions on the farm. Season 2 kicked off during the 2022 Farm Progress show in late Aug. 2022 with new hosts. In this first season, we reached listeners in 42 U.S. states and 20 countries.

ROBUST AND UNBIASED RESULTS

The research projects conducted in the GPCAH are designed and implemented to ensure robust and unbiased results. To ensure that communications and recommendations from **the P&E Core** were robust and unbiased, methods used to generate work products were reviewed by topic-expert specialists (Internal Advisory Committee and Center Affiliates) and were reviewed by those familiar with farming operations (Regional Advisory Committee [RAC]). In addition, materials shared with external stakeholders first involved principal investigators and subject-matter experts (advisors) to confirm the scientific accuracy of translated results and clarity of messaging. This multi-tiered approach ensures that recommendations are both scientifically robust and culturally and linguistically appropriate to the broader audiences targeted for these outreach materials. Farmer needs assessment surveys were piloted prior to deploying, and response rates examined throughout the multi-month mailing cycle to ensure response targets were met, by each state targeted, while tracking mailing/incentive costs. The center research resulted in 41 peer-reviewed scientific papers across this project period. Finally, information on emerging issues were prioritized by collecting information on: 1) the number of requests for technical assistance that GPCAH faculty and staff receive pertaining to the issue, 2) formal tracking of priority health and safety concerns via surveys (web, farm shows), and 3) routine communications with Center advisory committees.

The **Roadway** project developed procedures that review, code, and analyze the data from the *SaferTrek* devices were standardized and documented to promote accuracy and consistency between the individuals completing the work and over time as the project continues through two more growing seasons. Data visualization was a key tool in this effort and has resulted in discoveries leading to improvements in data

processing and accuracy. The team has finalized objective measurements to validate the data output by the video image processing algorithms.

The **Air Quality** project collected field samples and data in both the intervention room and a matched control room in some study periods, and Quality Assurance / Quality Control procedures were used throughout its experimental process, with all participants trained in standard operating procedures to prepare, deploy, retrieve, and post-process field samples.

The **Surveillance** project provided robust analytical models, accounted for within-policy correlations and states in the Nationwide Insurance data analysis. Methods to address underreporting of agricultural injuries have expanded the search for farm-related injuries by including both self-identified data (done in the Iowa Trauma Registry) and examining high-probability ICD codes with a narrative inspection to rule out/in additional cases. The robustness of the data-linking efforts includes deterministic and probabilistic linkages, with sensitivity analysis. For the field study, the team demonstrated high inter-rater reliability: weighted kappas = 0.86 – 0.94 for categories within the safety assessment checklist.

The **Pilot/Feasibility Program** relies on a formal review process to evaluate the scientific merit of submitted proposals, with feedback given to all applicants, including those not funded. Mentoring to review and guide applicants is available prior to submission to enhance the scientific merit, and ongoing communications with pilot grantees is formalized to ensure robust and unbiased results in these studies. The process includes many formal review procedures, including assessments of the responsiveness of pilot grant submissions, incorporating multiple peer-reviews in scoring, and thorough examinations of conflicts of interest—to ensure fiduciary responsibility of pilot grant funds.

Finally, the **Outreach Core** solicits both internal and external reviews of materials generated for the 40-hour *Core Course* and for outreach. Content is reviewed internally by personnel with health and safety expertise, followed by external reviews by individuals with relevant content expertise. Narrative messages, particularly in *Telling the Story* and *Safety Watch*, have combined qualitative interviews and story-telling methods with proven intervention messages to address the hypothesis that behaviors and outcomes can improve with a humanized approach to prevention messaging. Formal evaluations of these narratives will examine the successfulness of this approach. Outreach materials developed for farmers and advocates undergo internal and external reviews (RAC, experts in other NIOSH AFF centers, and subject-matter experts); and at shows, information is collected on whether displays/materials are effective, which can trigger revisions before wider distribution of materials (e.g., on the web).

B.3. Competitive Revisions/Administrative Supplements

None

B.4. What opportunities for training and professional development did the project provide?

STUDENT TRAINING

While this Center does not serve the mission of training and providing professional development for Center personnel, 19 undergraduate students, 44 graduate students, and four post-docs have provided time and expertise to several activities within the GPCAH over this six-year project period.

P&E Core: Graduate students include Jessica Ricchio (MS, IH). Amy Kopale (Geography), Divya Bhagianadh (PhD, Health Management and Policy), and Emma Samellie (MS, IH). During the COVID pandemic, starting in 2020, the following students participated in ongoing activities in the P&E Core: Jessica Ralphs (MPH), undergraduate public health students (Paige Grissinger, Breanna Haak, John Young), and post-doc Dr. Kate Crawford.

Roadway Project: Undergraduates in engineering (Griffith, Milroy, Nwakama, Tank, Wheeler, Wu) and public health (Eckles) and graduate students in public health (Bash-Brooks, Conrad, Daly, Faust, McCoy,

McDonald) at the University of Iowa had participated in this project. Two doctoral students from Iowa State University (Ketabchi Haghigat, Arabi) contributed to video data processing activities during this study.

Air Quality Project: Seven undergraduate students (Barlow, Celozzi, Li, Meador, Nonnenmann, Perez, Wolf) and 10 graduate students (Adamu, Anderson, Irfan, Knight, Clark, Liles, Harris, Meador, Strandberg, Wei) participated in field and lab experiences conducted to accomplish this project. In addition, two post-doctoral fellows (Sousan, Eubeda) were supported to conduct field and laboratory activities essential to this project.

Surveillance Project: Four graduate students (Baidwan, Moskowitz) from the University of Minnesota and 5 graduate students (Boonstra, Estes, Faust, Jackson, Soupene) from the University of Iowa participated in surveillance activities.

Pilot/Feasibility Project: Four students were directly involved in pilot grant funding, either as a principal investigator (Kapur, undergrad; Kline, doctoral; Liang, doctoral) or using pilot studies as a component of their graduate thesis/dissertation (Shrestha, doctoral) during this project period.

Outreach Core: Undergraduate students (Grissinger) and graduate students (Bentley, Morley, Morrison, Proctor, Ralphs, Rudolphi, Soupene, Thornton) students and a post-doc (Crawford) participated in some aspect of outreach activities during this project period.

PROFESSIONAL DEVELOPMENT FOR GPCAH INVESTIGATORS

Center investigators and staff often attended multiple training events throughout the year, including attending MRASH, ASHCA, and ASABE conferences to stay updated on agricultural and safety and health innovations. In addition, staff have compiled and presented results of Center-wide impact and emerging issues topics at conferences and at regional meetings, including pesticide drift (Pesticides and Public Health, American Industrial Hygiene Conference and Exposition, ISASH, MRASH, Practical Farmers of Iowa) and social media strategy for agricultural health and safety (ISASH, MRASH), mental health (P.E.O. International, United Methodist Church mental health community partnership), and on manure gas exposures and monitors (National Pork Board producers meeting), among others. The ISASH Conference provides opportunities for improving professional skills and knowledge in addition to sharing information about research and intervention programs. To stay current during the evolving COVID-19 pandemic, staff members attended multiple COVID-related webinars presented by various organizations throughout the pandemic. These included webinars from: the CDC; National Academies of Science, Engineering, and Medicine; the American College of Medical Toxicology; and the American Industrial Hygiene Association.

INDIVIDUAL DEVELOPMENT PLANS AT UI'S COLLEGE OF PUBLIC HEALTH

Beginning in 2019, formal Individual Development Plans (IDPs) were developed by graduate research assistants in conjunction with their academic advisors, following structure developed by the NIOSH Heartland ERC (<https://www.youtube.com/watch?v=W0k4TPucZXo>). Plans were reviewed between students and advisor both prior to summer conferences and prior to the last semester of coursework.

B.5. How did you disseminate the results to communities of interest?

Key dissemination methods for results of research and outreach efforts across the GPCAH are provided here.

Website: We have had over 118,000 page views of our web site over this project. The GPCAH.org website was updated throughout the project period, each time improving the ease of access to materials, with input provided by our regional advisory committees. Outreach materials were organized for easy access on the Resources tab and educational materials (information on live and online courses) were contained in an *Education* tab. Updates to research projects, including pilot grant awardees, were made to help investigators share information to their research partners and investigators interested in their topic.

Social Media Platforms: A social media communications strategy (Facebook, Twitter, and YouTube) was developed and followed to disseminate findings and share information to followers. At the end of this project period, GPCAH has 639 Facebook followers and 372 Twitter followers, which increased steadily by ~50 each year. Since 2019, we have tracked over 134,000 views of posts on Facebook and over 178,000 on Twitter. We engage followers with Center-generated material and with relevant materials, media, or events generated by others.

National Collaborations: The *P&E Core* participated in annual ag safety initiatives, including the Farm Bureau Ag Safety Awareness Weeks every March and the National Farm Health and Safety Weeks every September. We provide resources aligned with focused daily topics for other centers to share in Media Kits while also promoting these events to the media and coordinating interviews. We also participated in ad-hoc promotional campaigns, including the summer 2018 Beat the Heat campaign (developed template press releases), compiled and hosted resources for Mental Health Month (May 2019), and participated in developing innovative materials for COVID-19 guidance as part of the U.S. AgFF Centers' effort to disseminate information about the updated CDC guidelines in 2020.

MRASH Conference: The *P&E Core* provided staff to help plan and evaluate MRASH conferences; we also provided sponsorship to offset the meeting costs to minimize registration fees for participants. Throughout this project period, registration ranged from 55 to 132 attendees, with attendees coming from 7 (2016) to 20 (2021) states and an expanding collaborative role for our neighboring AgFF centers. Attendance increased in 2020 and 2021, during virtual meetings, where we also increased international participation. MRASH typically provided 16 hours of education, including updates on research and outreach projects relevant to improving the safety and health of our region's farmers. We also hosted workshops in conjunction with MRASH in attempts to build technical capabilities in the rural communities where we meet. This included a community safety day event (Sioux Center, 2016) and a virtual training on the Surveillance team's safety checklist app (Zoom, 2021). These events have also supported pilot projects, including ammonia safety education (Neenan, Council Bluffs, 2018) and hosting a farm bill meeting that incorporated suicide prevention education (Brown, Marshalltown, 2019).

Press Releases: The *P&E Core* prepared 23 press releases over the project period (3 in Y1; 5 in Y2, 3 in Y3, 6 in Y4, 4 in Y5, and 2 in Y6) to promote upcoming events and to share information on important publications published by GPCAH investigators, including pilot grant awardees. These are archived in our News page (<https://gpcah.public-health.uiowa.edu/news-archive/>). Examples of impactful press releases include: Dr. Arora's findings of increased rates of dementia in ag workers (2021: picked up by local news affiliates, radio, and print media); Dr. Fethke's publication on whole-body vibration (2018: 6 print, four interviews, and University video promotion); and Dr. Ramirez's study relating alcohol impairment and on-road farm crash injuries (2017: 10 stories); and the multi-Center press release on *Telling the Story* (2018: tied to ISASH promotion, coverage by 11 media).

In addition, *P&E Core* staff have compiled and presented results of Center-wide impact and emerging issues topics at conferences and at regional meetings, including pesticide drift (Pesticides and Public Health, American Industrial Hygiene Conference and Exposition, ISASH, MRASH, Practical Farmers of Iowa) and social media strategy for agricultural health and safety (ISASH, MRASH), mental health (P.E.O. International, United Methodist Church), and on manure gas exposures and monitors (National Pork Board producers meeting). We also presented at the request of the Livestock and Poultry Environmental Learning Community (May 15, 2020 webinar) (103 participants, archived at <https://lpehc.org/human-health-pathogens-and-contaminants-in-livestock-systems/>).

FarmSafe Podcast: In 2020, the *P&E Core* used some of the unspent resources during the COVID pandemic to develop and deploy a new podcast as an additional means of disseminating safety and health best practices. The first episode had a soft opening in August 2021, with a short introduction episode, and released new episodes every other week through July 2022 for a 23-episode Season 1. As of the end of this project period, episodes have been downloaded 1000 times in 214 cities across 42 states and 19 countries.

While the first year was a slow growth period, the interest in both audience and guests motivated additional commitments to continuing the podcast as an Outreach activity in the future.

Emerging Issues were investigated and shared with relevant communities, four of which are highlighted here. Manure gas fatality interventions began by responding to community requests in 2016-17, then translating questions on monitor selection and performance into research investigations about Pit Gases and Testing Equipment to 20 safety and health managers at swine production companies at the National Pork Board Safety Roundtable (2018), and outreach kits were developed and evaluated at local businesses and shared with educators at ISASH (2019). Community concerns regarding pesticide drifts led us to reach out to state investigators, developing a database, and generating [story maps](#) to share both drift data and prevention messages. Mental health responses began at the community level, with partnership with faith-based leaders of the community and expanded to educating crisis center volunteers about farming stressors (from regional surveys), and sponsoring QPR training for MRASH attendees. Surveys asking farmers about their use of respirators (FFRs, elastomeric) and fit-testing performance at farm shows has identified a gap to be addressed.

Professional Conferences: Investigators have shared research findings at professional conferences via presentations and posters. These include meetings at traditional agricultural engineering / safety and health meetings (ASABE, ISASH, MRASH), national injury meetings (Safe States Injury and Violence Prevention Conference, Society for the Advancement of Violence and Injury Research Conference, NOIRS), and other professional conferences related to health and safety (International Society of Environment Epidemiology, Symposium to Advance Total Worker Health conference, American Industrial Hygiene Conference and Exhibition), to name a few.

Farm Shows and Other Events: Direct interactions with farmers at shows occurred throughout the project period, including attending virtual events throughout the pandemic. We partner with other ag centers at the Farm Progress Show, Minnesota FarmFest, and the Western Farm Show, presenting resources in safety tents. We expanded to reach new connections by presenting and displaying at the ASHCA Safety Summit, National FFA Convention, and National Association of County Ag Agents. New participation at the Ohio Farm Science Review, at Women, Land and Legacy meeting, and at Iowa Corn Growers association provided new connections to discuss resources to help farmers and safety advocates. Throughout this project period, we attended a range of outreach events to reach farmers directly, including farm shows (21), conferences (21), agricultural safety days (17), and additional local events (3).

Print: The Center also communicates directly with farmers via traditional media outlets. Twelve monthly articles per year were prepared for Lee Agrimedia, reaching ~150,000 households, communicating information on risks and prevention on multiple topics, including COVID-19 focuses (vaccinations, stress management, preventing the spread) and others persistent hazards and prevention messages, with guidance on youth safety, respiratory protection, first aid, and rural crash prevention, to name a few. These stories are compiled at <https://gpcah.public-health.uiowa.edu/safety-watch-2-2/> in addition to being available via multiple publisher platforms. Four issues of the Center's Alive and Well Newsletter were distributed to farm families and other agricultural safety and health stakeholders annually, sharing information on activities and key findings from GPCAH and from neighboring AgFF centers (<https://gpcah.public-health.uiowa.edu/alive-and-well/>).

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

Not Applicable

C. PRODUCTS

C.1. Publications, conference papers, and presentations

In our Overall section, we are only compiling the Center's list of peer-reviewed publications that were generated through activities conducted by GPCAH personnel as related to the projects funded. See specific Core/Project reports for details of other product categories.

2016

Jennissen CA, Harland KK, Denning GM: [2016] Characteristics of side-by-side vehicle crashes and related injuries as determined using newspaper reports from nine US states. *Safety*. Apr. 2(2):10. PMID: PMC9380433 (<https://doi.org/10.3390/safety2020010>) [2012 Pilot Grant] (not reported previously)

2017

Anthony TR, Yang AY, Peters TM. [2017] Assessment of interventions to improve air quality in a livestock building. *Journal of Agricultural Safety and Health*. Nov 2017, 23(4):247-263. PMID: [PMC5704995](#) DOI: [10.13031/jash.12426](https://doi.org/10.13031/jash.12426) [2011-16 Air Quality Project]

Anthony TR, Cai C, Mehaffy J, Sleeth D, Volckens J. [2017] Performance of prototype high-flow inhalable dust sampler in a livestock production facility. *Journal of Occupational and Environmental Hygiene*. May 2017, 14(5):313-322. PMID: PMC5503137 DOI: [10.1080/15459624.2016.1240872](https://doi.org/10.1080/15459624.2016.1240872) [2011-16 Air Quality Project]

Beswick-Honn J, Peters T, Anthony T. [2017] Evaluation of low-cost hydrogen sulfide monitors for use in livestock production. *Journal of Agricultural Safety and Health*, 23(4): 265-279. PMID: PMC5704997 DOI: [10.13031/jash.12530](https://doi.org/10.13031/jash.12530) [Emerging Issues]

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*. 17(1):3931. PMC6987961 DOI: [10.22605/rrh3931](https://doi.org/10.22605/rrh3931) [Outreach]

Douphrate D, Gimeno D, Nonnenmann MW, Hagevoort R, Reynolds S, Rodriguez A, Fethke N. [2017] Effects of milking unit design on upper extremity muscle activity during attachment among U.S. large-herd parlor workers. *Applied Ergonomics*. Jan 2017, 58:482-490. PMID: PMC7008452 DOI: [10.1016/j.apergo.2016.08.008](https://doi.org/10.1016/j.apergo.2016.08.008) [2011-16 Ergonomic project]

Janssen B, Nonnenmann, M. [2017] New institutional theory and a culture of safety in agriculture. *Journal of Agromedicine*. 2017, 22(1): 47-55. PMID: PMC5763477 DOI: [10.1080/1059924X.2016.1249444](https://doi.org/10.1080/1059924X.2016.1249444) [Outreach]

Schneberger D, DeVasure JM, Baily KL, Romberger DJ, Wyatt TA. [2017] Effect of low-level CO2 on innate inflammatory protein response to organic dust from swine confinement barns. *Journal of Occupational Medicine and Toxicology*. 12(9). PMID: PMC5366145 DOI: [10.1186/s12995-017-0155-8](https://doi.org/10.1186/s12995-017-0155-8) [2013 Pilot Grant]

TePoel M, Rohlman DS, Shaw M. [2017] The impact of work demand and gender on occupational and psychosocial stress in Hispanic farmworkers. *Journal of Agricultural Safety and Health*. Apr 2017, 23(2): 109-123. PMID: PMC6094363 DOI: [10.13031/jash.11753](https://doi.org/10.13031/jash.11753) [Outreach]

Toussaint M, Faust K, Peek-Asa C, Ramirez M. [2017] Characteristics of farm equipment-related crashes associated with injury in children and adolescents on farm equipment. *The Journal of Rural Health*. Apr 2017, 33(2):127-134. PMID: PMC8367094 DOI: [10.1111/jrh.12162](https://doi.org/10.1111/jrh.12162) [2011-16 Surveillance]

2018

Fethke NB, Schall MC, Merlino LA, Chen H, Branch CA, Ramaswamy M. [2018] Whole-body vibration and trunk posture during operation of agricultural machinery. *Annals of Work Exposures and Health*. 2018, 62(9): 1123-1133. PMID: PMC8328096 DOI: [10.1093/annweh/wxy076](https://doi.org/10.1093/annweh/wxy076) [2011-16 Ergonomics Project]

Harland KK, Bedford R, Wu H, Ramirez M. [2018] Prevalence of alcohol impairment and odds of a driver injury or fatality in on-road farm equipment crashes. *Traffic Injury Prevention*. Apr 2018, 19(3):230-234. PMID: PMC7034777 DOI: [10.1080/15389588.2017.1407924](https://doi.org/10.1080/15389588.2017.1407924) [2011-16 Surveillance]

<p>Khan KM, Evans SS, Bielko SL, Rohlman DS. [2018] Efficacy of technology-based interventions to increase the use of hearing protections among adolescent farmworkers. <i>International Journal of Audiology</i>. Feb 2018, 57(2):124-124. PMID: PMC6987960 DOI: 10.1080/14992027.2017.1374568 [2013 Pilot Grant]</p>
<p>Nordgren TM, Charavaryamath C. [2018] Agriculture occupational exposures and factors affecting health effects. <i>Curr Allergy Asthma Rep</i>. 18(12):65. PMID: PMC6644660 (https://doi.org/10.1007/s11882-018-0820-8) [2017 Pilot Grant]</p>
<p>Ringgenberg W, Peek-Asa C, Donham K, Ramirez M. [2018] Trends and characteristics of occupational suicide and homicide in farmers and agriculture workers, 1992-2010. <i>The Journal of Rural Health</i>. Jun 2018, 34(3): 246-253. PMID: PMC7069527 DOI: 10.1111/jrh.12245 [2011-16 Surveillance]</p>
<p>Rudolphi JM, Campo S, Gerr F, Rohlman DS. [2018] Social and individual influences on tractor operating practices of young adult agricultural workers. <i>The Journal of Adolescent Health</i>. May 2018, 62(5):605-611. PMID: PMC8189782 DOI: 10.1016/j.jadohealth.2017.11.300 [2014 Pilot Grant]</p>
<p>Shutske JM, Schaefer D, Larson R, Erb K, Skjolaas C, Leonard S, Nelson J, Binversie E, Rifleman S. [2018] Investigation of a worker death while agitating manure in a non-enclosed storage. <i>Journal of Agromedicine</i>. 2018, 23(1):10-19. DOI: https://doi.org/10.1080/1059924X.2017.1397076 [Emerging Issues]</p>
<p>2019</p>
<p>Bhat SM, Massey N, Karriker LA, Singh B, Charavaryamath C. [2019] Ethyl pyruvate reduces organic dust-induced airway inflammation by targeting HMGB1-RAGE signaling. <i>Respir Res</i>. 20(1):1-19. PMID: PMC6364446 (https://doi.org/10.1186/s12931-019-0992-3) [2017 Pilot Grant]</p>
<p>Donham KJ, Meppelink SM, Kelly KM, Rohlman DS: [2019] Health indicators of a cohort of Midwest Dairy Farmers: Health outcomes of participants in the Certified Safe Farm Program. <i>Journal of Agromedicine</i>, 24(3):228-238. PMID: 30849293. DOI: https://doi.org/10.1080/1059924x.2019.1591316 [Outreach Core]</p>
<p>Kates AE, Dalman M, Torner JC, et al. [2019] The nasal and oropharyngeal microbiomes of healthy livestock workers. <i>Plos One</i>. 14(3):e0212949. PMID: PMC6413945 (https://doi.org/10.1371/journal.pone.0212949). [2014 Pilot Grant]</p>
<p>Missikpode C, Peek-Asa C, Wright B, Ramirez M. [2019] Characteristics of agricultural and occupational injuries by workers' compensation and other payer sources. <i>American Journal of Industrial Medicine</i>. 2019; 62(11): 969-977. PMID: PMC6944284 DOI: 10.1002/ajim.23040 [2011-16 Roadway Project]</p>
<p>Massey N, Puttachary S, Bhat S, et al. [2019] HMGB1-RAGE signaling plays a role in organic dust-induced microglial activation and neuroinflammation. <i>Tox Sci</i>. 169(2):579-592. PMID: PMC6542342 (https://doi.org/10.1093/toxsci/kfz071) [2017 Pilot Grant]</p>
<p>Scott-Harp D, Peek-Asa C, Rohlman DS, Janssen B: [2019] More than time and money: A mixed-methods study of the barriers to safer cattle handling practices. <i>American Journal of Industrial Medicine</i>, 62(11):978-985. PMID: PMC7069494. DOI: https://doi.org/10.1002/ajim.23043 [Outreach Core]</p>
<p>2020</p>
<p>Arora K, Cheyney M, Gerr FE, Bhagianadh D, Gibbs J, Anthony TR. [2020] Assessing Health and Safety Needs and Psychological Stressors among Agricultural Workers in the Midwest. <i>J Ag Safe Health</i>. Nov 6. 26(1):45-58. PMID: PMC7250162 DOI: 10.13031/jash.13660 [P&E Core]</p>
<p>Fethke NB, Schall Jr MC, Chen H, Branch CA, Merlino LA. [2021] Biomechanical factors during common agricultural activities: Results of on-farm exposure assessments using direct measurement methods. <i>Journal of Occupational and Environmental Hygiene</i>. 2021; 17(2-3): 85-96. PMID: PMC8256625 DOI: 10.1080/15459624.2020.1717502 [2011-16 Ergonomics Project]</p>
<p>Swanton A, Peek-Asa C, Torner J. [2020] Time to definitive care among severely injured farmers compared to other work-related injuries in a Midwestern state. <i>Injury Epidemiology</i>. 2020; 7(33) PMID: PMC7329543 DOI: 10.1186/s40621-020-00259-w [2011-16 Surveillance Project]</p>

2021

Arora K, Xu L, Bhagianadh D. [2021] Dementia and Cognitive Decline in Older Adulthood: Are Agricultural Workers at Greater Risk? *J Gerontology: Series B*. Sept 13. PMID: PMC8849525 DOI: [10.1093/geronb/gbab005](https://doi.org/10.1093/geronb/gbab005) [P&E Core]

Baidwan NK, Ramirez MR, Gerr F, Boonstra D, Cavanaugh JE, Casteel C.[2021] Cost, Severity and Prevalence of Agricultural-Related Injury Workers' Compensation Claims in Farming Operations from 14 U.S. States. *International Journal of Environmental Research and Public Health*. 2021; 18(8):4309. DOI: [10.1016/j.scitotenv.2021.149245](https://doi.org/10.1016/j.scitotenv.2021.149245) [Surveillance Project]

Berman JD, Ramirez MR, Bell JE, Bilotta R, Gerr F, Fethke NB. [2021] The association between drought conditions and increased occupational psychosocial stress among U.S. farmers: An occupational cohort study. *Sci Total Environ*. 2021 Dec 1;798:149245 DOI: [10.1016/j.scitotenv.2021.149245](https://doi.org/10.1016/j.scitotenv.2021.149245) [2019 Pilot Grant]

Beseler CL, Crawford KJ, Charlier DE, Ramos AK: [2021] The NIOSH Agricultural Centers' YouTube Channel: Time Series Modeling of Viewership of Agricultural Health and Safety Videos. *J Agromedicine*. 27(4):368-377. PMID: PMC9072590. DOI: <https://doi.org/10.1080/1059924X.2021.2000907> [P&E Core]

Bhat SM, Shrestha D, Massey N, Karriker LA, Kanthasamy AG, Charavaryamath C. [2021] Organic dust exposure induces stress response and mitochondrial dysfunction in monocytic cells. *Histochem Cell Biol*.155(6):699-718. PMID: PMC8195852 DOI: (<https://doi.org/10.1007/s00418-021-01978-x>) [2017 Pilot Grant]

Gibbs JL, Walls K, Sheridan C, Sullivan D, Cheyney M, Janssen B, Rohlman DS.[2021] Evaluation of Self-Reported Agricultural Tasks, Safety Concerns, and Health and Safety Behaviors of Young Adults in U.S. Collegiate Agricultural Programs. *Safety*. 2021; 7(2): 44 PMID: [PMC8455168](https://pubmed.ncbi.nlm.nih.gov/3445168/) . DOI: [10.3390/safety7020044](https://doi.org/10.3390/safety7020044) [Outreach Core]

Hamann C, Daly E, Schwab-Reese L, Askelson N, Peek-Asa C. [2021] Community engagement in the development and implementation of a rural road safety campaign: Steps and lessons learned, *Journal of Transport & Health*, 23: 101282. PMID:9348780 DOI: [10.3390/safety7020044](https://doi.org/10.3390/safety7020044) [Roadway Project]

Liang Y, Wang K, Janssen B, Casteel C, Nonnenmann M, Rohlman DS. [2021]. Examination of symptoms of depression among cooperative dairy farmers. *Int J Environ Res Public Health*. 8(7):3657. PMID: PMC8037613 (<https://doi.org/10.3390/ijerph18073657>) [2020 Pilot Grant]

Massey N, Shrestha D, Bhat SM, Kondru N, Charli A, Karriker LA, Kanthasamy AG, Charavaryamath C. [2021] Organic dust-induced mitochondrial dysfunction could be targeted via cGAS-STING or cytoplasmic NOX-2 inhibition using microglial cells and brain slice culture models. *Cell Tissue Res*. 384(2):465-486. PMID: PMC8154696 DOI: [10.1007/s00441-021-03422-x](https://doi.org/10.1007/s00441-021-03422-x) [2017 Pilot Grant]

McFalls M, Ramirez M, Harland K, Zhu M, Morris N, Hamann C, Peek-Asa C. [2021] Farm vehicle crashes on public roads: Analysis of farm-level factors. *J Rural Health*. 2021 Sept.38:537-545. PMID: NA, Open Access at DOI: [10.1111/jrh.12621](https://doi.org/10.1111/jrh.12621) [2011-16 Roadway Project]

Shrestha D, Bhat SM, Massey N, Maldonado CS, Rumbelha WK, Charavaryamath C. [2021] Pre-exposure to hydrogen sulfide modulates the innate inflammatory response to organic dust. *Cell Tissue Res*. PMID: 33409657 DOI: [10.1007/s00441-020-03333-3](https://doi.org/10.1007/s00441-020-03333-3) [2017 Pilot Grant]

Wickman A, Duysen E, Cheyney M, Pennington W, Mazur J, Yoder A. [2021] Development of an educational YouTube channel: A collaboration between U.S. Agricultural Safety and Health Centers. *J Agromedicine*. 26(1):75-84. PMID: PMC8117175 DOI: [10.1080/1059924X.2020.1845269](https://doi.org/10.1080/1059924X.2020.1845269) [P&E Core/Outreach Core]

2022

Aribi S, Sharma A, Reyes M, Hamann, C Peek-Asa C. [2022] Farm Vehicle Following Distance Estimation Using Deep Learning and Monocular Camera Images. *Sensors*. 22(7): 2736. PMID:9003299 DOI: [10.3390/s22072736](https://doi.org/10.3390/s22072736) [Roadway Project]

Faust K, Casteel C, Gerr F, Cavanaugh JE, Boonstra DE, Anthony TR, Soupene VA, Ramirez MR. [2022] Development of a Checklist to Identify Injury Hazards on Row Crop Farms in the Midwestern United States. *Journal of Agricultural Safety and Health* (in press, <https://doi.org/10.13031/jash.15269>) [Surveillance Project]

Liang Y, Casteel C, Janssen B, Wang K, Rohlman DS. [In press] Organizational resources and social support influences on stress and depression: A comparison among cooperative and non-cooperative farmers. *Journal of Agromedicine* (in press, <https://doi.org/10.1080/1059924X.2022.2134243>) [2020 Pilot Grant]

C.2. Website(s) or other Internet site(s) – include URL(s)

See core/project reports for detailed products.

<https://gpcah.public-health.uiowa.edu>

Main web site for GPCAH

C.3. Technologies or techniques

See project / core specific pages for details

C.4. Inventions, patent applications, and/or licenses

Nothing to report

C.5. Other products and resource sharing

See project / core specific pages for details

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/ K	Name	Degrees(s)	Role	Cal	Ac a	Su m	Forg n	Component
RANTHONY	Y	Anthony, T. Renee	PhD	Center Director	2.6			N	ADMIN /AIRQUAL
	N	Altmaier, Ralph	MS	Research Associate	2.0			N	AIRQUAL
KAARORA	Y	Arora, Kanika	PhD	Center Evaluator	1.7			N	ADMIN
MBENTLEY1	N	Bentley, Matison	MS	Student Hourly	1.5			N	OUTREACH
DEBOONSTRA	N	Boonstra, Daniel	MS	GRA	6.0			N	SURVEILLAN CE
CCASTEEL	Y	Casteel, Carri	PhD	Project PI	1.0			N	SURVEILLAN CE
CAVANAUGHJ	Y	Cavanaugh , Joseph	PhD	Biostatistica n	1.1			N	SURVEILLAN CE / ROADWAY
	N	Cheyney, Marsha		Center Evaluation	12			N	ADMIN / OUTREACH
KJLEONARD	N	Crawford, Kathryn	PhD	Postdoc	10			N	ADMIN / PILOT
DAVISJONATHA NA	N	Davis, Jonathan	PhD	Pilot Project PI	2.0			N	PILOT
	N	Dusil, Ryan		Research Assoc	6.5			N	ROADWAY
FETHKE	Y	Fethke, Nathan	PhD	Center Deputy Director	2.0			N	ADMIN / PILOT
GHHANBARI	N	Ghanbari, Amir		GRA	9.9			N	ROADWAY
ESMEGIBSON	N	Gibson, Esme		Undergradu ate student	1.0			N	ROADWAY
CARAHAMANN	Y	Hamann, Cara	PhD	Project PI	3.1			N	ROADWAY
HULSCHER	N	Hulscher, Kyle		Undergradu ate student	2.8			N	ROADWAY
EALTISER	N	Klingner, Ericka		Admin Services Coordinator	0.6			N	OUTREACH
LEONARDSA	N	Leonard, Stephanie	MS		2.2			N	OUTREACH
	N	Mohling, Lisa Kay		Outreach Coordinator	4.3			N	OUTREACH
Lchriste1	N	Morrison, LaShelle		GRA	11			N	OUTREACH
MNONNENMAN N	Y	Nonnenma nn, Matthew	PhD	Project PI / Co- Investigator	4.8			N	AIRQUAL / OUTREACH
	N	Patterson, Jennifer		Core Coordinator	7.2			N	ADMIN

Aproctor	N	Proctor, Anna		GRA	1			N	ADMIN
MLRIES	N	Reyes, Michelle		Project Coordinator	4.5			N	ROADWAY
ROHLMAND	Y	Rohlman, Diane		Outreach Core Director	1			N	OUTREACH
Mchugh	N	Sickels Sterbenz, Mindy		Center Fiscal Administrator	1.8			N	ADMIN
ESMAELIE	N	Smaelie, Emma		GRA	2.0			N	ADMIN
ESTAPLET	N	Stapleton, Emma		Research Assistant	5.3			N	AIRQUAL
EUBEDA	N	Ubeda, Ericka		Research Scientist	2.4			N	AIRQUAL
JWWACHOWSKI	N	Wachowski, Jonathan		Undergraduate Student	1.8			N	AIRQUAL
MIXWEI	N	Wei, Michelle		GRA	11.6			N	AIRQUAL
LZHANG115	N	Zhang, Ling		GRA	0.9			N	PILOT

D.2 Personnel updates

- a. Level of Effort: No
- b. New Senior/Key Personnel: No
- c. Changes in Other Support: No
- d. New Other Significant Contributors: No

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

Nothing to report

E.2 - What is the impact on physical, institutional, or information resources that form infrastructure.

Not applicable

F. CHANGES

F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures

Nothing to report

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

Nothing to report

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

Nothing to report

G. Special Reporting Requirements**G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements**

Nothing to report

G.2 Responsible Conduct of Research

Nothing to report

G.3 Mentor's Research Report or Sponsor Comments

Nothing to report

G.4 Human Subjects

G.4.a Does the project involve human subjects?

Yes. The only projects that had enrollment for human subjects were pilot grant awarded projects, specifically these four, totaling 753 subjects.

- Y3: Growing resiliency in tough times (GRITT) (Holstrom, PI) – Enrolled 133
- Y5: Examining the role of agricultural cooperatives in protecting farmers' mental health (Liang, PI) – Enrolled 95 women, 212 men
- Y5: Preventing workplace injury in pig production systems: applying behavior change interventions for safe animal handling (Rudolphi, PI) – Enrolled 11 women, 19 men
- Y6: Uncounted and invisible: The lives and health of H-2A workers in Ohio (Kline, PI) – Enrolled 284

G.4.b Inclusion Enrollment Data

Cumulative Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

Study Title: Enrollment over all Studies in the Great Plains Center for Agricultural Health, 2016-22

Comments: This incorporates all enrolled subjects from 4 pilot projects with IRB (Holstrom, Liang, Rudolphi, Kline)

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native										0
Asian										0
Native Hawaiian or Other Pacific Islander										0
Black or African American										0
White	68	59								127
More Than One Race										0
Unknown or Not Reported				1		284	107	234		626
Total	68	59	0	1	0	284	107	234	0	753

G.4.c ClinicalTrials.gov

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?

No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?

No

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?

No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?

No

G.8 Project/Performance Sites

The University of Iowa, 2 Gilmore Hall, Iowa City, IA 52242-1320
 Congressional District IA-02
 UEI: Z1H9VJS8NG16

University of Minnesota, 200 Oak Street SE, Minneapolis, MN 55455
 Congressional District MN-05
 UEI: KABJZBBJ4B54

Ag Health and Safety Alliance, 4560 230th Ave, Greenville, IA 51343
 Congressional District: IA-02
 UEI: PW5GJ6179MC3

Iowa State University, 505 Morrill Rd, Ames, IA 50011-2103
 Congressional District: IA-04
 UEI: DQDBM7FGJPC5

G.9 Foreign Component

No foreign component

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

Not applicable

G.11 Program Income

Is program income anticipated during the next budget period?

Not applicable

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?

Not applicable

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

The mission of the Great Plains Center for Agricultural Health is to prevent agricultural injury and illness and improve safety and health among agricultural communities. To accomplish this mission, the Center

advances knowledge through scientific research and prevents agricultural injury and illness through education, outreach, and intervention programs.

Projects and activities in 2016-22 have answered important questions to help protect farm workers in our region, including understanding at-risk driving behaviors on roadways shared by farming equipment and its surrounding community members; developing and testing technology to improve air quality in livestock buildings to protect both worker and animal health; and understanding the limitations and benefits of existing surveillance data sets to improve our understanding of on-farm hazards and their impacts.

Efforts to translate research into practice occurred throughout the Center to communicate and disseminate evidence-based practices and resources through multiple communication channels to speed implementation and adoption, and to enhance educational opportunities for farmers and the communities that serve them. The cornerstone of the GPCAH Outreach Core included the Agricultural Safety and Health Core Course, offered annually at five institutions around the country and adapted for use at new institutions in both undergraduate and graduate programs targeted to bring hazard awareness and injury/illness prevention to ag workers and their trusted advocates to speed the implementation and adoption of safe practices throughout the farming community. Additionally, best-practice information has been disseminated through multiple media channels, including providing monthly *SafetyWatch* articles in agricultural media (print), sharing resources with rural healthcare providers, engaging in electronic media (newsletters, web, social media). A new podcast (FarmSafe) was developed to expand our reach, with the goal of allowing an audience to engage with content on their own time through widely available and adopted platforms, which allows for quick dissemination of information to address timely hazards in our region while also allowing listeners to hear stories of those affected by hazards along-side solutions that have been proven to be successful.

Key lessons from this Center include the following, with where to get resources on gpcah.org:

- Users of outreach materials want complete packages, including sufficient details to “train-the-trainer” (for those new to a subject matter), hands-on activities to communicate the message, and “evaluation” materials (questions for reflection, exams, homework). See GPCAH “Outreach Kits”.
- Gas monitors for manure operations need to be low cost, robust (long sensor life), small but not too small to fit through the slats, and have concentration displayed (not just alarm) to be useful to warn farmers to respond to high hydrogen sulfide concentrations. See “Manure Gas Safety”.
- Modules for providing agricultural safety and health education are now available for adoption by instructors globally, designed to enhance educational conversations about farming health and safety. See “Online Modules.”
- Traumatic injuries associated with falls (22%), transportation (21%), interaction with equipment (38%) and animals (8%) results in 1.8 Iowa Farmer visits to the emergency room per day, which helps advocates share safety messages within Iowa and throughout the region. See “Injury Facts & Trends”
- Midwest Farmers report chemical hazards, equipment hazards, and health outcomes as their top safety and health needs (Arora et al. 2019). Their rural healthcare providers identified that they treat more commonly for musculoskeletal (e.g., shoulder/back pain), acute injuries and lacerations, and sprains.
- The new *SaferTrek* device and new processing algorithms have been validated to detect (98.5% with automation) and estimate distance (0.5 m resolution) of approaching vehicles to allow processing of behavioral factors regarding vehicle – farm equipment interaction on roadways. Details are in the *Instrumented Farm Vehicle Roadway Study* research project report.
- Filtration and UVC disinfection using large units can reduce airborne contaminants in livestock units, but increased airflow is likely needed in finishing rooms compared to the 5 air changes per hour rate that was successful in farrowing. Smaller, modular air treatment units are likely needed to adopt this technology in livestock buildings. Details are in the *Air Quality Improvements* research project report.

- Surveillance records demonstrate little overlap between trauma registry and workers compensation claims records, again illustrating the need to find cases and, thus, risk factors, in multiple sources. Details are in the *Surveillance of Injuries and Risk Factors* research project report.

A. COVER PAGE

Project Title: Great Plains Center for Agricultural Health	
Component: Planning & Evaluation Core Component Project Lead: Anthony, T. Renee	
Grant Number: 5 U54OH007548	Project/Grant Period: 9/30/16 - 9/29/22
Reporting Period: 9/30/16 – 9/29/22	Date Submitted:
Program Director/ Principal Investigator T. Renee Anthony, BS, MSEE, PhD Ph: 319-335-4429 Email: renee-anthony@uiowa.edu	Administrative Official Information Wendy Beaver Executive Director, Division of Sponsored Programs 2 Gilmore Hall Iowa City, IA 52242 Ph: 319-335-2123 Email: nih@uiowa.edu
Change of Contact PD/PI: N/A	
Human Subjects: Yes	Vertebrate Animals: No
hESC: No	Inventions/Patents: No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Aim 1: Ensure efficient management of Center resources.

Aim 2: Track and report current and anticipated agricultural health and safety needs throughout the region.

Aim 3: Coordinate Center Advisory Committees and facilitate communication among Center personnel and between Center personnel and community, public health, academic, and government stakeholders.

Aim 4: Develop and implement the overall Center Evaluation process to guide Center management and project directors in their efforts to maximize the impact of their programs and projects on agricultural injury and illness.

Aim 5: Identify and respond to emerging issues that pose risks to the health and safety of agricultural workers throughout the region.

B.2. What did you accomplish under these goals?

We present the major activities and significant results by each of the five aims of the Planning & Evaluation Core. Then, we present the Key Contributions and Impact, followed by a discussion of how our work generated robust and unbiased results.

ACTIVITIES AND SIGNIFICANT RESULTS

Aim 1: Ensure efficient management of Center resources.

The Center Administration (CA) team provided primary leadership to the Center to oversee center resources and plan and evaluate activities to maximize the impact of our center. This team consisted of the Center Director, Deputy Director, Evaluation Leader, Center Coordinator, and Evaluator, along with other personnel as needed to complete activities throughout this period. For example, in response to COVID-19 issues, in June 2020, Dr. Crawford was added to the *P&E Core* to assist with national and regional COVID-19 translational activities and then transitioned to plan, develop, implement, and test new P&E activities (e.g., FarmSafe podcast) and to contribute to external activities in ag safety and health. Ms. Sickles (financial administration) provided monthly account summaries, available for review in Internal Advisory Committee meetings (2nd Wed. monthly) with individual project investigators. In addition, Ms. Sickles requests internal budget reviews each year, prior to allocating future Center funds. These ongoing substantially reduces the possibility of project failure due to poor allocation of limited funds.

The CA team worked through personnel changes throughout this six-year period: Dr. Gibbs reduced her effort and then stepped down in 2019, Dr. Foushee was appointed in December 2019 and stepped down in July 2021; after which our Communications Communicator (Ms. Patterson) stepped up to fill this role through the remainder of the project period. In Dr. Fethke took over the Center's Deputy Director responsibilities on Feb. 1, 2020, following the retirement of Dr. Gerr. The CA team met weekly to discuss major activities throughout the project period to identify progress, opportunities, and threats to the Center's success. The CA team continues to meet weekly for routine progress and planning events, coordinates monthly meetings with project PIs, quarterly meetings with regional advisors, and annual meetings with external advisors. The defined structure of the *P&E Core* and our lines of communication allowed all Center investigators to maximize their productivity and ensure efficient management of Center resources, meeting the objective of Aim 1.

Aim 2: Track and report current and anticipated agricultural health and safety needs throughout the

region.

While the Center had a *Surveillance* research project team that conducted systematic reviews of injury data for research objectives, the *P&E Core* used media tracking, trauma registry records, farmer needs assessment surveys, health care provider surveys, and quarterly input from regional advisors to collect information on safety and health needs across the region. The key contributions for tracking and reporting agricultural health and safety needs during this project period were the completion of (1) a regional needs assessment survey and analysis and (2) analysis of trauma registry records of Farmers.

Farmer Needs Assessment: The CA team assisted with the development of a survey of farmers for mailing (random selection of farm operators in Iowa, Ohio, and Missouri) and at farm shows (in Iowa, Minnesota, and Nebraska) to understand current health and safety concerns. Comments to the question “What is your greatest health and safety concern on the farm?” were analyzed to identify themes, and 13 categories emerged as themes. In this 2018 survey, the top three farmer concerns centered on chemical safety, tools/equipment safety, and health outcomes (including respiratory, hearing loss, cancer). These, and other concerns, informed the development of outreach tool kits and course content throughout the remaining project period.

Due to downward market prices in 2017-8, we included an open-ended question on stressors: “Over the past year, what has caused you the most stress?” Responses were sorted by themes, and the top concerns were financial, climate/weather, and workload and management. Additional factors included family matters, farming processes, current health conditions, regulations, and aging. These data were shared with local crisis counselors to help build an understanding of farming stressors to understand when staffing crisis hotlines. The results of the needs and stressor survey are detailed in:

Arora K, Cheyney M, Gerr F, Bhagianadh D, Gibbs J, Anthony TR [2020] **Assessing Health and Safety Concerns and Psychological Stressors among Agricultural Workers in the U.S. Midwest.** *Journal of Agricultural Safety and Health.* 2020; 26(1): 45-58. PMID: PMC7250162

Rural Healthcare Provider Needs Assessment: The *P&E Core* also conducted a survey of rural healthcare providers (HCPs) to identify conditions perceived to most affect ability to farm (*musculoskeletal diseases* and *mental health illnesses*) and what conditions are HCPs most commonly treating in farmer patients (*musculoskeletal, acute injuries* including *lacerations* and *sprains*). This was distributed in early 2020 as the COVID pandemic restricted access to health care providers, preventing a robust analysis. However, preliminary data provided an interesting difference in what farmers reported as priorities and what health care providers were seeing in their farming patients.

Trauma Registry: Data from the Iowa Trauma Registry (2014-17) were analyzed to evaluate injury trends among Iowa farmers, with the presumption that similarities among row crop production and livestock operations apply to other locations in our region. The Iowa Trauma Registry database is unique in that it includes a special cell for “ag relatedness”, not captured by other state registries. In addition, cases not tagged as farming but included injuries in specific ICD-9 (E821, E862, E900-901) or ICD-10 (W30, V84) were evaluated individually to consider inclusion after assessing whether these were farm-related injuries. The final case count was 1981. Four cause categories contained 92% of all cases sending farmers to the emergency room for injuries: Interaction with equipment (748, 37.8%), Falls (428, 21.6%), Transportation (416, 21%), and Natural/Environmental (235, 7.8%). Data trends identified that farmers 55 years or older visit the ER 1.6 times more often than younger farmers. Examining outcomes by injury cause codes, falls accounted for 30% of fractures, with 40% of fall-fractures affecting the lower limb. Additional fracture cases were from contact with machines (14%), animal causes (“Natural”, 12%), and motor vehicle no-traffic causes (11%). Information was shared with Regional Advisors and our regional ag centers, presented at MRASH, and is available in text on the web site. A two-sided handout is available showing “Most Prominent Farmer Injuries” written to help health professionals have the conversation with farmers about injury risks on the farm, which have been shared by our partners throughout Iowa (since the data are from Iowa injuries).

GPCAH [2019]. **2014-17 Iowa Trauma Registry Analysis and Summary of Agricultural Injuries.** November 20, 2019. Available at: <https://gpcah.public-health.uiowa.edu/wp-content/uploads/2019/12/Iowa-Trauma-Registry-Ag-Surveillance-2014-17.pdf>

Additional Outcomes: Hazards identified in the injury surveillance and needs assessment efforts were used to identify priorities for activities in other Core activities. The *Pilot/Feasibility Project* team included top farmer concerns as priority topics in grant solicitation announcements to encourage projects that address these relevant hazards. In addition, the *Outreach Core* used these topics to prioritize outreach material development, content for the *Core Course*, and topics for monthly *Safety Watch* articles. Data from the health care provider surveys, while modest in numbers and unfortunately interrupted by the COVID pandemic, has been shared with the *Outreach Core* and others to identify preferences in methods to receive information on farmer safety and health. The ongoing activities coordinated and led by the *P&E Core* resulted in the identification of new trends that were communicated regionally through multiple channels, meeting the objective of Aim 2.

Aim 3: Coordinate Center advisory committees and facilitate communication among Center personnel and between Center personnel and community, public health, academic, and government stakeholders.

During this project period, substantial *Planning* activities included nurturing and developing new partners for *advisory committees*, facilitating a regional needs assessment, and developing new partnership networks. The advisory committee meetings, including the internal (*IAC*, monthly), regional (*RAC*, quarterly) and external (*EAC*, annually), met throughout the project period to ensure open communication between investigators, stakeholders, and national experts. Specific examples of how these committees have influenced the actions taken across the Center are highlighted below.

The *IAC meetings* facilitated idea exchange among Center investigators and staff throughout the project period. For example, investigators across all projects participated in focus groups to help the *Roadway* research team identify data metrics important for the collection and analysis of their video/GPS devices under development. The *IAC* also provided guidance to this team's selections of study communities for the intervention phase of this project. Connections built with the *Air Quality Project* allowed our expertise in Gas Monitor training (*Emerging Issues*) to be shared with the National Pork Board safety committee, where member organization company safety directors took immediate action for their sites during the training session. Trainees completing the *Outreach Core* Ag S&H Core Course have become new partners to the Center: former trainees reached out to the *Air Quality Project* team, who responded with technical industrial hygiene assistance, which led to collaborative participation in their field study. Additional partnerships have been formed with Core Course members, where access has been provided to farms, connections to new healthcare providers, and bringing health and safety experts into the agricultural sector. The interconnectedness of the *P&E*, *Research*, and *Outreach Cores* is a direct outcome of the collaborative nature of these *IAC* meetings, coordinated by the *P&E Core*.

Quarterly *RAC meetings* supported two-way conversations between the Center and our partners throughout the region. *RAC* members are experts in agriculture, safety and health, and allied fields throughout the region, who volunteer to meet quarterly to exchange information on protecting farmworkers. The *RAC* has provided feedback on outreach materials, which improved the content messaging and format, and identified train-the-trainer toolkit topics that would assist others to conduct outreach on new topics. The *RAC* also provided critical guidance on both structure and content of the roadway safety, gas monitor safety, and hearing protection outreach kits, suggesting we: include both overview and in-depth guidance, provide detailed instructions for how outreach personnel could use materials in the kits, and develop scripts to guide others to how to structure field demonstrations. The *RAC* has provided an ongoing check of our products to ensure they are culturally, linguistically, and educationally appropriate for audiences with whom they interact.

Annual *EAC meetings* provided comprehensive review of project progress, suggested new partners or additional data analyses, and identified new audiences to reach with dissemination. For example, the *EAC* contributed to long discussions and enthusiastically supported our transition from our historically defined “region.” While the Center has supported North Dakota and South Dakota since our beginnings in 1990, these states have been well-served by three additional NIOSH AgFF centers starting in 2011. Our *EAC* supported reaching out to Ohio and Indiana throughout this project period, which have similar heavy row crop farming operations, have strong extension programs, and are not served by other AgFF centers. Throughout this project period, with the support of our *EAC*, we included OH and IN in planning activities, including pilot grant solicitations, *RAC* membership, pesticide drift mapping (IN), rural healthcare association meetings (OH), and inclusion in the 2018 farmer needs assessment survey (OH). Other substantial *EAC* guidance included suggestions on the content of the *Surveillance* project’s new Farm Safety Checklist and provided additional helpful evaluation of our new approach when our insurance partner declined to participate in the field deployment of the checklist. Finally, throughout several *EAC* meetings, this committee suggested exploration of whether a podcast could improve our reach directly to our region’s farmers. In Fall 2020, the *P&E Core* strategized and began implementing steps to build a regional *FarmSafe* podcast during the COVID pandemic; biweekly episodes have been released, with the first episode released on August 20, 2021. Season 1 ended in July 22 with 23 bi-weekly episodes plus 2 bonus episodes promoting-time sensitive events. Season 2 kicked off with a Farm Progress Show episode (August 2022) and new hosts, and future activities will be transitioned to the *Outreach Core*.

At all our scheduled meetings, the *P&E Core* hosted engaging meetings, solicited input, built connections between advisors and project personnel, and developed and implemented action plans from each of these advisory groups to maximize the impact of efforts throughout the Center. The strategic use of *P&E Core* personnel helped amplify the impact of Research projects, including sharing new knowledge, materials, and connections, which could not have been realized without the ability to use Center personnel to reach audiences outside of research-level projects.

The *P&E Core* also collaborated across AgFF centers to improve synergies. The Center Coordinator and *P&E* staff actively contributed to the AgFF Evaluation, Coordinators and Outreach (ECO) team. Our Center coordinated calls in 2016-17; hosted social media webinars; authored and hosted the US Ag Centers Mental Health Activities and resources web pages (2019); and provided the AgFF Mental Health Awareness materials shared with HRSA Federal Office of Rural Health Policy. We contributed to data analysis and manuscript development with our ECO partners (YouTube papers). We worked collaboratively with AgFF centers to coordinate informational health and safety material development for COVID-19 (see *Emerging Issues*), and we collaborated with evaluators to perform the livestock activity contribution analyses with NIOSH.

Outside of these networks, consistent interactions with the region’s agricultural safety and health community were coordinated through annual coordination and co-sponsoring of the Midwest Rural and Agricultural Safety and Health (MRASH) conferences, quarterly *Alive and Well* newsletter, active social media accounts, and news features and content updates on our website. The *P&E* staff participated in planning and hosting committees for MRASH. A comprehensive communications plan evolved over the project period to incorporate strategic postings on Facebook and Twitter, and developed a new YouTube posting strategy, important during the pandemic, with activities organized by the Center Coordinator. Newsletters and social media were used to assist Center researchers and our partners recruit study participants, to share results from studies, and to provide reminders and best practice guidance on many farm hazards.

The *P&E Core* also responded directly and efficiently to stakeholders in community, public health, academic, and government. The following are examples that demonstrate the range of requests we have responded to over the past project period. *P&E* staff analyzed survey data for Iowa Department of Public Health’s farmer Coffee Corner Survey (2017) at the region’s Farm Progress Show; responded to request for Spanish language materials on hearing loss prevention (2017); provided a letter of support for a County Supervisor

on the inclusion of safe manure management practices in their revised Master Matrix (for livestock siting approval, 2017); responded to information requests on wind monitors for farmers applying pesticides (2018); responded to community questions regarding pesticide hazards (2018-9); provided pesticide air sampling guidance to MN Dept. of Public Health (2018); provided hearing conservation materials to audiologists in Indiana (2018); provided guidance on exposures in hog barns to Canadian farmer (2019); responded to media to discuss safety during harvest (2019-2021); responded to trauma registry findings to MN Dept. of Public Health (2019); and authorized the SHEilds.org (among others) to use GPCAH hearing protection materials in their e-learning courses (2019). Requests for media interviews across the Center are coordinated by the *P&E Core*, where we identify the most appropriate Center investigator to respond to requests for expertise on a given topic or inquiry. Through Dec 2021, the Center was involved in 265 media stories related to study findings, products, and outreach events coordinated by the Center. Starting in 2020, the expertise developed by GPCAH personnel during the COVID-19 pandemic resulted in the direction of numerous questions from the University, College of Public Health, and surrounding community were directed to GPCAH *P&E Core* personnel (Anthony, Gerr, Crawford). These included community inquiries regarding ventilation, protective equipment, social distancing, and eventually vaccinations. Communication included contributions to webinars on back-to-school safety, protective equipment and masking, precautions for community health navigators. In brief, the Center has been sought out to provide expertise on a wide range of health and safety topics throughout the project period, and the *P&E Core* facilitated communication among Center personnel and between Center personnel and community, public health, academic, and government stakeholders.

Combined across advisory committees, established communication platforms, and ongoing responses to requests from a variety of stakeholders, the Center's *P&E Core* has developed and implemented systems to provide clear communications channels among many of our stakeholders, meeting the objective of Aim 3.

Aim 4: Develop and implement the overall Center evaluation process

The goal of the evaluation process was to guide Center management and research investigators to maximize the impact of programs and projects on the reduction of agricultural injury and illness. Evaluation activities have focused on (1) supporting Center administration in identifying the regional burden and needs of farmers and their advocates and (2) coordinating ongoing monitoring of project and Center progress to achieve its goals while maximizing the potential to protect farmworkers. The Evaluation team has developed and implemented an evaluation system to assess the practical impacts of the Center. Key accomplishments are highlighted below.

- We have evaluated the **impact of research publications** in year 5 (Y5): 37 Center-only funded publications identified that 11 were in the top 25% of Altmetric scores (and 2 were in top 5%), in line with expectations of this sample size. Citations from papers from 2016-20 averaged 6.2 (median 4.5; range of 0 to 22).
- Evaluations of **press releases** in Y3 identified additional steps to improve attention scores of the broader media going forward. We now have increased media interest in press releases in 2020-22.
- We evaluated the effectiveness of **new displays and materials** for the *Outreach Core*. For example, farm show participants related to the symptoms described in a *Whole-Body Vibration (WBV)* display, but they did not recognize that WBV applied to them. Materials were revised to use the term "Vehicle Vibration" to better engage farmers with the prevention messaging.
- We also coordinated student evaluations for the *Outreach Core's 40-hr Agricultural Safety and Health Core Course*. Critical feedback for the 2020 all-virtual course (COVID) was analyzed and used to inform improvements to the 2021 session. Adopted changes included reducing the frequency of evaluations (daily instead of after every topic), coordinating live farm tours to allow interaction with the tour guide when hazards came into view, and shifting live sessions to the middle of the day to accommodate attendees in multiple time zones. Evaluation feedback identified benefits from these 2021 efforts, including that class participants "felt reenergized about ag safety" and that "presentations by farmers themselves added a real human perspective" to the class.

- We coordinated the annual **Midwest Rural Agricultural Safety and Health Conference (MRASH)** conference evaluation. Feedback from attendees have been used to improve the conference agendas. The current “keynote followed by a panel discussion” structure came from feedback requesting the conference allow time to explore a single relevant topic in depth. Evaluations identified the benefits of including farmer panels to share ways that farmers have implemented solutions to timely topics (e.g., identifying why procedures need to be documented, understanding how to navigate mental health crises), which have been continued with useful feedback, particularly during the pandemic. Positive feedback on the addition of career networking lunches have helped justify the additional meeting costs to support student and early career mentoring. Finally, feedback that suggests new topics are routinely incorporated into preparations for future conference agendas.
- We also collaborated with NIOSH to generate a **cross-center logic model** to summarize research, training, and outreach conducted at NIOSH Ag Centers focused on protecting the health and safety of **livestock workers**. We have applied the similar contribution analysis framework to conduct retrospective evaluation of Center projects, visually depicting movement along the research-to-practice continuum over the current (and previous) project periods. Retrospective logic modeling identified additional opportunities and contributions made across the Center while highlighting to investigators the importance of measuring impact *beyond* scholarly productivity.

Aim 5: Identify and respond to emerging issues that pose risks to the health and safety of agricultural workers throughout the region.

The Center has responded rapidly and effectively to several emerging issues that have developed over this project period. Topics included direct reading gas monitor use guidance, pesticide drift trend analysis, mental health education, a scoping review of mental health intervention literature, COVID-19 response and communication, and avian influenza protection updates and train-the-trainer respirator fit-test training (ongoing). In every case, we responded to community concerns, often highlighted by calls for assistance directly to the GPCAH and by input from IAC members and RAC members. We efficiently identified partners with expertise, capacity, and community connections to prepare responses in real time, then translated efforts into general recommendations that were disseminated to broader communities and designed to be adoptable and sustainable for use by others. Below are significant activities and key outcomes from few of our *Emerging Issues* responses.

In 2016-17, gas monitor education materials and guidance were developed in response to a string of regional fatalities from manure gases. We responded to community concerns providing gas monitors from our field studies to deploy in communities experiencing hydrogen sulfide emissions lethal to animals, and then stayed to identified concerns and answer questions from these communities. With this information, we conducted additional investigations to answer longer-term questions, such as monitor performance on the farm and key features of concern by farmers. From this, we generated both scientific papers and a comprehensive outreach kit to include training-the-trainers. Requests to provide community outreach on gas monitors continue – upon request, we provided demonstrations during the 2021 Minnesota Farm Fest, have been asked to assist Extension with bump testing during 2022 manure management training, and helped a MN health department investigator propose for pilot funding for firefighter-farmer gas monitor outreach program.

In 2017-18, regional concerns in rural communities focused on pesticide drift as farmers began applying dicamba-resistant soybeans and neighboring fields became damaged. The *P&E Core* worked with state-based pesticide drift agencies to obtain and examine cases and evaluate trends; we communicated findings with the public and co-sponsored a *Pesticides in Public Health* networking meeting to respond to the concerns. Research findings were translated into innovative story maps to highlight the data (<https://gpcah.public-health.uiowa.edu/pesticide-mapping-project/>). The stories describe why the application restrictions (temperature, humidity, wind) are in place and what specific PPE types and materials should be used during handling of the top five pesticides in drift cases from each of three states, and these maps are available to use in pesticide applicator training as well as for the public.

In 2020-1, *Emerging Issues* funds were used to support additional staff to help respond to the COVID-19 pandemic. The *P&E Core* developed and disseminated FAQs on COVID-19, starting on April 7, 2020, to answer questions sent to Center investigators from the media and the community at large. Initially, comments from our ag partners indicated that our FAQ was answering questions that were not being answered on other web sites. Working with other NIOSH AgFF centers, we helped NIOSH draft the CDC guidance for ag workers and identified tools needed to translate this scientific guidance into something easily understood by our farming audience. With input from other AgFF centers, our Center selected tools to develop for release when the CDC Ag worker guidance was finalized and released to the public. Since our Center has industrial hygienists and an occupational medicine physician who were actively engaged in COVID-19 responses locally, our toolkit items focused on respiratory protection, social distancing, and medical questions, demonstrating multidisciplinary approach needed to respond to our farming and rural communities. We focused on both written and video formats, with “hierarchy of controls” informational video (cartoon) and an the COVID “exposure-infectivity-disease timeline” (YouTube video, watched over 13,000 persons globally) being widely viewed. Expertise in our Center on COVID-19 prevention was sought by new partners, including Community Health Navigators (who provide Spanish language translation to injured/sick ag workers), Proteus (provides immigrant agricultural workers with health care), and physicians at healthcare centers (e.g., Dr. Corwin, who was involved in vaccination clinics in Iowa, who we invited into NORA and who contributed to the COVID-19 white paper project). The Center COVID-19 team participated in communications via the web, social media, regional webinars, and conversations with print, radio, and television media to maximize our reach to rural citizens to provide evidence-based COVID-19 guidance.

The above examples demonstrate that the *P&E Core* has implemented effective system to identify and prioritize responses to emerging hazards. We have demonstrated our ability to use *Emerging Issues* resources to work both independently and with other centers to address important questions and provide outputs designed for variety of stakeholder uses. Outputs developed from *Emerging Issues* activities have been integrated into *Outreach Core* efforts, available on the GPCAH.org. We have used our communication networks (Aim 3) to share and promote *Emerging Issues* resources. The *P&E Core* has identified and responded to critical hazards throughout this project period, which presented substantial and serious health and safety hazards to our region’s agricultural workers, meeting our objective in Aim 5.

KEY CONTRIBUTIONS AND IMPACT

The *P&E Core* has coordinated the communication of research, outreach, and surveillance information on the web site, allowing easy access to and efficient sharing of information to help farmers, their advocates, policy makers, and health care providers understand the best practices associated with significant farming hazards in our region. Our communication efforts (social media, podcasts, newsletters, etc.) include links to drive people to web where we host resources for use by anyone at any time. We have included a co-branding policy (<https://gpcah.public-health.uiowa.edu/cobranding/>) to encourage others to adopt these resources for their efforts that focus on injury and illness prevention.

The GPCAH has co-sponsored ongoing MRASH conferences since 2002, co-sponsored by the Iowa’s Center for Agricultural Safety and Health (I-CASH), funded by the Iowa legislator to address the protection of Iowa farmers. The conference’s purpose has been to strengthen collaborative efforts among researchers, producers and health care professionals while providing updated information on health and safety in agriculture and rural communities. The *P&E Core* has sponsored this even, including coordinating evaluation, and across this project period, it now includes collaborative participation from neighboring AgFF centers, making this annual meeting a relevant information exchange and training forum to protect farmers throughout the GPCAH region and beyond.

The *P&E Core* has also developed, deployed, and evaluated new ways to communicate with farmers about injury and illness prevention. Using a GIS and *Story Mapping* to communicate Pesticide Drift (Emerging Issues) helped tell a story that incorporates health and safety tips with production guidance, which can be

useful for future data sharing opportunities. The new biweekly FarmSafe Podcast focuses on hazards relevant to our region's farmers, but listeners tune in from beyond the Midwest (42 states, 19 countries) because the topics we explore are relevant to conversations in other agricultural regions. This platform can be used to share resources, with motivating stories, from investigators and community groups that have identified best practices that serve to protect farmers in the GPCAH region.

The *P&E Core* also hosts a repository of research publications that has been accessed 244 times between June 1, 2018, and Sept 29, 2022. This page provides links to both the original publication and to publicly accessible versions of these peer-reviewed publications to allow quick access to these studies by the public and the media. We list and link manuscripts generated from NIOSH-funding for GPCAH activities (research projects, pilot grant projects, outreach core, and planning & evaluation core) as well as relevant ag safety and health studies produced by GPCAH investigators when they are relevant to share on our publications page <https://gpcah.public-health.uiowa.edu/publications/>.

ROBUST AND UNBIASED RESULTS

To ensure that communications and recommendations from the *P&E Core* are robust and unbiased, methods used to generate work products are reviewed by topic-expert specialists (*Internal Advisory Committee* and Center Affiliates) and by those familiar with farming operations (*Regional Advisory Committee*). Press releases are generated in collaboration between P&E staff and PIs to ensure the content is appropriate for the reader and adequately reflects the unbiased results contained in the study findings. In addition, materials shared with external stakeholders involves principal investigators and subject-matter experts (advisors) to confirm the scientific accuracy of translated results and clarity of messaging. This ensures that recommendations are scientifically robust and culturally and linguistically appropriate to a broader audience. Additional products developed by this Core rely on reviews of topic-expert specialists in the Center and advisory committees. All tools are pilot tested, with input from multiple audiences, to ensure clarity and data robustness. A data-driven approach to identified emerging issues, using multiple inputs to identify critical new hazards facing the region's farmers. Emerging issues were prioritized by collecting information on: (1) the number of requests for technical assistance that GPCAH faculty and staff receive pertaining to the issue, (2) formal tracking of priority health and safety concerns via surveys (web, farm shows), and (3) routine communications with Center advisory committees, and products developed from these efforts were similarly reviewed.

B.3. Competitive Revisions/Administrative Supplements

None

B.4. What opportunities for training and professional development did the project provide?

While this Center does not serve the mission of training and providing professional development for Center personnel, five graduate students, three undergraduate students, and one Post-Doc have provided time and expertise to several activities in the *P&E Core*.

Graduate students include **Jessica Ricchio** (MS, IH), who in 2018 analyzed the pesticide drift data, which was included in her MS thesis for the industrial hygiene program (<https://ir.uiowa.edu/etd/6256/>). Upon graduation, her first job was as a corporate industrial hygienist at John Deere Corp. **Amy Kopale**, a graduate student in Geography, with an environmental policy focus, worked to create the pesticide story maps using Ricchio's analysis and data. Kopale graduated in May 2019. **Divya Bhagianadh**, a PhD student in the Health Management and Policy program, has participated in the Evaluation team's data analysis of GPCAH Needs Assessment survey data and is a coauthor on this manuscript. In 2022, **Emma Samellie** (MS, IH) worked to understand the need and resources available to fit-test our region's farmers; this began as a response to the 2022 avian influenza outbreak, but quickly expanded to identify needs and eventually

recommend resources for fitting farmers for respirators during dusty operations, pesticide applications, and at the ready during anhydrous ammonia applications. Samellie's project is ongoing.

During the COVID pandemic, starting in 2020, the following students participated in ongoing activities: **Jessica Ralphs**, a Community and Behavioral Health graduate student (MPH), participated in a new mental health emerging issues project with Dr. Afifi. Undergraduate public health students (**Paige Grissinger**, **Breanna Haak**, **John Young**) have worked with the *P&E* team to develop outreach kits, help scope the podcast, and to help systematically scope mental health intervention studies for farmers. In spring 2020, we hired **Dr. Kate Crawford**, a recent industrial hygiene PhD graduate, first as a temporary hire then as a post-doctoral fellow to take the lead on COVID-19 communications, taking the burden off the Center Director. Dr. Crawford contributed to COVID-19 education, leading updates and video productions in middle 2020. She also led the development of the FarmSafe podcast and coordinated its first season (August 2020-July 2021). Dr. Crawford is now a Research Manager at the National Safety Council.

The *P&E Core* staff often attend multiple training events throughout the year, including attending MRASH conferences, including Marsha Cheyney [Evaluation/Outreach], Jennifer Patterson [Communicator/Center Coordinator], Kate Crawford [Emerging Issues/Podcast Director], Russ Foushee [Center Coordinator], Jenna Gibbs [Center Coordinator], Nathan Fethke [Deputy Director/Pilot Grant PI], Kanika Arora [Evaluation Director], and Renee Anthony [Center Director]. In addition, *P&E Core* staff have compiled and presented results of Center-wide impact and emerging issues topics at conferences and at regional meetings, including pesticide drift (Pesticides and Public Health, American Industrial Hygiene Conference and Exposition, ISASH, MRASH, Practical Farmers of Iowa) and social media strategy for agricultural health and safety (ISASH, MRASH), mental health (P.E.O. International, United Methodist Church), and on manure gas exposures and monitors (National Pork Board producers meeting).

The ISASH Conference provides opportunities for improving professional skills and knowledge in addition to sharing information about research and intervention programs. To stay current during the evolving COVID-19 pandemic, staff members (Crawford, Anthony) attended multiple COVID-related webinars presented by various organizations throughout the COVID pandemic. These included webinars from: the CDC; National Academies of Science, Engineering, and Medicine; the American College of Medical Toxicology; and the American Industrial Hygiene Association.

Beginning in 2019, formal Individual Development Plans (IDPs) were developed by all graduate research assistants in conjunction with advisors, following structure developed by the NIOSH Heartland ERC (<https://www.youtube.com/watch?v=W0k4TPucZXo>). Plans were reviewed between students and advisor both prior to summer conferences and prior to the last semester of coursework.

B.5. How did you disseminate the results to communities of interest?

The *P&E Core* provided a conduit to disseminate Center-wide information to communities through multiple platforms, in partnership with the Outreach Core. Lists of scientific publications from this core and activities (media, presentations, educational events) are reported under Section C.

We disseminated information via multiple face-to-face platforms. We coordinated interactions with Center investigators and health and safety advocates throughout the region with quarterly communications with our regional advisory committee network, which allows for two-way discussions of new materials and emerging issues between ag safety and health advocates in meetings, who also share information on what has been shared to the farmers/ranchers they serve. This Core provided staff to coordinate and co-host MRASH meeting (Nov. annually) to share findings and bring together advocates to discuss progress on regional priorities. We also used funds to support attending national meetings (e.g., ISASH, ASABE) to share important findings with research communities.

We also disseminated information through traditional and electronic multi-media networks, including newsletters, web pages, social media, and conferences. The *P&E Core* maintained our website and social media accounts, and we generated and distributed press releases to share research findings on best practices to the media. Highlights include:

Website: We have had over 118,000 page views of our web site over this project. The GPCAH.org website updated were coordinated by the P&E Core throughout the project period, each time improving the ease of access to materials, with input provided by our regional advisory committees. Outreach materials were organized for easy access on the Resources tab and educational materials (information on live and online courses) were contained in an *Education* tab. Updates to research projects, including pilot grant awardees, were made to help investigators share information to their research partners and investigators interested in their topic.

Social Media Platforms: A social media communications strategy (Facebook, Twitter, and YouTube) was developed and followed to disseminate findings and share information to followers. At the end of this project period, GPCAH has 639 Facebook followers and 372 Twitter followers, which increased steadily by ~50 each year. Since 2019, we have tracked over 134,000 views of posts on Facebook and over 178,000 on Twitter. We engage followers with Center-generated material and with relevant materials, media, or events generated by others.

National Collaborations: The *P&E Core* participated in annual ag safety initiatives, including the Farm Bureau Ag Safety Awareness Weeks every March and the National Farm Health and Safety Weeks every September. We provide resources aligned with focused daily topics for other centers to share in Media Kits while also promoting these events to the media and coordinating interviews. We also participated in ad-hoc promotional campaigns, including the summer 2018 Beat the Heat campaign (developed template press releases), compiled and hosted resources for Mental Health Month (May 2019), and participated in developing innovative materials for COVID-19 guidance as part of the U.S. AgFF Centers' effort to disseminate information about the updated CDC guidelines in 2020.

MRASH Conference: The *P&E Core* provided staff to help plan and evaluate MRASH conferences; we also provided sponsorship to offset the meeting costs to minimize registration fees for participants. Throughout this project period, registration ranged from 55 to 132 attendees, with attendees coming from 7 (2016) to 20 (2021) states and an expanding collaborative role for our neighboring AgFF centers. Attendance increased in 2020 and 2021, during virtual meetings, where we also increased international participation. MRASH typically provided 16 hours of education, including updates on research and outreach projects relevant to improving the safety and health of our region's farmers. We also hosted workshops in conjunction with MRASH in attempts to build technical capabilities in the rural communities where we meet. This included a community safety day event (Sioux Center, 2016) and a virtual training on a new safety checklist app in 2021. These events have also supported pilot projects, including ammonia safety education (Neenan, Council Bluffs, 2018) and hosting a farm bill meeting that incorporated suicide prevention education (Brown, Marshalltown, 2019).

Press Releases: The *P&E Core* prepared 23 press releases over the project period (3 in Y1; 5 in Y2, 3 in Y3, 6 in Y4, 4 in Y5, and 2 in Y6) to promote upcoming events and to share information on important publications published by GPCAH investigators, including pilot grant awardees. These are archived in our News page (<https://qpcah.public-health.uiowa.edu/news-archive/>). Examples of impactful press releases include: Dr. Arora's findings of increased rates of dementia in ag workers (2021: picked up by local news affiliates, radio, and print media); Dr. Fethke's publication on whole-body vibration (2018: 6 print, four interviews, and University video promotion); and Dr. Ramirez's study relating alcohol impairment and on-road farm crash injuries (2017: 10 stories); and the multi-Center press release on telling the story (2018: tied to ISASH promotion, coverage by 11 media).

In addition, *P&E Core* staff have compiled and presented results of Center-wide impact and emerging issues topics at conferences and at regional meetings, including pesticide drift (Pesticides and Public Health, American Industrial Hygiene Conference and Exposition, ISASH, MRASH, Practical Farmers of Iowa) and social media strategy for agricultural health and safety (ISASH, MRASH), mental health (P.E.O. International, United Methodist Church), and on manure gas exposures and monitors (National Pork Board producers meeting). We also presented at the request of the Livestock and Poultry Environmental Learning Community (May 15, 2020 webinar) (103 participants, archived at <https://lpehc.org/human-health-pathogens-and-contaminants-in-livestock-systems/>).

FarmSafe Podcast: In 2020, the *P&E Core* used some of the unspent resources during the COVID pandemic to develop and deploy a new podcast as an additional means of disseminating safety and health best practices. The first episode had a soft opening in August 2021, with a short introduction episode, and released new episodes every other week through July 2022 for a 23-episode Season 1, and 2 episodes in Season 2 dropped during this project period. As of the end of this project period, episodes have been downloaded 1000 times in 214 cities across 42 states and 19 countries. While the first year was a slow growth period, the interest in both audience and guests motivated additional commitments to continuing the podcast as an *Outreach Core* activity in the future.

Emerging Issues were investigated and shared with relevant communities, four of which are highlighted here. Manure gas fatality interventions began by responding to community requests in 2016-17, then translating questions on monitor selection and performance into research investigations about Pit Gases and Testing Equipment to 20 safety and health managers at swine production companies at the National Pork Board Safety Roundtable (2018), and outreach kits were developed and evaluated at local businesses and shared with educators at ISASH (2019). Community concerns regarding pesticide drifts led us to reach out to state investigators, developing a database, and generating [story maps](#) to share both drift data and prevention messages. Mental health responses began at the community level, with partnership with faith-based leaders of the community and expanded to educating crisis center volunteers about farming stressors (from regional surveys), and sponsoring QPR training for MRASH attendees. Surveys asking farmers about their use of respirators (FFRs, elastomeric) and fit-testing performance at farm shows has identified a gap to be addressed.

D. PRODUCTS

C.1. Publications, conference papers, and presentations

PUBLICATION Citations	
2017	
	Beswick-Honn J, Peters T, Anthony T: [2017] Evaluation of low-cost hydrogen sulfide monitors for use in livestock production. <i>Journal of Agricultural Safety and Health</i> , 23(4): 265-279. PMCID: PMC5704997. DOI: 10.13031/jash.12530 [Emerging Issues]
2020	
	Arora K, Cheyney M, Gerr FE, Bhagianadh D, Gibbs J, Anthony TR: [2020] Assessing Health and Safety Needs and Psychological Stressors among Agricultural Workers in the Midwest. <i>J Ag Safe Health</i> . Nov 6. 26(1):45-58. PMCID: PMC7250162. DOI: 10.13031/jash.13660 [P&E Core]
2021	

<p>Arora K, Xu L, Bhagianadh D: [2021] Dementia and Cognitive Decline in Older Adulthood: Are Agricultural Workers at Greater Risk? <i>J Gerontology: Series B</i>. Sept 13. PMID: PMC8849525. DOI: https://doi.org/10.1093/geronb/qbab005 [P&E Core]</p>	
<p>Wickman A, Duysen E, Cheyney M, Pennington W, Mazur J, Yoder A: [2021] Development of an educational YouTube channel: A collaboration between U.S. Agricultural Safety and Health Centers. <i>J Agromedicine</i>. 26(1):75-84. PMID: PMC8117175. DOI: https://doi.org/10.1080/1059924x.2020.1845269 [P&E Core and Outreach Core]</p>	
<p>Beseler CL, Crawford KJ, Charlier DE, Ramos AK: [2021] The NIOSH Agricultural Centers' YouTube Channel: Time Series Modeling of Viewership of Agricultural Health and Safety Videos. <i>J Agromedicine</i>. 27(4):368-377. PMID: PMC9072590. DOI: https://doi.org/10.1080/1059924X.2021.2000907 [P&E Core]</p>	
<p>C.2. Website(s) or other Internet site(s) – include URL(s)</p>	
<p>https://gpcah.public-health.uiowa.edu</p>	<p>Main web site for GPCAH</p>
<p>https://gpcah.public-health.uiowa.edu/mental-health/</p>	<p>Gibbs J: [2019] Mental Health Month Campaign for U.S. Ag Centers</p>
<p>https://gpcah.public-health.uiowa.edu/pesticide-mapping-project/</p>	<p>Anthony R and Gibbs J: [2019] Pesticide Drift in the Midwest</p>
<p>https://gpcah.public-health.uiowa.edu/outreach-2/topics/2-0/</p>	<p>GPCAH staff: [2019] Revised fact sheets, videos, and other resources for understanding and preventing hazardous gas-related incidents</p>
<p>https://gpcah.public-health.uiowa.edu/wp-content/uploads/2019/12/Iowa-Trauma-Registry-Ag-Surveillance-2014-17.pdf</p>	<p>GPCAH Surveillance Team: [2019] Iowa Trauma Registry Ag Surveillance 2014-17</p>
<p>https://uicapture.hosted.panopto.com/Panopto/Pages/Embed.aspx?id=0051960f-3dab-4b43-86d4-ac2a0119c3d1</p>	<p>Anthony TR: [2020] CPH Webinar: Facing the Facts - The Role of Face Coverings in Containing COVID-19, 20 September 2020</p>
<p>https://www.facebook.com/watch/live/?v=688922348411024&ref=watch_permalink</p>	<p>Anthony TR: [2020] Facebook Live COVID-19 Update for Iowa State Education Association, 14 Oct. 2020</p>
<p>https://uicapture.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=697d2abe-9d7c-47b0-a805-abf4010d2620</p>	<p>Anthony TR: [2020] Preparing to Learn: Covid-19 Health and Safety Precautions for Schools, 25 June 2020</p>
<p>https://www.youtube.com/channel/UCLPatwyvcmY1ack6tFQAfhw</p>	<p>GPCAH investigators: [2020-1] Videos about COVID-19 timeline, symptom screening, the Hierarchy of controls, proper masking selection, use, maintenance, frequently asked questions and other COVID-19 related videos available on the GPCAH YouTube channel</p>
<p>https://gpcah.public-health.uiowa.edu/cobranding/</p>	<p>GPCAH staff [2021]: Informational materials available for co-branding available at</p>
<p>https://gpcah.public-health.uiowa.edu/materials-forhealth-care-providers/</p>	<p>GPCAH staff [2021]: Materials for Health Care Providers</p>
<p>https://gpcah.public-health.uiowa.edu/farmsafe/</p>	<p>GPCAH Staff: [2021-2]. FarmSafe Podcasts</p>

https://gpcah.public-health.uiowa.edu/covid-19_april/	GPCAH staff: [2020-2] Guidance, resources, and additional information documents for ag workers regarding COVID-19 and vaccine information (multiple updates since 2020)
C.3. Technologies or techniques	
Nothing to report	
C.4. Inventions, patent applications, and/or licenses	
Nothing to report	
C.5. Other products and resource sharing	
Category	Explanation
2017	
New Business Creation	Emerging Issues/Outreach Core Staff (Leonard) collaborated with the Biadasz farm (a family-owned operation in Wisconsin) on advising and outreach efforts (to community, extension, and producers) on manure handling safety in March, 2017. These efforts have led to the establishment of the Mike Biadasz Farm Safety Education and Memorial Fund. (P&E Core/Emerging Issue) https://www.facebook.com/mikebiadaszfarmsafetyandeducationmemorialfund/
Other	Ramaswamy, R; Gibbs, JL. [2017] Pilot study looks at musculoskeletal symptoms among beginning farmers. Alive and Well Newsletter. March 2017. https://gpcah.public-health.uiowa.edu/wp-content/uploads/2017/03/Alive-Well-Newsletter-March-2017.pdf (P&E Core)
2018	
Other	Ricchio J, Gibbs J, Anthony T. (2018). Pesticide drift in the Midwest: Trends and characteristics of reported incidents. Presented at the Pesticides and Public Health Meeting on May 14, 2018 in Iowa City, IA. (Emerging Issue)
Other	Gibbs J, Anthony R, Ricchio J, Marek R, Hornbuckle K. (2018). Pesticide drift exposures to common herbicides on Iowa farms. Presented at the Pesticides and Public Health Meeting on May 14, 2018 in Iowa City, IA and at the ISASH Conference on June 22-24, 2018 in Halifax, N.S. (Emerging Issue)
Other	Gibbs J, Schultz E. (2018). Op-Ed for National Farm Safety and Health Week. In times of strife, farmers connect with the church. Published in the Kalona News, Des Moines Register, and Cedar Rapids Gazette in September 2018. (Emerging Issue)
Other	Gibbs J, Fethke N and Snee T. (2018). Press release: With longer hours spent on farm equipment, whole body vibration and lower back pain is a concern to some farmers. This press release resulted in news articles featured in five media outlets, including AgWeb, The Daily Iowan, Cedar Rapids Gazette, Tri-State Livestock News, and Farm Journal. (2011-16 Project)
Other	Arora K, Wendell M, Cramer M, Wilson F, Keeney A. (2018). Evaluation methods to measure Ag Center end outcomes. MRASH Conference, November 27-28, 2018. Council Bluffs, IA. (Evaluation)

Other	Agricultural Health and Safety Networking Reception. (2018). This reception was held at the end of the first day (June 11, 2018) of the Agricultural Health and Safety Core Course. The event brings together University of Iowa researchers and community partners who address a variety of rural health and safety topics. This reception is hosted by GPCAH, the Healthier Workforce Center of the Midwest (a NIOSH Total Worker Health Center of Excellence), the Heartland Center for Occupational Health and Safety (a NIOSH Education and Research Center), Iowa's Center for Agricultural Safety and Health, and the Iowa Injury Prevention Research Center. Community partners include the Rural Health and Safety Clinic of Greater Johnson County and AgriSafe. There were 35 posters and educational displays, with topics including rural health data gaps, livestock handling, bioaerosols in agriculture, and pesticide drift. Approximately 75 individuals attended the Networking Reception. GPCAH hosted a rural roadway safety display, a noise-induced hearing loss prevention display, and hearing protection fit testing. (P&E Core and Outreach)
Other	Arora K, Cheyney M, Gerr F, Gibbs J, Anthony TR. (2018). Assessing agricultural health and safety needs: A comparison of survey modalities. Evaluation 2018. Oct 28-Nov 3, 2018, Cleveland, OH. (Evaluation)
Other	Ricchio JL. (2018). Pesticide drift in the Midwest: 2010-2016. M.S. Thesis, Occupational and Environmental Hygiene (Industrial Hygiene), University of Iowa. May 2018. Available at https://ir.uiowa.edu/etd/6256/ (Emerging Issue)
Other	Gibbs J. (2018) Hearing Protection and Farmers. Presented to thirteen individuals during Ag Safety Awareness Week, Webinar, March 5, 2018. This was the first time that GPCAH partnered with American Farm Bureau on an educational webinar. (P&E Core)
Other	Kopale A, Gibbs J, Anthony TR. (2018). Pesticide drift story mapping project. MRASH Conference, November 27-28, 2018. Council Bluffs, IA. (Emerging Issue)
Audio or video	Fethke N, Overton M, Stites K. (2018) Farming Machinery Whole-Body Vibration and Back Pain. YouTube Video. October 24th, 2018. (2011-16 Project) https://www.youtube.com/watch?v=HulOiX8pgqs&t=26s
Other	Gibbs J, Cheyney M. (2018). Development of a social media strategy for agricultural safety and health messaging. ISASH Conference, June 22-24, 2018. Halifax, N.S. (P&E Core)
Other	Gibbs J (2018). Press release: Mental health a priority during national farm safety week. This press release resulted in news articles featured in three media outlets, including Harvest News and Farm Futures Magazine. B. Janssen was also interviewed by Tim Harwood of 1450 KXEL in Waterloo, IA. (Emerging Issue)
Other	Pesticides and Public Health Networking Meeting, co-hosted by GPCAH, University of Northern Iowa Center for Energy and Environmental Education, and Iowa State University Extension and Outreach. There were 35 attendees. Johnson County Extension Office, Iowa City, IA, May 14, 2018. (Emerging Issue)
Educational aids or curricula	Anthony TR. (2018). GPCAH: Pit Gases and Testing Equipment. National Pork Board Safety Roundtable, October 3, 2018. National Pork Board, Clive IA. Attended by 20 safety and health managers at swine production companies. (Emerging Issue)
Audio or video	Beck, M. (2018). Wind-blown pesticides an issue in courtrooms, communities across the U.S. Harvest Public Media, Iowa Public Radio. August 13, 2018. (Interview with J Gibbs) (Emerging Issue)

Other	Ricchio JL, Gibbs JL, Anthony TR. (2018). Pesticide drift in the Midwest: 2010-2016. AIHce, Philadelphia, PA, May 21-23, 2018. This poster was also presented at the Agricultural Health and Safety Networking Reception on June 11, 2018. Available at: https://i3hsa.org.uiowa.edu/article/student-posters---aihce-2018 (Emerging Issue)
Other	Regional Midwest Rural Agricultural Safety and Health (MRASH) Conference. (2018). GPCAH supported this conference, which was held in Council Bluffs, Iowa. This two-day conference had 97 attendees registered, from ten US states (CA, CO, IA, ID, IL, KS, MN, MO, NE, WI). MRASH presentations and activities were selected to provide attendees with skills and resources on fundamental safety and health hazards (e.g., livestock safety, noise exposures, and injury surveillance) as well as updates on resource availability, evaluation methods, and behavioral health. At the end of the conference, there was also an anhydrous ammonia safety training for local emergency responders. (P&E Core)
Other	Gibbs J, Janssen B, Rohlman. (2018). Guest Editorial: Slow down during Farm Safety Week, March 2-9, 2018. g National Farm Safety & Health Week on September 16-22. Published in four newspapers in March 2018: Charles City Press, Charles City, IA; Tama News-Herald, Tama, IA; Mount Vernon Sun, Mt. Vernon, IA; Sigourney News Review, Sigourney, IA. (P&E Core)
2019	
Educational aids or curricula	Gibbs J. Mental health and suicide risk in agricultural and rural communities. Developed a series of educational slides describing the current science on suicide risk among farmers, common stressors, and how farmers cope. The slides were used during a Question, Persuade, and Refer (QPR) training at Sharon Center United Methodist Church with the Johnson County Crisis Center in Kalona, IA on November 14th, 2018. The educational slides were also presented in a ZOOM webinar during the Mental Health Awareness call, held by the NIOSH AFF Center ECO Group (Evaluators, Coordinators, and Outreach Personnel), on January 30, 2019.m (Emerging Issue)
Other	Gibbs JL. (2019). U.S. Ag Centers Mental Health Activities Summary. The document was prepared by the NIOSH Evaluators/Coordinators/Outreach (ECO) group to summarize ongoing mental health projects and outreach. On February 4, 2019, the document was shared to all 11 AFF Centers and shared with partners at the Federal Office of Rural Health Policy and the National Rural Health Association. (Emerging Issue)
Other	Gibbs J. (2019). Updates on pesticide drift in Iowa. Practical Farmers of Iowa Conference, January 18, 2018. Ames, IA. 45 attendees, including farmers and agronomists attended this session for continuing education credits.(Emerging Issue)
Other	Anthony TR, Cheyney M, Gibbs J, Wedeking SE. (2019). Protégase del gas de estiércol (Protect yourself from manure gases). Educational brochure in Spanish. Available at https://gpcah.public-health.uiowa.edu/resources-in-spanish/ (Emerging Issue)
Other	Janssen B: [2019] Farm stress and mental health. Interview for WHO TV (NBC) Agribusiness Report. May 2019 (Emerging Issue)
Other	Janssen B: [2019] Farmer stress and mental health. Interview for The Daily Skimm Podcast. May 2019. (Emerging Issue)
Other	Staff Writer: [2019] For May Mental Health Awareness Month, Dairy Girl Network is offering a mini-series on behavioral health topics. The Bolvine. May 6, 2019. Includes information on a webinar given by D Rohlman on mental health. (Emerging Issue)

Educational aids or curricula	Gibbs J, Afifi R: [2019] Mental health and suicide risk in agricultural communities. Presented to CommUnity Crisis Services, Coralville, IA, Aug 6, 2019. Attended by 20 CommUnity staff and volunteers as well as community members interested in providing mental health services to rural and farming communities. (Emerging Issue)
Other	Gibbs J, Rudolphi J, Jones-Bitton, A, O'Hara P, Moynihan M, Chasek C, Holstrom A: [2019] What's Next? Overcoming Mental Health Stigma in Agricultural Communities. International Society for Agricultural Safety and Health Conference (ISASH); Des Moines, IA, Jun 24-27, 2019. (GPCAH-coordinated Panel) (Emerging Issue/Pilot collaboration)
Other	Rural PREP Grand Rounds: Mental health in rural communities – the example of the Midwest dairy farmer (Emerging Issue)
Other	Fitzpatrick A: [2019] Iowa organization works to break stigma of mental illness in agricultural communities. The Daily Iowan. Story includes an interview with J Gibbs. May 5, 2019. At https://dailyiowan.com/2019/05/05/iowa-organization-works-to-break-stigma-of-mental-illness-in-agricultural-communities/ (Emerging Issue)
Other	Gibbs J, Mosher G: [2019] Mental health and the agribusiness workforce: ISASH Networking Reception. The session featured flash talks and provided opportunities for participants to present their diverse research, model programs, and other projects. International Society for Agricultural Safety and Health Conference, Des Moines, IA. Jun 26, 2019. 45 attendees. (Emerging Issue)
Other	Janssen B: [2019] Farmer mental health. Interview for Iowa Watch. Jun 2019. (Emerging Issue)
Other	Cheyney M, Hartis A: [2019] Manure Gas Safety: Use of Gas Monitors. International Society for Agricultural Safety and Health Conference (ISASH); Des Moines, IA, Jun 24- 27, 2019. (Educational Display) (Emerging Issue)
Other	Gibbs J: [2019] Mental Health Networking Session, ISASH; June 27, 2019, Des Moines, IA. Coordinated networking session at ISASH to bring stakeholders into a room to discuss needs and opportunities to address mental health needs of North American farmers. Incorporated survey of needs and actions taken to reduce stigma from 50 participants. Policy makers attended. (Emerging Issue)
Other	Staff Writer: [2019] Mental Health Awareness Month focuses on farmers. WhoTV. May 28, 2019. Story includes interview with B Janssen. At https://whotv.com/2019/05/28/mental-health-awareness-month-focuses-on-farmers/ (Emerging Issue)
Other	Janssen B: [2019] Farmers and mental health. Article for the Des Moines Register. Apr 2019. (Emerging Issue)
Other	Anthony T, Arora K: [2019] What is hurting farmers in Iowa? Data for injury prevention conversations with rural farmers. Midwest Rural and Agricultural Safety and Health Conference, Marshalltown, IA. Nov. 13, 2019 (P&E Core)
Other	Fethke N, Anthony T: [2019] Community outreach grant writing skills for rural health professionals. Midwest Rural and Agricultural Safety and Health Conference, Marshalltown, IA. Nov. 13, 2019 (P&E Core)
Other	Arora, K: [2019] A Needs Assessment of Agricultural Health and Safety Concerns in the US Midwest. International Society for Agricultural Safety and Health Conference (ISASH); Des Moines, IA, June 24-27, 2019. (Poster) (Evaluation)
Other	Gibbs J: [2019] Updates on pesticide drift in Iowa. Practical Farmers of Iowa Conference, Ames, IA, Jan 18th, 2019. 45 attendees. (Invited speaker) (Emerging Issue)

Other	Hartis A: [2019] Hydrogen sulfide monitor education for use in agricultural operations. 4th Annual Occupational Health & Safety Student Research Conference, Iowa City, IA, Apr 26, 2019. (Poster) (Emerging Issue)
Other	Hartis AE: [2019] Hydrogen sulfide monitor education for use in agricultural operations. MS Thesis, Occupational and Environmental Hygiene (Industrial Hygiene), University of Iowa. August 2019. Available at https://www.proquest.com/pagepdf/2310307940/Record/38C5DCE8FA8A46E2PQ/1?accountid=14663 (Emerging Issue)
Other	Gibbs J: [2019] Colleen McRoberts, Crisis Services Coordinator at CommUnity Crisis Services and Food Bank requested a presenter about stress and suicide rates and culturally specific factors related to overcoming stigma and mental illness in farming communities for employee in-service. Jun 6, 2019. (Mental Health)
Other	Patterson J: [2019] Press release: Great Plains Center for Agricultural Health works to keep agricultural communities informed about safety. Sept 9, 2019 (P&E Core)
Other	Janssen B, Anthony TR, Gibbs J, Afifi R: [2019] Mental Health Roundtable. May 3, 2019, Des Moines, IA. Met with Iowa Department of Ag and Land Stewardship, CommUnity Crisis Services, Extension, and representatives from producer groups and mental health providers. 29 attendees. Discussed resources, challenges, and path forward. (Emerging Issue)
Other	Godwin K: [2019] Farmer suicide and access to care in Iowa. MS Thesis, Agricultural Safety and Health, University of Iowa. May 2019. (Emerging Issue)
	Patterson. J: [2019] Press release about 2019 joint conference brings disaster response in rural areas, emergency response planning, mental and behavioral health, and more to the forefront. Oct 17 At . https://gpcah.public-health.uiowa.edu/great-plains-center-for-agricultural-health-works-to-keep-agricultural-communities-informed-about-safety/
2020	
Educational Aid	Cloth face covering guidance for COVID-19, at https://gpcah.public-health.uiowa.edu/cloth-face-covering-ga-video-and-demo-series/
Educational Aid	Frequently Asked Questions about COVID-19, at https://gpcah.public-health.uiowa.edu/covid-19_april/ , see also archives at https://gpcah.public-health.uiowa.edu/covid-19-resources-archive/
Educational Aids	COVID-Posters in English (https://gpcah.public-health.uiowa.edu/posters/) and Spanish (https://gpcah.public-health.uiowa.edu/posters-for-spanish-speakers/) -- Series of 5: Who is at risk? Cleaning and Disinfecting, Physical distancing, Infographic, How masks work
Audio or video	COVID-19 Prevention on the Farm Q&A: Tips for selecting a Cloth Face Covering, video at https://youtu.be/qil3ZL1btZ0
Audio or video	Cloth Face Coverings Donning and Doffing Demo: One Tie, video at https://youtu.be/a_IDaULpjkq
Audio or video	Cloth Face Coverings Donning and Doffing Demo: Dual Tie, video at https://youtu.be/pn8psY3EmiA
Audio or video	Cloth Face Covering Donning and Doffing Demo: Elastic Bands, video at https://youtu.be/uJeGdZd_Q1Q
Audio or video	Cloth Face Covering Donning and Doffing Demo: Ear Straps, video at https://youtu.be/H5yt1xARXQ4
Audio or video	COVID-19 Timeline, video at https://youtu.be/xePKImLS_SU
Audio or video	Symptom Screening during the COVID-19 Pandemic, video at https://youtu.be/iJb0TeLcyf8

Audio or video	COVID-19 and the Hierarchy of Controls, at https://youtu.be/FyBMpdaEaD4
Other	Patterson J: [2020] Press Release: 2020 GPCAH Pilot Grants, 4/1/20, available at https://gpcah.public-health.uiowa.edu/6043-2/ Press release announcing competitive pilot grant applications (P&E Core)
Other	Patterson J: [2020] Press Release: Preventing and controlling COVID-19 on the farm, 6/2/20, at https://gpcah.public-health.uiowa.edu/preventing-and-controlling-covid-19-on-the-farm/ Press release about the release of the CDC guidelines and how GPCAH can help farmer workers understand recommendations (Emerging Issue)
Other	Patterson J: [2020] Press Release: Virtual conference is taking Midwest farm safety to the world, 10/14/20, at https://gpcah.public-health.uiowa.edu/virtual-conference-is-taking-midwest-farm-safety-to-the-world/ Press release announcing the 2020 virtual MRASH conference(P&E Core)
Other	Anthony R, Crawford K, Patterson J: [2020] Holidays 2020: Recommendations to Prevent COVID-19 Spread. Farm Families Alive and Well Newsletter 27(1): December 2020. At https://gpcah.public-health.uiowa.edu/wp-content/uploads/2020/12/Alive-Well-Newsletter-December-2020.pdf (Emerging Issue)
Other	Arora, K and Patterson J. [2020] What are Midwestern farmers' top concerns and stressors? <i>Farm Families Alive and Well Newsletter</i> 26(2) March 2020. At https://gpcah.public-health.uiowa.edu/wp-content/uploads/2020/03/Alive-Well-Newsletter-March-2020.pdf (Evaluation)
Other	Staff Writer: [2020] Article titled Trauma care for injured farmers often delayed by almost an hour compared with other rural workers: study. Safety+Health. October 30, 2020. At https://www.safetyandhealthmagazine.com/articles/20466-trauma-care-for-injured-farmers-often-delayed-by-almost-an-hour-compared-with-other-rural-workers-study (P&E Core)
Other	Taylor J: [2020] UI Study Shows Agriculture Workers More Likely to Have Dementia. WHO Newsradio 1040. February 1, 2020. At https://whoradio.iheart.com/content/2021-02-01-ui-study-shows-agriculture-workers-more-likely-to-have-dementia/ (P&E Core)
2021	
Other	Arora K and Patterson J: [2021] Press Release: Study shows working in agriculture poses higher risk of developing dementia, 1/19/21. Press release announcing publication highlights of Center Evaluator's paper in <i>Journal of Gerontology</i> . At https://gpcah.public-health.uiowa.edu/press-release-study-shows-working-in-agriculture-poses-higher-risk-of-developing-dementia/ (P&E Core)
Other	Staff Writer: [2021] Press release titled Study shows agriculture workers more likely to have dementia. University of Iowa. February 3, 2021. At https://www.public-health.uiowa.edu/news-items/study-shows-agriculture-workers-more-likely-to-have-dementia/ (P&E Core)
Other	Murray S: [2021] News article titled College of Public Health examines mental health challenges for farmers. The Daily Iowan. February 9, 2021. At https://dailyiowan.com/2021/02/09/college-of-public-health-examines-mental-health-challenges-for-farmers/ (Emerging Issue)
Other	Brooks G: [2021] Recent study shows agriculture workers have a greater chance of having dementia. Story about the results of the Health and Retirement Study by K Arora. CBS14 Fox44 Siouxland News, CBS2, and KCRG. January 31, 2021. At https://siouxlandnews.com/news/local/recent-study-shows-agriculture-workers-have-a-greater-chance-of-having-dementia and

	https://cbs2iowa.com/news/local/recent-study-shows-agriculture-workers-have-a-greater-chance-of-having-dementia (P&E Core)
Other	Crawford K: [2021] FarmSafe: From a seed to a podcast. Midwest Rural Agricultural Safety and Health (MRASH) Conference. November 8-12, 2021. (P&E Core)
Other	Crawford K: [2021] The US Agricultural Safety and Health Centers' YouTube Channel: Examining viewership of agricultural health and safety videos. Midwest Rural Agricultural Safety and Health (MRASH) Conference. November 8-12, 2021. (Evaluation)
Other	Crawford K and Anthony TR: [2021] Developing the FarmSafe Podcast. NORA AgFF Sector Council, November 17, 2021. (P&E Core)
Other	Anthony TR: [2021] Information provided to caller about respirators and respirator fit testing. Dec 28, 2021. (P&E Core)
Other	Crawford K: [2021] Listen up! The FarmSafe Podcast is Here. Alive & Well Newsletter. 27(4):1. Sept. (P&E Core)
Other	Anthony TR: [2021] Director's Message: New Communication Avenues. Alive & Well Newsletter. 27(4):2. Sept. (P&E Core)
Other	Patterson J: [2021] Don't be Shy! Start the Conversation about Preventing Farm Injuries. Alive & Well Newsletter. 27(4):3. Sept (P&E Core)
Other	Patterson J: [2021] Access Core Course Materials, Audio, and Online Modules at No Cost. Alive & Well Newsletter. 27(4):3. Sept. (P&E Core)
Other	Olson G and Patterson J: [2021] Register Now and Join MRASH's Effort to "Raise the Cloak of Invisibility". Alive & Well Newsletter. 27(4):4. Sept (P&E Core)
Other	Crawford K: [2021] "There's an App for That!" Help Us Test the New Farm Safety Checklist App. Alive & Well Newsletter. 27(4):4. Sept. (P&E Core)
Other	Patterson J: [2021] Drought Can Lead to More than the Summertime Blues in Farmers. Alive & Well Newsletter. 27(4):3. Sept. (P&E Core)
Other	Aurora K: [2021] Do You Take Care of a Family Member with Dementia? Alive & Well Newsletter. 27(4): 6. Sept. (P&E Core)
Other	Rudolphi J: [2021] Help Researchers Learn About Stress in the Household by Participating in a Farm Family Survey. Alive & Well Newsletter. 27(4):6. Sept. (P&E Core)
Other	Gibbs J: [2021] New Interactive Informational Resources: Guidance for Farmers when Using Respirators in Agriculture. Alive & Well Newsletter. 27(4):4. Sept. (P&E Core)
2022	
Other	National Farm Safety and Health Week: Overall Farmer Health. KCRG 4 PM News. Interviewed by Jim Martens (livestream). Sept. 2022. (P&E Core)
Other	Froust Prater L: Back Pain Can Be Attributed to Whole-Body Vibration. Successful Farming. Aug. 2022. LINK (2011-16 Project)
Other	Anthony TR: [2022]. Director's Message. Alive & Well Newsletter. 28(4):2. Sept. (P&E Core)
Other	Aurora K: [2022]. Dementia and Farm Safety. 28(4):3. Sept. (P&E Core)
Other	Anthony TR: [2022]. Farm Safety App. Alive & Well Newsletter. 28(4):5. Sept (P&E Core)

Other	Patterson J: [2022]. Timely Web Resources: Mental Health and Farmers. Alive & Well Newsletter. 28(4):6. Sept (P&E Core)
Other	Patterson J: [2022]. GPCAH Pilot Grants are Available to Develop a New Line of Research Inquiry for Preventing Injury and Illness on the Farm. Alive & Well Newsletter. 28(4):7. Sept. (P&E Core)
Other	Crawford K: [2022]. FarmSafe Podcast. Alive & Well Newsletter. 28(4):8. Sept. (P&E Core)
Other	Crawford K and Patterson J: [2022]. Catching Up with the FarmSafe Podcast. Alive & Well Newsletter. 28(2):3. Mar. (P&E Core)
Other	Anthony TR: [2022] Request for information/materials on whole body vibration by nurse in Agrinurse program. May 17, 2022. (P&E Core)
Other	Arora, K: [2022] Request to use article information and link from Dementia and Farm Safety (Alive & Well Newsletter, June 2022) in UMASH spotlight article. Sept 8, 2022(P&E Core)
Other	Aurora K: [2022] Legislative analyst Tania Calle requested dementia in agricultural workers study findings. (P&E Core)
Other	Smaellie E: [2022] Respiratory Protection on the Farm, Farm Progress Show, Boon, IA. Aug 30-September 1, 2022. (Emerging Issue)
Other	Arora, K: [2022] Request to use article information and link from Dementia and Farm Safety (Alive & Well Newsletter, June 2022) in UMASH spotlight article. Sept 8, 2022. (P&E Core)
2021-22 podcast	
Audio or video	<p>FarmSafe Podcasts, all available at https://gpcah.public-health.uiowa.edu/farmsafe/ (P&E Core)</p> <ol style="list-style-type: none"> 1. Crawford, K. 2021. <i>FarmSafe Podcast Introducing FarmSafe and the Great Plains Center for Agricultural Health</i> [Audio podcast episode]. August 20, 2021 2. Crawford, K. 2021. <i>FarmSafe Podcast: ATVs on Roadways</i> (Guest: Charles Jennissen) [Audio podcast episode]. Sept. 1, 2021 3. Crawford, K. 2021. <i>FarmSafe Podcast: Young ATV Riders</i> (Guest: Charles Jennissen) [Audio podcast episode]. Sept. 15, 2021 4. Crawford, K. 2021. <i>FarmSafe Podcast: ATVs on the Farm</i> (Guest: Charles Jennissen) [Audio podcast episode]. Sept. 29, 2021 5. Crawford, K. 2021. <i>FarmSafe Podcast: ATV Safety Features</i> (Guest: Carolyn Sheridan and Jenna Gibbs) [Audio podcast episode]. Oct. 13, 2021 6. Crawford, K. 2021. <i>FarmSafe Podcast: Sleep</i> (Guest: Amanda Prokasky and Susan Harris) [Audio podcast episode]. Oct. 27, 2021 7. Crawford, K. 2021. <i>FarmSafe Podcast: Whole Body Vibration</i> (Guests: Fred Gerr and Nate Fethke) [Audio podcast episode]. Nov. 6, 2021 8. Crawford, K. 2021. <i>FarmSafe Podcast: Thanksgiving Special</i>. [Audio podcast episode]. Nov. 24, 2021 9. Crawford, K. 2021. <i>FarmSafe Podcast: Lighting and Marking in Agriculture Vehicles</i> (Guests: Marsha Cheyney, Roadway) [Audio podcast episode]. Dec. 8, 2021. 10. Crawford, K. 2022. <i>FarmSafe Podcast: Cold Weather Gear</i> (Guests: GPCAH) [Audio podcast episode]. Jan. 12, 2022. 11. Crawford, K. 2022. <i>FarmSafe Podcast: Falls on Ice</i> (Guest: Kathy Lee) [Audio podcast episode]. Jan. 26, 2022. 12. Crawford, K. 2022. <i>FarmSafe Podcast: Cold Weather Training Tips</i> (Guest: Maristela Rovai) [Audio podcast episode]. Feb. 9, 2022.

13. Crawford, K. 2022. *FarmSafe Podcast: Grain Bin Safety* (Guests: Salah Issa) [Audio podcast episode]. Feb. 23, 2022.
14. Crawford, K. 2022. *FarmSafe Podcast: Anhydrous Ammonia* (Guest: Dan Neenan, **Pilot**) [Audio podcast episode]. Mar. 9, 2022.
15. Crawford, K. 2022. *FarmSafe Podcast: Research Spotlight: Farm Vehicle Crashed on Public Roads* (Guests: Matt McFalls and Marizen Ramirez, **Roadway**) [Audio podcast episode]. Mar. 23, 2022.
16. Crawford, K. 2022. *FarmSafe Podcast: Avian Influenza* (Guests: Renee Anthony and Matt Nonnenmann, **Emerging Issue**) [Audio podcast episode]. Apr. 7, 2022.
17. Crawford, K. 2022. *FarmSafe Podcast: Pilot Spotlight: Stress on the Farm: Strategies to Help Each Other* (Guests: David Brown, **Pilot**) [Audio podcast episode]. Apr. 20, 2022.
18. Crawford, K. 2022. *FarmSafe Podcast: Airing Out Farm Stress* (Guests: Meg Moynihan, **Pilot**) [Audio podcast episode]. May 4.
19. Crawford, K. 2022. *FarmSafe Podcast: Pilot Spotlight – Examining Support Systems for Farmers’ Mental Health* (Guest: Yanni Liang, **Pilot**) [Audio podcast episode]. May 18, 2022.
20. Crawford, K. 2022. *FarmSafe Podcast: Pilot Spotlight – Job Demands and Health Outcomes for Beginning Farmers* (Guests: Maya Ramaswamy, **Pilot**) [Audio podcast episode]. Jun. 1, 2022.
21. Crawford, K. 2022. *FarmSafe Podcast: Manure Gas Safety* (Guest: Renee Anthony, **Emerging Issue**) [Audio podcast episode]. Jun. 29, 2022.
22. Crawford, K. 2022. *FarmSafe Podcast: Gas Monitors* (Guest: Renee Anthony, **Emerging Issue**) [Audio podcast episode]. Jul. 13, 2022.
23. Crawford, K. 2022. *FarmSafe Podcast: Season One Wrap-Up* (Guest: Matison Bentley) [Audio podcast episode]. Jul. 27, 2022.
24. Bentley, M. 2022. *FarmSafe Podcast: Farm Progress Show 8/30-9/1* (Guest: Marsha Cheyney, **Outreach**) [Audio podcast episode]. Aug. 30, 2022.
25. Bentley, M. 2022. *FarmSafe Podcast: Women in Agriculture and Safety Issues* (Guests: Shelby Wright and Susan Wright) [Audio podcast episode]. Sept. 21, 2022.

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

This information is provided only in the *GPCAH OVERALL* component, in concurrence with guidance from our Program Officer.

D.2 Personnel updates

- a. Level of Effort: n/a
- b. New Senior/Key Personnel: n/a
- c. Changes in Other Support: n/a
- d. New Other Significant Contributors: n/a

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

Nothing to report

E.2 – What is the impact on physical, institutional, or information resources that form infrastructure?

Not applicable.

F. CHANGES

F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures

Nothing to report

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

Nothing to report.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

Nothing to report

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements

Nothing to Report

G.2 Responsible Conduct of Research

Nothing to report

G.3 Mentor's Research Report or Sponsor Comments

N/A

G.4 Human Subjects

G.4.a Does the project involve human subjects?

No. IRB approval was obtained for overarching approval; no activity resulted in human subjects recruitment.

G.4.b Inclusion Enrollment Data

None

G.4.c ClinicalTrials.gov

N/A

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?

No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?

No

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?

No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?

No

G.8 Project/Performance Sites

The University of Iowa, 105 Jessup Hall, Iowa City, IA 52242-1316
Congressional District IA-002
UEI: Z1H9VJS8NG16

Ag Health and Safety Alliance, 4560 230th Ave, Greenville, IA 51343
Congressional District: IA-02
UEI: PW5GJ6179MC3

G.9 Foreign Component

No foreign component

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

Not applicable

G.11 Program Income

Is program income anticipated during the next budget period?

Not applicable

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?

Not applicable

I. OUTCOMES

The Planning & Evaluation (P&E) Core of the Great Plains Center for Agricultural Health (GPCAH) was responsible for coordinating and communicating injury and illness surveillance, coordinating, and facilitating communication between center and stakeholders, and identifying and responding to emerging issues posing risks to the health and safety of agricultural workers throughout our region. This Core is also tasked with managing center resources, reporting to our funder, and implementing evaluation program to maximize our impact on the region's safety and health.

We surveyed farmers and health care providers to understand the safety and health priorities of farming operations, reaching out to farmers in Iowa, Ohio, Minnesota, Missouri, and Nebraska and identified top concerns centered on chemical safety, tools/equipment safety, and health outcomes (including respiratory, hearing loss, cancer). Surveying rural healthcare providers identified that *musculoskeletal diseases* and *mental health illnesses* are most likely to affect their ability to farm and that *musculoskeletal, acute injuries* including *lacerations* and *sprains* are the conditions most treated for patients that farm. In looking at trauma records, evaluating what is most often sending a farmer to the emergency room for treatment, the hazards look different from farmer concerns and healthcare provider treatments: interaction with equipment (748, 37.8%), falls (428, 21.6%), transportation (416, 21%), and natural/environmental -- which does include animal-caused injuries-- (235, 7.8%). These studies identify the farmer concerns that have to be addressed (with resources) and then address hazards seen by both routine medical providers (less severe but common) and by trauma care (more severe but less common).

We participated in multiple networks to exchange information about hazards and prevention messaging (Outreach Core) and research findings from our Research Core. Formal quarterly regional advisory meetings and annual external advisory meetings provided direction and new partnerships to magnify what we accomplished. The P&E Core also coordinated stories for the quarterly *Alive and Well* newsletter, participated and sponsored the Midwest Rural and Agricultural Safety and Health (MRASH) conference, shared information through social media accounts, and generated press releases and coordinated investigator connections with interested media to share research findings and promote health and safety on the farm. New ways of sharing safety and health messages were explored by the P&E Core by developing the [FarmSafe](#) podcast, which incorporated telling a first-hand story of an incident on the farm followed by with messages of prevention.

Hazards that emerged over the course of the 6-year project that we provided community guidance on include topics related to manure gas safety, pesticide drift, mental health, COVID-19, and avian influenza. Below are some of the **key messages** from these Emerging Issues Projects.

Manure Gas (Hydrogen Sulfide) in Livestock Operations

- Low cost (\$100-200) monitors are available and should be used when working around manure
- Critical features of the monitors include: concentration should be displayed; size not too small so it falls between floor slats; units with hibernation cases may extend the life span of units, but don't expect the chemical sensors to last longer than 2 years
- Critical features to using these monitors includes: wear them near your face, not on your belt; bump checks are the only way to know they will alarm if you are in danger; education on how to respond to alarms and how to interpret the concentrations is critical to safe use of these monitors

Pesticide Drift

- Dicamba brought drift to the attention when crops were damaged, but drifts occur when application doesn't follow recommended practices
- Herbicides are most likely reported as drifts in the spring, fungicides in the summer (matching seasonal application needs)
- [Story map](#) may be useful to educational efforts of pesticide applicators and farmers
- Applications when the wind is < 10 mph is best, but gusts are important to consider; use handheld velocity meters to check windspeed at your site (not at the airport)
- Temperature and humidity affect how quickly droplets evaporate, and smaller droplets travel farther, causing damage from drift and wasting money
- We shared findings at a GPCAH co-sponsored *Pesticides and Public Health in Iowa* networking meeting (May 2018)

Mental Health

- After collaborating with local clergy to prepare an op-ed article in the newspaper, we helped convene clergy around the region for a discussion and QPR training session. This session identified gaps in urban call center volunteers and rural farmers/farm workers that needs to be addressed in these trainings.
- We co-sponsored a Rural Mental Health Roundtable to openly discuss concerns and observations with key stakeholders
- We compiled national resources for a May 2018 National Mental Health Awareness month for media and Ag Centers.
- We provided training to CommUnity Crisis Center for in-service training to inform volunteers on the stressors on the farm, including input from the *P&E Core* farmer needs assessment survey (August 2019)
- We coordinated a Mental Health Round Table at the June 2019 ISASH meeting (50 participants)

COVID-19

- Initial posting of frequently asked questions (that were coming in from all Iowa citizens, including rural communities, schools, parents, and businesses) were organized in an FAQ that was initially updated frequently; most of these are now archived for posterity.
- We worked with other NIOSH Ag centers to split up topics to cover, and our Center focused on respiratory protection / masks, and symptom screening, bringing in IH and Medical expertise
- Interview style videos were first developed to answer questions coming in from the community
- Early informational posters (cleaning and disinfection; social distancing) evolved into multi-center collaborative posters on protecting ag workers and cloth face covering protection levels
- Our COVID timeline video explains why the 14-day quarantine/10-day post symptom isolation period was recommended in the pre-vaccination era: this has been watched by 13,000 viewers by the end of the project period.

Avian Influenza

- We updated the 2015 Avian Influenza PPE Guidelines in April 2022, shortly after outbreaks occurred in the Midwest, updating links and videos.
- We used the [FarmSafe](#) podcast to quickly provide information to producers (April 7 episode) about resources and protective measures.
- We collaborated with AgriSafe, CS-CASH, and UMASH to revise the PPE Guideline and replaced our posted interim document with the multi-center final version in June 2022.
- We generated a [new web page](#) with current resource and state-specific guidance for our center
- Respirator fit testing resources do not exist in the Midwest, so surveys of farmers and FFA advisors are underway to identify where farmers have/would go to get fit tested for use on the farm.

A. COVER PAGE

Project Title: Great Plains Center for Agricultural Health	
Component Title: Instrumented Farm Vehicle Roadway Study	
Component Project Lead: Hamann, Cara	
Grant Number: 5 U54OH007548	Project/Grant Period: 9/30/16 - 9/29/22
Reporting Period: 9/30/16 – 9/29/22	Date Submitted:
Program Director/ Principal Investigator T. Renee Anthony, BS, MS, PhD Ph: 319-335-4429 Email: renee-anthony@uiowa.edu	Administrative Official Information Wendy Beaver Executive Director, Division of Sponsored Programs 2 Gilmore Hall Iowa City, IA 52242 Ph: 319-335-2123 Email: nih@uiowa.edu
Change of Contact PD/PI: N/A	
Human Subjects: No	Vertebrate Animals: No
hESC: No	Inventions/Patents: No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Phase 1: Using *SaferTrek*, an innovative GPS/video integrated data acquisition system developed by this research team, we will record farm equipment roadway exposure and behavior of vehicle drivers approaching the farm equipment from behind.

Aim 1: Measure farm equipment exposure to the roadway (miles traveled, location) and the frequency with which cars approach the farm equipment.

Aim 2: Identify behavior of vehicle drivers as they approach farm equipment from behind. Behaviors to be examined include speed, deceleration while approaching farm equipment, following distance, number of passing attempts, and passing.

Phase 2: Develop, implement, and evaluate a community-level intervention to increase driver awareness and reduce driving errors in order to protect farm equipment operators.

Aim 3: Estimate the effectiveness of a community campaign by measuring change in attitude and perceptions of threat, efficacy, and norms about safe driving around farm equipment via surveys and interviews.

Aim 4: Measure effectiveness of a community campaign to improve driver behavior when approaching farm equipment on the roadway, using objective data from *SaferTrek*.

B.2. What did you accomplish under these goals?

MAJOR ACTIVITIES

Phase 1: Naturalistic Driving Data

For this study, a custom data collection device called *SaferTrek* was developed through an iterative design and testing process. Using approximately 20 *SaferTrek* devices, farm equipment roadway data were captured during four agricultural seasons (3 harvests and 1 planting).

Major accomplishments include:

- A process was finalized to detect when vehicles were captured in the video recordings and excerpt a video clip of each vehicle detection. Video recordings from all four data collections were processed to detect vehicles and output video excerpts around each detection, though some detections from spring 2019 were impacted due to rotated camera views.
- Processes were developed for extracting GPS and speed profile data that coincided with each vehicle detection video excerpt as well as for each trip where the farm equipment vehicle's speed was above 8 mph.
- Three approaches for estimating the following distance of a vehicle traveling behind the farm equipment were developed using test-track data collected with multiple *SaferTrek* devices and high-accuracy GPS units, with a sedan and a pickup truck each in the following position. The best performing algorithm had a distance error (relative to the distance measured with GPS units) of approximately 0.5 m (range: -1.7, 5.1 m) for the sedan and 0.4 m (range: -.27, 1.97 m) for the pickup truck. These results were published and presented (conference poster):
 - Arabi S, Sharma A, Reyes M, Hamann, C Peek-Asa C. [2022]. Farm Vehicle Following Distance Estimation Using Deep Learning and Monocular Camera Images, *Sensors*. 22(7): 2736. PMC9003299, <https://doi.org/10.3390/s22072736>
 - Arabi, S: [2022] Farm Vehicle Following Distance Estimation by Using Deep Learning and Monocular Camera Images. 2022 Transportation Research Board Annual Meeting, Washington, DC, January 9-13.

- Algorithms for processing the video images to isolate individual vehicles; deriving distance estimates for a following vehicle; and classifying the trajectories of following vehicles were developed. All three harvest season data have been processed using these algorithms.
- Protocols for importing GPS data into GIS software, processing the data to extract on-road trips, and integrate the data with the state road network database (roadway class, posted speed limit, annual average daily traffic, etc.) were developed. Development of the final pipeline for processing GPS data is in progress, but anticipated to be completed very soon. A product that will come from this process is an R package called MapMatchr, which is an R interface for a fast map matching utility that snaps noisy GPS data to roads. This package will be made available publicly along with documentation explaining how to use it.
- A custom graphical user interface (GUI) and annotation guide were developed for this project.
- A team of analysts was trained to use the GUI and annotation guide to annotate the video data for vehicle interactions identified via image processing meeting certain criteria. The annotation of 886 video recordings of farm equipment-passenger vehicle interactions was completed in fall 2022.

Phase 2: Safety Campaign

Two communities were identified and designated as intervention and control. 100 intercept surveys were completed in each community pre-intervention. A community advisory board (CAB) was created for this study, consisting of 8 community members from the intervention community. With the help of the CAB we developed a community-level campaign called “We’re on this Road Together” with the key behavioral messages of Avoid Passing, Leave More Space, and Slow Down. The campaign was implemented during summer and fall of 2019. It was intended to be in place for an entire calendar year, but that plan was changed due to the COVID-19 pandemic. However, there were still campaign materials posted throughout the community into 2020. Planned post-intervention intercept surveys were also modified in response to the pandemic. They were conducted virtually instead of in-person and only in the intervention community, not the control community. The targeted number (100) surveys were completed by sharing survey links on intervention community social media channels and via community email listservs. Data from the pre- and post-intervention surveys is being analyzed to examine the impact of the campaign on community perceptions.

In lieu of conducting additional campaign activities into 2020 as originally planned, we conducted a process evaluation with the community advisory board (CAB) to assess the effectiveness of the community engagement in campaign development and dissemination. All 8 CAB members completed telephone interviews conducted by one of the project’s research assistants. Interviews were recorded and transcribed by a third-party vendor. Results from this process evaluation were published in the *Journal of Transport & Health*.

Hamann C, Daly E, Schwab-Reese L, Askelson N, Peek-Asa C: [2021] Community engagement in the development and implementation of a rural road safety campaign: Steps and lessons learned, *Journal of Transport & Health*, 23: 101282. PMC9348780 <https://doi.org/10.1016/j.jth.2021.101282>

A paper based on results from the baseline community surveys is in preparation (Accident Analysis and Prevention), which is focused on examining predictors of rural driver self-reported passing behaviors when interacting with farm equipment on the roadway.

SIGNIFICANT RESULTS

The vehicle detection algorithms were found to detect 98.5% of vehicles. The distance estimation algorithms were found to have an accuracy of about 0.5 m for the test track data. Preliminary results using the pinhole model and the baseline period data before the campaign showed that the average following distance of passenger vehicles behind farm equipment was 26.4 meters (range 2.91 to 50.0). Baseline results also showed the following distance decreased when farm equipment speed increased. Data processing and analyses are underway to compare driver behaviors from before versus after the campaign, relative to the control community, results forthcoming.

Results from the process evaluation showed that formation of a community advisory board was successful and critical in message development, implementation, and overall impact of the rural road safety campaign.

Preliminary survey results showed the campaign had good reach, as 59% of respondents recalled seeing the campaign messaging, and 73.8% correctly identified a location where the messaging had been posted. Over half (53.1%) of post-intervention survey respondents correctly recalled the content of the messages. There was a 9% increase in reports of having seen messages about safely sharing the road with farm equipment in the post-intervention period compared to pre-intervention.

KEY OUTCOMES OR OTHER ACHIEVEMENTS

All roadway data have been collected and data processing of the naturalistic data is nearly complete. All the image processing and annotation is complete and we are finalizing the GPS data processing. More than 400 deployments of the *SaferTrek* data collection devices occurred and each deployment was for 7-10 days, which resulted in 3100+ days of data collection. This translates to approximately 600 hours of on-road video. Data analyses and manuscript preparation will begin very soon.

A total of 200 pre-campaign surveys and 100 post-campaign survey were completed. Post-campaign surveys were not collected in the control community due to pandemic disruptions, which made it infeasible to develop relationships with the control community for adequate online dissemination of the survey.

We also completed the community campaign portion of the project, which involved summer and fall of 2019 campaign activities, post-intervention surveys, and a process evaluation with the community advisory board. The next step is to evaluate the impact of the campaign on community perceptions and driving behavior using both the survey data and the roadway data that were collected.

To date, 2 peer-reviewed papers have been published, 1 dissertation has been completed, and 12 conference presentations have been made based on results from this study. (See section C.)

DISCUSSION OF STATED GOALS NOT MET

Analyses to answer the main aims of this study have not yet been completed as of the time of this report. The data collection and processing experienced major delays due to the COVID-19 pandemic, which set back the timeline of the study. All data have been collected and data processing is nearly complete. The team will continue to work on analyses and papers in the coming months to answer the main research questions. Specifically, we will work on analyses related to the following: 1) farm equipment exposure to the roadway (miles traveled, location) and the frequency with which cars approach the farm equipment, 2) Identify behavior of vehicle drivers as they approach farm equipment from behind. Behaviors to be examined include speed, deceleration while approaching farm equipment, following distance, number of passing attempts, and passing, 3) Estimate the effectiveness of a community campaign by measuring change in attitude and perceptions of threat, efficacy, and norms about safe driving around farm equipment via surveys, 4) Measure effectiveness of a community campaign to improve driver behavior when approaching farm equipment on the roadway, using objective data from *SaferTrek*.

ROBUST AND UNBIASED RESULTS

All procedures that our team uses to review, code, and analyze the data from this study are standardized and documented to promote accuracy and consistency between the individuals completing the work and over time. Data visualization is a key tool in this effort and has already resulted in discoveries leading to improvements in data processing and accuracy. As previously described, we also used objective measurements from high-accuracy GPS devices and video annotation/coding to validate the data output by the video image processing algorithms.

B.3. Competitive Revisions/Administrative Supplements

None

B.4. What opportunities for training and professional development did the project provide?

While this Center does not serve the mission of training and providing professional development for Center personnel, 13 graduate students, 14 undergraduate students, and 2 post-doctoral scholars have provided time and expertise to several activities in the Roadway project, as detailed below.

Matt Finley was an undergraduate engineering student when he joined the project team in 2016. He worked on the initial design of the *SaferTrek* data collection device, including the approach of using magnetized switches to mount the devices on the farm equipment.

Nichole Griffith joined the project team in the second half of Year 1 when she was a third-year undergraduate majoring in electrical engineering. With guidance from both a professor and a research scientist in electrical engineering, by the end of Year 2 she had designed, implemented and tested software to control the *SaferTrek* data collection device and significantly contributed to the design, assembly and testing of the *SaferTrek* hardware. During Year 3, Ms. Griffith worked to upgrade the devices, build additional devices, and perform routine maintenance and repairs. Also during that year, she presented a poster about the device development at an engineering event featuring student research and at the 2018 Midwest Rural Agricultural Safety and Health Conference. Maintenance/repair activity continued into Year 4 and she also contributed to the collection of validation data with a radar sensor. Ms. Griffith received an undergraduate degree in electrical engineering in December 2019.

Grace Milroy was a second-year undergraduate majoring in electrical engineering when she joined the project team in the last month of Year 1. She assisted with testing power supplies, assembling *SaferTrek* devices, and verifying the GPS data that was recorded during the pilot data collection during the fall 2017 harvest (i.e., beginning of Year 2). Ms. Milroy received an undergraduate degree in electrical engineering in December 2020.

Alyssa Conrad joined the team in January 2018 when she was a second-year graduate student pursuing a MS degree in Epidemiology (conferred in 2018). She gathered data for more than 40 candidate communities and identified pairs that matched well as candidates for Phase 2 of the study. After the two communities were selected, she gathered information about potential contacts in each community, in addition to reviewing videos of 100+ vehicle interactions with farm equipment.

David Wu, an undergraduate in electrical and computer engineering, joined the team in Year 2. He investigated the possibility of integrating a radar device into one of the *SaferTrek* devices for data validation. In Year 3, David learned how to operate the radar sensor and used it to record validation data.

Chibuzo Nwakama, an undergraduate in electrical and computer engineering, joined the team in Year 2. He worked to modify a graphical user interface from a different project for the purpose of reviewing and coding GPS and video data for this project.

Henna McCoy joined the project team in the fall of 2018 when she was a second-year graduate student. She assisted with data processing, baseline intercept surveys, and literature review. Ms. McCoy received an MS in Epidemiology in May 2019.

Whitney Bash-Brooks worked on the project team during Years 3 and 4 while she was a graduate student in the Master of Science program in Community and Behavioral Health. She made significant contributions to the community intervention portion of the study. With guidance from the project PI and a faculty member from CBH, she developed and deployed intercept surveys, conducted primary analyses on those data, assisted with community advisory board meetings, and developed campaign materials.

Felicia Pieper also supported the community intervention portion of the study during Years 3 and 4 while she was a staff research assistant in CBH. She assisted with developing and conducting the intercept

surveys, assisted with community advisory board meetings, provided input on campaign material development, and coordinated administrative aspects of the study (e.g., incentive payments).

Aaron Wheeler joined the project team in September 2019 as an undergraduate majoring in electrical engineering. He was responsible for the maintenance and repair of the *SaferTrek* devices and batteries. He also contributed to the collection of validation data using high-end GPS recording devices. During Year 5 he also worked to make improvements to a graphical user interface that facilitates video annotation. Mr. Wheeler graduated in May 2021 with a BSE in Electrical Engineering.

During Year 3, as an undergraduate research assistant, **Laura Eckles** assisted with video review, played a major role in the dissemination of community campaign materials, conducted intercept surveys, and performed most of the field data collection activities in fall 2019. After receiving her bachelor's degree from the College of Public Health in December 2019, she worked as a research assistant through April 2020, contributing to data review and management. She also completed an observational survey in spring 2020 to determine how many businesses were still displaying the campaign window clings.

Kayla MacDonald was an undergraduate research assistant who contributed to the project during Years 4 and 5 and received a graduate degree from the College of Public Health in December 2020. She assisted with video review and data management/validation.

Caroline Tank contributed to the project in Years 4 and 5 while she was a graduate student studying industrial engineering. Ms. Tank has assisted with video review, data management, and performed most of the field data collection activities in fall 2020.

Eliza Daly received a graduate degree from the College of Public Health in spring 2020 and continued to work on the project as a research assistant during Year 5. She led the design and implementation of the community advisory board process evaluation and assisted with drafting those results for a published journal article.

Nicole Corcoran was a graduate student in industrial engineering during Years 4 and 5. She conducted extensive processing of the GPS data collected by the *SaferTrek* devices and joined it to the Iowa Road Network data. She received her MSE in Industrial Engineering in 2021.

Kayla Faust, post-doctoral scholar, worked on data management and analysis of intercept survey data and preparation of a related manuscript during Year 5.

Koray Ozcan was a post-doctoral scholar at Iowa State University during Years 2, 3, and 4. Dr. Ozcan consulted on the design of device and calibration requirements for the video cameras and developed preliminary procedures for processing the video data.

Arya Ketabchi Haghghat was a doctoral candidate in civil engineering at Iowa State University during Years 4 and 5. He designed the procedure for processing the video data to detect vehicles and extract video excerpts of vehicle interactions for further post processing. His PhD degree was conferred in 2022.

Saeed Arabi worked on the project during Years 4, 5, and 6 while he was a doctoral candidate in civil engineering at Iowa State University. Mr. Arabi devised the processes for estimating distance to the following vehicle in the video data using validation data collected on the closed track, for applying the distance estimation to the vehicle interactions recorded on-road, and for segmenting and classifying the behaviors (i.e., approaching, following, passing, flying pass) of vehicles following farm equipment. His PhD degree was conferred in 2022 and his work on this project was featured in his dissertation.

Ashirwad Barnwal was a doctoral candidate in civil engineering at Iowa State University during Year 6. Mr. Barnwal's work focused on smoothing, map matching, and classifying the GPS trip data. His PhD degree was conferred in 2022.

Atousa Zarindast was a doctoral candidate in civil engineering at Iowa State University during Year 6. She continued to refine Dr. Arabi's approaches for distance estimation and behavior classification in order to improve data accuracy and completeness.

Amir Ghanbari was a graduate research assistant in Epidemiology who joined the team during Year 6. Mr. Ghanbari translated the video annotation coding protocol into a draft guide to train the annotators on the annotation task and conducted testing of the graphical user interface during its development.

Stephanie Jansson was a graduate research assistant in Biostatistics who contributed to analysis of intercept survey questions about drivers perceptions of their own and others driving around farm equipment and to manuscript preparation in Year 6.

Kyle Hulscher was an undergraduate student in computer science who worked on the project in Year 6. He implemented the final design specifications and coding protocol for the video annotation into the graphical user interface (under the mentorship of Mr. Wheeler), resolved bugs, and implemented an automatic data backup feature.

The following undergraduate (u) and graduate (g) students worked on video review and annotation during Year 6: **Kaleb Brooks** (g), **Orlando Reyes** (u), **Seamus O'Connor-Walker** (u), **Josie Capesius** (u), **Esme Gibson** (u), **Abby Wiedmann** (u), and **Josh Ventling** (g).

B.5. How did you disseminate the results to communities of interest?

Results from our studies have been shared through multiple venues to reach a diverse group of stakeholders who can use both the tools and findings from this study. Specific details on presentations are provided in Section C.

Study methods and findings were presented to transportation experts and researchers at meeting such as the Statewide Traffic Records Coordinating Committee, Iowa DOT Local Technical Assistance Program, Transportation Research Board annual meeting, and the Mid-Continent Transportation Research Symposium. Attendees at these events learned not only about the technology advances developed in this study but were informed about the importance of farm equipment crashes as a public health issue and the need prevent future crashes.

The process evaluation from the community campaign were shared with researchers, academics, and practitioners in injury prevention, road safety, and ag safety, via publications (Journal of Transport and Health) and presentations (Society for the Advancement of Violence and Injury Research Conference; the Core Course's annual Ag Safety & Health Core Course).

General injury trends identified from this study were shared with safety and health organizations, including Midwest Region Ag Safety and Health Conference, International Society for Ag Safety and Health Conference, and the World Injury Conference, to inform researchers about new methods (e.g., *SaferTrek* and data processing protocols), to present methods on community-level interventions to prevent farm-vehicle crashes, and to share intercept survey results from community rural driver perceptions and beliefs.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

Not applicable

E. PRODUCTS

C.1. Publications, conference papers, and presentations

PUBLICATION Citation

Hamann C, Daly E, Schwab-Reese L, Askelson N, Peek-Asa C: [2021] Community engagement in the development and implementation of a rural road safety campaign: Steps and lessons learned, *Journal of Transport & Health*, 23: 101282. PMC9348780 <https://doi.org/10.1016/j.jth.2021.101282>

Arabi S, Sharma A, Reyes M, Hamann, C Peek-Asa C. [2022]. Farm Vehicle Following Distance Estimation Using Deep Learning and Monocular Camera Images, *Sensors*. 22(7): 2736. PMC9003299, <https://doi.org/10.3390/s22072736>

CONFERENCE PAPERS and Presentations Citations

2016

Finley M, Su Q: [2016] Farm equipment roadway study instrumentation, Statewide Traffic Records Coordinating Committee Meeting, Coralville, IA. September.

Peek-Asa C: [2016] Agricultural safety with a focus of rural roads. Invited keynote presentation. World Injury Congress. Tampere, Finland. Sept.

Peek-Asa C: [2016] Transportation safety research highlights. Local technical assistance program. Iowa Department of Transportation, Moravia, IA. Oct. 26.

Hamann CJ: [2016] Transportation safety research highlights. Local technical assistance program. Iowa Department of Transportation. Council Bluffs, IA. Oct. 27.

2019

Pieper F, Hamann C, Askelson N, Bash-Brooks W: [2019] Sharing the road with farm equipment: Driver rural roadway perceptions and beliefs. International Society for Agricultural Safety and Health Conference (ISASH). Des Moines, IA, Jun. 24-27.

Reyes M & Hamann CJ: [2019] Naturalistic study of farm equipment and vehicle interactions on Iowa's roadways. Mid-Continent Transportation Research Symposium. Ames, IA. Aug. 21.

Hamann CJ: [2019] Impacting Road Safety Policy: Perspectives from a Public Health Researcher. UI College of Law Innovation, Business, & Law (IBL) Center Speaker Series. Oct. 10. Speaker on the *SaferTrek* project.

2020

Peek-Asa C, Hamann C, Ramirez M: [2019] Innovative collaborations to reduce rural roadway crashes. Safe States Injury and Violence Prevention Conference Sept. 11-13, Atlanta, GA. (Covered both the farm equipment road crash surveillance project from last cycle and *SaferTrek* farm equipment roadway study).

2021

Hamann CJ, Daly E, Askelson N, Schwab-Reese L, & Peek-Asa C. (2021). Community engagement and the development of a rural road safety campaign, Society for the Advancement of Violence and Injury Research, Virtual Conference. Apr. 9.

Hamann CJ (2021). Community-level intervention & naturalistic study of farm equipment and vehicle interactions on Iowa's roadways. *Agricultural Safety and Health: The Core Course*. Virtual. Jun. 14.

2022

Arabi, S: [2022] Farm Vehicle Following Distance Estimation by Using Deep Learning and Monocular Camera Images. 2022 Transportation Research Board Annual Meeting, Washington, DC, Jan. 9-13.

Ghanbari, A, Hamann C, Reyes M, Jansson S, Hulscher K, Kruger A, Peek-Asa C: [2022] Naturalistic study of vehicle interaction with farm equipment on Iowa's roadways. MRASH, Cedar Rapids, IA, Nov. 2022.

C.2. Website(s) or other Internet site(s) – include URL(s)

<https://gpcah.public-health.uiowa.edu/instrumented-farm-vehicle-roadway-study/>

GPCAH Center Projects

C.3. Technologies or techniques

Protocol/Method/Other: Determination of method for estimating following distance of vehicles in the video data. Shared in published *Sensors* article (<https://doi.org/10.3390/s22072736>) and S. Arabi dissertation (see C.5)

Protocol: Video annotation guide for logging observations related to vehicle behaviors and environment.

Surveys: Baseline intercept survey conducted in communities selected for the study.

Surveys: Online survey conducted in campaign community after dissemination.

C.4. Inventions, patent applications, and/or licenses

Nothing to report

C.5. Other products and resource sharing

Category	Explanation
2017	
Intervention	Community safety campaign: We're on this Road Together with three main messages and logo. Disseminated to community and at onthisroadtogether.org
Other: Process evaluation	Community advisory board process evaluation. Published in <i>Journal of Transport & Health</i> .
2022	
Other	Arabi, S. (2022). Monitoring of civil infrastructure: A deep-learning-based computer vision approach (Order No. 29162037). PhD Dissertation. Iowa State University. Available from ProQuest Dissertations & Theses Global. (2677059326). At http://login.proxy.lib.uiowa.edu/login?url=https://www.proquest.com/dissertations-theses/monitoring-civil-infrastructure-deep-learning/docview/2677059326/se-2

D. PARTICIPANTS

D.1. What individuals have worked on the project?

This information is provided only in the OVERALL component, in concurrence with guidance from our Program Officer.

D.2 Personnel updates

- a. Level of Effort: No
- b. New Senior/Key Personnel: No
- c. Changes in Other Support: No
- d. New Other Significant Contributors: No

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

Nothing to report

E.2 – What is the impact on physical, institutional, or information resources that form infrastructure?

Not applicable

F. CHANGES

F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures

Nothing to report

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

As commonly happens when working with customized equipment and novel data, we encountered several unexpected issues that had to be resolved through additional hardware, software, and personnel. These issues included (1) inaccurate timekeeping on the device, (2) challenges with synchronizing time between video the video and GPS data, (3) three different attempts to collect validation data that could be used to verify distance estimation, and (4) determining criteria for classifying the GPS trajectory of a farm vehicle being on-road versus in the field. Resolving the issues also impacted the project timeline. Since data collection tasks were time- critical and had to be completed while the farm equipment was in use, prioritizing those solutions resulted in delays for data processing. Finally, COVID impacted our plans for data collection and campaign dissemination.

As reported in a previous section, many students made significant contributions to this project. However, as each student joined the project, there was a significant learning curve followed by trial and error to find

solutions. Progress would be made but tasks frequently had to be handed-off to a new student upon graduation, with the cycle then repeating.

Our team continues to work on validating data processing procedures for the farm equipment exposure data and the distance estimates, completing procedures for integrating the annotation data and deriving dependent measures, and conducting analyses. At least three additional journal articles are expected to be submitted in the coming year.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

Nothing to report

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements

Nothing to report

G.2 Responsible Conduct of Research

Nothing to report

G.3 Mentor's Research Report or Sponsor Comments

Nothing to report

G.4 Human Subjects

G.4.a Does the project involve human subjects? No

G.4.b Inclusion Enrollment Data

Not applicable

G.4.c ClinicalTrials.gov

Not applicable

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?

No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?

Yes

Across this project period, the following individuals completed the Collaborative Institutional Training Initiative program (CITI) online to become "certified" in human subject protections, as they were new to human subjects research when they joined the research team:

Nichole Griffith

Grace Milroy
 Chibuzo Nwakama
 David Wu
 Aaron Wheeler
 Kyle Hulscher
 Orlando Reyes
 Xiaoyu Tang
 Abby Wiedmann
 Josh Ventling
 Vishakha Gupta

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?

No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?

No

G.8 Project/Performance Sites

The University of Iowa, 105 Jessup Hall, Iowa City, IA 52242-1316
 Congressional District IA-002
 UEI: Z1H9VJS8NG16

Iowa State University, 505 Morrill Rd, Ames, IA 50011-2103
 Congressional District: IA-04
 UEI: DQDBM7FGJPC5

G.9 Foreign Component

No foreign component

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

Not applicable

G.11 Program Income

Is program income anticipated during the next budget period?

Not applicable

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?

Not applicable

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

Crashes between farm equipment and passenger vehicles on rural roadways are often severe, are commonly the fault of the passenger vehicle driver, and tend to result in more injuries to the passenger vehicle driver. However, little is known about how passenger vehicles interact with farm equipment on the roadway and community-level campaigns to improve rural roadway safety are sparse. In this project, we collected naturalistic roadway data of passenger vehicle driver interactions with farm equipment on rural roadways, using *SaferTrek*, which is an innovative GPS/video integrated data acquisition system developed by the research team. We also developed and deployed a community-level campaign and used the roadway data to examine the impact of the campaign on driver behavior.

We measured farm equipment exposure to the roadway (how long farm equipment travel on public roads) and the frequency with which cars approach farm equipment. We examined passenger vehicle driver behaviors when they were approaching farm equipment from behind. Behaviors examined include speed, deceleration while approaching farm equipment, following distance, number of passing attempts, and passing. Image processing using vehicle detection algorithms that were customized for this project were used to identify vehicle interactions from the roadway video data. The vehicle detection algorithms were found to detect 98.5% of vehicles. The distance estimation algorithms were found to have an accuracy of about 0.5 m. Results from the baseline period before the campaign showed that the average following distance of passenger vehicles behind farm equipment was 26.4 meters (range 2.91 to 50.0), with similar results by vehicle type (cars, SUVs, trucks). Baseline results also showed with each one unit (meter per second) increase in farm equipment speed, the following distance decreased by 1.4 meters (CI: 0.06 - 2.67). A custom graphical user interface (GUI) and annotation guide were created for this project to extract important variables from the video and GPS data. A total of 886 video recordings of farm equipment-passenger vehicle interactions were annotated.

A community-level campaign called “We’re On This Road Together” was developed and deployed with the assistance of a community advisory board (CAB) that was formed to work on this project. The campaign focused on driver behavior around farm equipment and the main messages included: Slow Down, Avoid Passing, and Leave More Space. Results from a process evaluation showed that formation of a community advisory board was successful and critical for message development, implementation, and overall impact of the rural road safety campaign.

Pre- and post-intervention surveys were conducted in the intervention community and baseline surveys were conducted in the control community. Preliminary survey results showed the campaign had good reach, as 59% of respondents recalled seeing the campaign messaging, and 73.8% correctly identified a location where the messaging had been posted. Over half (53.1%) of post-intervention survey respondents correctly recalled the content of the messages. There was a 9% increase in reports of having seen messages about safely sharing the road with farm equipment in the post-intervention period compared to pre-intervention.

A. COVER PAGE

Project Title: Great Plains Center for Agricultural Health	
Component Title: Air Quality Improvements in Livestock Production Buildings	
Component Project Lead: Nonnenmann, Matthew	
Grant Number: 5 U54OH007548	Project/Grant Period: 9/30/16 - 9/29/22
Reporting Period: 9/30/16 – 9/29/22	Date Submitted:
Program Director/ Principal Investigator T. Renee Anthony, BS, MS, PhD Ph: 319-335-4429 Email: renee-anthony@uiowa.edu	Administrative Official Information Wendy Beaver Executive Director, Division of Sponsored Programs 2 Gilmore Hall Iowa City, IA 52242 Ph: 319-335-2123 Email: nih@uiowa.edu
Change of Contact PD/PI: N/A	
Human Subjects: No	Vertebrate Animals: No
hESC: No	Inventions/Patents: No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Aim 1: Evaluate engineering system effectiveness to improve air quality in commercial operations.

Aim 2: Optimize bioaerosol control for commercial swine production using filtration and UVC light.

Aim 3: Evaluate a bioaerosol treatment system on reducing airborne concentrations of bioaerosol in a commercial swine farrowing building.

B.2. What did you accomplish under these goals?

Aim 1: Activities

As proposed, we developed a prototype trailer-based recirculating ventilation system (tRVS) for the control of *dust* and *bioaerosols* to improve air quality in commercial swine production. The tRVS was designed for deployment outside of production buildings to minimize building modifications needed for installation. The tRVS (i.e., 3.7 m long, 1.7 m wide, and 1.8 m high) used a Minimum Efficiency Reporting Value (MERV) 8 pre-filter and MERV 16 filter in series to remove dust and bioaerosol from air room air. A blower (Class L, 150 BCVR, Twin City Fan & Blower, Minneapolis, MN) was positioned downstream of the filters and a specially designed plenum that used germicidal ultra-violet light – C band (UVC) array to inactivate bioaerosols not removed by filtration. Other hazards (i.e., CO₂, CO, H₂S and ammonia) were characterized at baseline (Aim 1, Study 1) and found to be below recommended exposure limits at the commercial swine farrowing site recruited for the study. We proposed to replace unvented space heaters with heaters designed to remove the combustion gases outdoors to reduce indoor CO₂ concentrations. This activity was not completed in this intervention barn as the pigs were the primary source of indoor CO₂ concentrations in this building (compared to previous studies); this modern production barn had less reliance on gas-fired heaters, with minimal operation in the colder months, due to improved commercial building design and construction (e.g., insulation) compared to Kirkwood Community College.

Major developments/findings targeting dust control in commercial swine production:

- We installed the tRVS in a commercial swine farrowing barn (Aim 1, Study 2) and conducted a filtration only study over a six-week period during the winter months in the midwestern US.
- We demonstrated that our system was effective at controlling dust in a commercial swine farrowing room at 5 room air exchanges per hour (ACH). Specifically, mean inhalable and respirable dust concentrations observed during the study period for the “treatment” room were 2.61 and 0.14 mg/m³, respectively, compared to 3.51 and 0.25 mg/m³, respectively, for the control room. Inhalable, and respirable dust concentrations were significantly reduced ($p \leq 0.04$).
- The tRVS, operating at a flow rate of 45 m³/min 5 ACH and reduced the inhalable dust and respirable dust by 25% and 48%, respectively, when compared to the control room.

Aim 2: Activities

As proposed, we designed a UVC plenum for the tRVS to control bioaerosols in commercial swine production. The UVC plenum consisted of 42 UVC lights (G36T5L, 39-watt Ozone free, PLT Solutions, Inc) oriented perpendicular to the direction of airflow through the plenum. The plenum walls were covered with a UVC reflective coating (UVC-Max, Lumacept, Inc) to minimize shadowing and maximize UVC particle dose. We developed laboratory methods to generate and sample bioaerosols containing live surrogate organisms [i.e., *E. coli* (ATCC 25922), MS2 (ATCC 15597-B1), *Phi X174* (ATCC 13706-B1)]. We introduced the bioaerosol to the tRVS and sampled “upstream” and “downstream” of the tRVS to assess for bioaerosol control across 73 experimental trials in the laboratory. We were challenged to aerosolize *Phi X174* virus at

similar concentrations as *E. coli* and *MS2*, however we were able to generate high enough concentrations to observe the effect of UVC treatment across the experiment.

Major developments/findings optimizing the control of bioaerosols using the tRVS:

- Using filtration in combination with UVC in the tRVS was the most effective treatment for reducing bacterial and virus bioaerosol concentrations.
- We observed a 6.0-log reduction in *E. coli* and a 0.21-log reduction in *MS2* with UVC only at a particle dose of 1.09 mJ/cm² (i.e., 1 UVC bulb in the tRVS).
- We observed a 1.1-log reduction in *Phi X174* UVC only at a particle dose of 3.20 mJ/cm² (i.e., 3 UVC bulb in the tRVS).
- A UVC particle dosage of 5.74 mJ/cm² (i.e., 7 UVC bulbs in the tRVS) was needed for a 1-log inactivation of *MS2* and a 35.5 mJ/cm² (i.e., 26 UVC bulbs in the tRVS) was needed for a 6.4-log reduction in *MS2*.
- Combining filtration and UVC was the most efficient approach as 6.0-log reduction in *MS2* and *E. coli* bioaerosol was observed at a UVC dose of 1.09 mJ/cm².

Aim 3: Activities

We proposed to evaluate bioaerosol treatment technology in commercial swine production. However, due to the risk of African Swine Fever being introduced to the commercial swine herd in the US, producers limited access to their farms. As a result, we conducted a field validation trial of the tRVS targeting *dust* and *bioaerosol* at Kirkwood Community College (KCC), Mansfield Swine Education Center in Cedar Rapids, Iowa. In this experiment, we targeted *swine finishing*, at 5 ACH [i.e., 500 m³/min] using filtration and UVC light treatment (i.e., 32.1 mJ/cm²) in series. Dust and bioaerosol concentrations were simultaneously measured in a room being “treated” with the tRVS and compared to an untreated “control room.” Room ventilation was controlled using curtain walls, which were sealed, and pit-fans were constantly operating during the experiment. 24-hr dust concentrations (i.e., inhalable, and respirable) and bioaerosol concentrations in the treatment and control rooms were collected in each room for 31 days. Also, bioaerosol concentrations were compared for the inlet/exhaust of the tRVS targeting total bacteria, *E. coli*, *Staphylococcus* and *Streptococcus* [colony forming units per cubic meter of air (CFU/m³)].

Major developments/findings evaluating the control of dust and bioaerosol using the tRVS in swine production:

- We failed to observe a difference in inhalable and respirable dust concentrations across the treatment and control rooms for this experiment ($p=0.74, 0.95$). These findings may suggest that 5 ACH may not be a high enough air treatment rate to overcome the dust generation rate *in swine finishing*, as compared to farrowing.
- We observed a significant reduction in bioaerosol concentrations ($p<0.001$) across inlet and exhaust air of the tRVS. Specifically, we observed a 1.2-log reduction in total bacteria and *staphylococcus*, a 1.9-log reduction in *staphylococcus* and nearly complete control of *E. coli* concentrations in tRVS exhaust air. Room concentrations of bioaerosol were significantly lower in the treatment room for total bacteria and *E. coli* bioaerosol (4.4-log reduction), however, *staphylococcus* bioaerosol room concentrations were not significantly lower in the treatment room compared to the control room.
- Our findings suggest that the tRVS is effective for controlling bioaerosols containing bacteria and virus that may be problematic for humans and pigs.

ROBUST AND UNBIASED RESULTS

The experiments conducted in this study are robust and unbiased by the inclusion of experimental controls across all aspects of the study. Specifically, all lab and field measurements evaluating the effectiveness of the tRVS are paired with identical measurements (e.g., “upstream and “downstream”). Furthermore, all measurements include appropriate Quality Assurance/Quality Control procedures (e.g., use of field and laboratory blanks, instrument, and airflow calibrations). Given we use an identical approach to evaluate the “treatment” and “control” room contaminant concentrations, the error associated with our measurements is unbiased.

B.3. Competitive Revisions/Administrative Supplements

None

B.4. What opportunities for training and professional development did the project provide?

While this Center does not serve the mission of training and providing professional development for Center personnel, two post-docs, ten graduate students, and seven undergraduate students have been trained to perform industrial hygiene and bioaerosol measurements in a field and laboratory setting because of this project.

Dr. Sinan Sousan (post-doc) has developed skills that include industrial hygiene method development, equipment and sampling media preparation, field data collection, sample analyses, electronic data collection and analyses and report writing. Dr. Sousan is a tenure track Assistant Professor at East Carolina University who works with the North Carolina Agromedicine Institute, continuing to work in areas of exposure assessment and control in agricultural workplaces. **Dr. Erika Ubeda** (post-doc) has developed her skills in industrial hygiene sampling, bioaerosol generation, industrial hygiene field and laboratory data collection, and data analyses. **Kelci Knight-Meachum** (MS industrial hygiene student) has participated in field data collection and has developed skills in bioaerosol sample collection and analyses. Ms. Knight-Meachum has worked as an OSHA inspector for the State of Iowa and is currently an industrial hygienist for Cone Health. She has applied her industrial hygiene and bioaerosol sampling skills to protect the health of workers during the COVID-19 pandemic. **Shelby Jonell-Clark** (MS industrial hygiene student) developed field sampling/industrial hygiene skills and now works as a health and safety professional for Eastern Virginia Medical School. **Tori Liles** (MS industrial hygiene student) led industrial hygiene data collection during a field sampling campaign. She is not currently working outside the home but plans on working in the health and safety field. **Sydney Harris** (MS Industrial Hygiene) developed industrial hygiene field data collection and analysis skills and currently works as an Industrial Hygienist at EI Group, Inc. We have also provided laboratory/field data collection rotation experiences for three PhD students (**Nafis MD Irfan, Ya'u Adamu and Michelle Wei**) in the UI CPH Human Toxicology Program. Ms. Wei assisted with the laboratory based bioaerosol experiments and the characterization of the UVC dosing. Ms. Wei plans to complete a PhD dissertation in a health and safety topic related to bioaerosol control.

We have had undergraduate students begin work on this project, continue to graduate school, and then transition to terminal degree programs or professional practice both inside and outside the field of public health. Specifically, **Kelsey Strandberg** (undergraduate and subsequent MS Industrial Hygiene student) developed industrial hygiene field data collection skills including bioaerosol sample collection and analyses. Kelsey is an Industrial Hygiene Consultant at Trinity Consultants - SafeBridge Regulatory and Life Sciences Group. **Ashley Anderson** (undergraduate and subsequent MS Industrial Hygiene student) has developed industrial hygiene field data collection skills including bioaerosol sample collection and analyses. Ashley is an Industrial Hygienist at Stantec Inc. **Lauren Barlow** (undergraduate and subsequent MS Industrial Hygiene student) has performed extensive industrial hygiene field data collection activities. She has accepted a position as a health and safety professional at Tesla Inc. **Morgan Wolff** (undergraduate, Health and Human Physiology) transitioned to a UI CPH 3-plus-2 program, received her MPH, and is now a PhD student in Epidemiology. She assisted in the laboratory performing bioaerosol sampling, DNA extraction, and polymerase chain reaction. **Emma Meador** (undergraduate and subsequent MPH student) has performed extensive laboratory work in bacterial culture, bacteria and virus aerosolization experiments, PCR experiments, and field data collection activities. Ms. Meador is employed as a Public Health Associate at BKH Technologies Inc. **Tianyue Li** (undergraduate student and subsequent graduate student in Biostatistics) assisted in the laboratory and the field performing bioaerosol sampling, DNA extraction, and PCR. **Bianca Celozzi** (undergraduate student) is currently a Masters in Health Administration graduate student doing laboratory work to prepare and process industrial hygiene and microbiological samples. **Joshua Perez** is an undergraduate student in CPH at the UI and plans to attend graduate school. Joshua has performed field and laboratory work to prepare, collect and process industrial hygiene and

microbiological samples. **Jacob Nonnenmann** is a former student at Kirkwood Community College and current undergraduate student at the University of Iowa. He assisted in deploying and retrieving equipment during field data collection activities. Using students from Kirkwood has been particularly helpful to maintain social distancing requirements for traveling during the COVID-19 pandemic.

B.5. How did you disseminate the results to communities of interest?

Conferences: Our project team has presented and discussed the tRVS approach and technology with agricultural engineers at ASABE meetings. We received feedback on the “stage” of swine production the tRVS technology may be most effective (e.g., nursery). We also communicated state-of-the-art agricultural safety and health information by participating on “expert panels” during annual conferences for the International Society of Agricultural Safety and Health. We continue to communicate information about worker exposures in agriculture with the exposure science field by presenting our research findings and moderating sessions at annual conferences for the industrial hygiene profession.

Producers: We developed relationships with swine producers through partners (e.g., National Pork Board) and community involvement. Through these relationships we have presented and received feedback on new research ideas which have resulted in new RVS designs and more focused research questions that interest our stakeholders (e.g., estimates of cost/savings). We also participated in worker safety training sessions on producer farms. These efforts have resulted in building a level of trust between the project PI and key stakeholders in the swine industry.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

Not applicable.

F. PRODUCTS

C.1. Publications, conference papers, and presentations

PUBLICATION Citations

None

CONFERENCE PAPER Citations

2019

Nonnenmann M: [2019] Project Ideas presented at the National Pork Board Unified Research Committee Meeting, Litchfield Park, AZ. Jan. 9. Invited speaker.

Nonnenmann M, Anthony TR, Sousan S, Altmaier R, Gibbs J, Ramirez A: [2019] Air quality in livestock production buildings: evaluating a prototype to reduce dust concentrations. International Society for Agricultural Safety and Health Conference (ISASH); Des Moines, IA, Jun. 24-27. (Oral)

Nonnenmann M: [2019] Air Quality in Livestock Production Buildings: Evaluating a Prototype Aerosol Control Technology to Reduce Dust Concentrations in Commercial Swine Farrowing. Biomedical Sciences Seminar, Iowa State University. Nov 21. Attended by undergraduate students.

Nonnenmann MW: [2019] Agricultural Organic Dust-Induced Respiratory Disease: What are we doing about it? International Society for Agricultural Safety and Health, Jun. 25. (Panel)
Nonnenmann MW: [2019] Animal Agriculture and the One Health Approach. Western Agriculture Safety and Health Conference; Seattle, WA, Aug. 7-9. (Panel)
Nonnenmann MW. [2019] Respirator Fit and Use, WVP Pork, Washington, IA, Aug 14.
Nonnenmann M: [2019] Project Ideas discussed with National Institute of Antimicrobial Resistance Research and Education. (Oral)
Clark S, Nonnenmann M: [2019] The Effect of Bioaerosol Sampling on the Viability of Aerosolized Influenza A Virus. American Industrial Hygiene Conference and Exposition, Minneapolis, MN. May 20-22. (Poster)
2020
Nonnenmann MW: [2020] Webinar presentation: Building Air Quality and Exposures in Human Health: Pathogens and Contaminants in Livestock Systems, Livestock and Poultry Environmental Learning Community (LEPC), May 15. Virtual training, available at https://lpec.org/human-health-pathogens-and-contaminants-in-livestock-systems/#more-30375 Delivered to over 100 livestock specialists.
Anthony TR: [2020] Webinar presentation: Building Air Quality and Exposures in Human Health: Pathogens and Contaminants in Livestock Systems, Livestock and Poultry Environmental Learning Community (LEPC), May 15. Virtual training, available at https://lpec.org/human-health-pathogens-and-contaminants-in-livestock-systems/#more-30375 Delivered to over 100 livestock specialists.
Nonnenmann M, Ubada E, Anthony R, Sousan S, Altmaier R, Ramirez A: [2020] Evaluation of a prototype aerosol control technology to reduce dust and bioaerosol concentrations in swine production. American Society of Agricultural and Biological Engineers (ASABE); Virtual, July 13-15. (Oral presentation)
2021
Nonnenmann M, Ubada E, Anthony R, Sousan S, Altmaier R, Ramirez A: [2021] Evaluating a Prototype Ventilation Control Technology to Reduce Dust and Bioaerosol Concentrations in Commercial Swine Production. American Society of Agricultural and Biological Engineers (ASABE); Virtual, Jul. 9. (Oral presentation)
Nonnenmann M, Ubada E, Anthony R, Sousan S, Altmaier R, Ramirez A: [2021] Evaluating a Prototype Ventilation Control Technology to Reduce Dust and Bioaerosol Concentrations in Commercial Swine Production. American Society of Agricultural and Biological Engineers (ASABE); Virtual, Jul. 9. (Oral presentation)
Nonnenmann M. [2021] Air Quality Improvements in Ag Production & Biosecurity. Jun. 8. The Core Course. Great Plains Center of Agricultural Health. University of Iowa, Iowa City, IA. (Virtual Oral Presentation)
Nonnenmann M. [2021] Air Quality Improvements in Ag Production & Biosecurity. September 13th, 2021. The Core Course. Great Plains Center of Agricultural Health. Dalhousie University, Halifax, Nova Scotia. (Virtual Oral Presentation)
2022
Strandberg K: [2022] Evaluation of a prototype recirculating ventilation system in swine production: Effects on inhalable and respirable dust concentrations. MS Thesis Defense. Department of Occupational and Environmental Health, College of Public Health, University of Iowa. Apr. 4. (Oral presentation)
Nonnenmann M. [2022] Air Quality Improvements in Ag Production & Biosecurity. Jun, 13. The Core Course. Great Plains Center of Agricultural Health. University of Iowa, Iowa City, IA. (Virtual Oral Presentation)

C.2. Website(s) or other Internet site(s) – include URL(s)

<https://gpcah.public-health.uiowa.edu/indoor-air-quality> Research website on GPCAH.org

C.3. Technologies or techniques

Nothing to report

C.4. Inventions, patent applications, and/or licenses

Nothing to report

C.5. Other products and resource sharing

Nothing to report

D. PARTICIPANTS

D.1. What individuals have worked on the project?

This information is provided only in the OVERALL component, in concurrence with guidance from our Program Officer.

D.2 Personnel updates

- a. Level of Effort: No
- b. New Senior/Key Personnel: No
- c. Changes in Other Support: No
- d. New Other Significant Contributors: No

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

Nothing to report

E.2 – What is the impact on physical, institutional, or information resources that form infrastructure?

Not applicable

F. CHANGES**F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures**

Nothing to report

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

Nothing to report

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

Nothing to report

G. Special Reporting Requirements**G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements**

Nothing to report

G.2 Responsible Conduct of Research

Nothing to report

G.3 Mentor's Research Report or Sponsor Comments

Nothing to report

G.4 Human Subjects

G.4.a Does the project involve human subjects?

No

G.4.b Inclusion Enrollment Data

Not applicable

G.4.c ClinicalTrials.gov

Not applicable

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?

No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?

Not applicable

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?

No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?

No

G.8 Project/Performance Sites

The University of Iowa, 105 Jessup Hall, Iowa City, IA 52242-1316
Congressional District IA-002
UEI: Z1H9VJS8NG16

G.9 Foreign Component

No foreign component

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

Not applicable

G.11 Program Income

Is program income anticipated during the next budget period?

Not applicable

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?

Not applicable

I. OUTCOMES

The *status quo* for respiratory protection in the swine industry relies on respirator use in production operations; however, voluntary use among workers is limited and personal protective equipment is less

effective at controlling exposures compared to ventilation systems that remove contaminants from the indoor air. We developed a prototype trailer-based recirculating ventilation system (tRVS) for deployment in commercial swine production buildings. The tRVS was an incremental advancement of recirculating ventilation system technology as the tRVS contained a germicidal ultraviolet (UVC) array to inactivate bioaerosol that filtration alone may not remove.

Outcome: The tRVS was developed, constructed, evaluated in the laboratory, deployed and field validated during this GPCAH project period. The tRVS was effective at reducing dust concentrations in commercial swine farrowing. Specifically, inhalable and respirable concentrations of dust were significantly reduced ($p \leq 0.04$), which demonstrates 5 ACH is effective to control dust in commercial farrowing during the winter months. The tRVS was also effective at reducing bacteria (*i.e.*, *E. coli*) and virus (*e.g.*, MS2, Phi X174) bioaerosol concentrations in the laboratory. Specifically, using filtration in combination with UVC was identified as the most effective treatment for reducing *E. coli* and MS2 bioaerosol concentrations in the tRVS.

The tRVS was also effective at reducing bioaerosol concentrations in swine finishing. We observed a significant reduction in bioaerosol concentrations ($p < 0.001$) across inlet and exhaust air of the tRVS. Specifically, we observed a *1.2-log reduction in total bacteria and staphylococcus concentrations*, *1.9-log reduction in streptococcus concentrations and nearly complete control of E. coli concentrations* in tRVS exhaust air. Room concentrations of bioaerosol were significantly lower in the treatment room for total bacteria and *E. coli* bioaerosol (4.4-log reduction); however, no difference was observed for *staphylococcus* bioaerosol. We believe that this project is *among the most comprehensive bioaerosol studies conducted in swine production*.

Continued development of the effective, low-cost, scalable, RVS technology will have substantial impact by reducing worker exposures to dust, bioaerosols, and zoonotic organisms in swine production. As a result of what we have learned from previous recirculating ventilation system projects (PI: Anthony) and this project (PI: Nonnenmann), we have designed a miniaturized, low-cost ($\leq \$500$) recirculating ventilation system prototype using filtration and UVC in series to control dust and bioaerosol concentrations. The tRVS prototype is an example of **transformative advancement** of technology to control dust and bioaerosol concentrations in the swine industry that would not have been possible without GPCAH continued support.

Over the course of the project Dr. Nonnenmann *has shared the results of the project through scientific conferences, student presentations and the GPCAH Outreach Core – The Core Course*. Through these efforts we have *developed partnerships with stakeholders*. Project activities have also *resulted in large swine farm including information about swine farm hazards in employee training materials*. Also, *the study PI (MW Nonnenmann) has participated in on-farm employee trainings to explain worker hazards in swine production*. We plan to continue our engagement with stakeholders into the next phase of recirculating ventilation system development as this technology can be applied in other sectors of agricultural production (*e.g.*, poultry). Our *long-term goal* is to develop a recirculating ventilation system to control dust and bioaerosols in livestock production buildings and translate our findings using the NIOSH r2p approach.

A. COVER PAGE

Project Title: Great Plains Center for Agricultural Health	
Component Title: Surveillance of Injuries and Risk Factors for Agricultural Injuries Using Workers' Compensation Data	
Component Project Lead: Ramirez, Marizen; Casteel, Carri	
Grant Number: 5 U54OH007548	Project/Grant Period: 9/30/16 - 9/29/22
Reporting Period: 9/30/16 – 9/29/22	Date Submitted:
Program Director/ Principal Investigator T. Renee Anthony, BS, MS, PhD Ph: 319-335-4429 Email: renee-anthony@uiowa.edu	Administrative Official Information Wendy Beaver Executive Director, Division of Sponsored Programs 2 Gilmore Hall Iowa City, IA 52242 Ph: 319-335-2123 Email: nih@uiowa.edu
Change of Contact PD/PI: N/A	
Human Subjects: No	Vertebrate Animals: No
hESC: No	Inventions/Patents: No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?**Study 1**

Aim 1a: Estimate the incidence of agricultural injury in Iowa reported through three sources: 1) the Iowa Trauma Registry (ITR), 2) Nationwide Insurance's Workers' Compensation program, and 3) the Iowa state Workers' Compensation data.

Aim 1b: Compare agricultural injuries by severity, type, mechanism, and demographics reported in Iowa Workers' Compensation data (both state and Nationwide Claims) with those reported in the Iowa Trauma Registry (ITR).

Study 2

Aim 2: Evaluate the effectiveness of the Agricultural Hazard Surveillance tool in predicting agricultural injuries.

B.2. What did you accomplish under these goals?**1. Major Activities**

Study 1. We completed analysis of Nationwide Insurance Claims data, which was presented at the National Occupational Injury Research Symposium (NOIRS) in fall 2018. A manuscript of findings was published in 2021 (Baidwin et al., 2021). We completed analysis of a linked dataset comprised Iowa Workers' Compensation (WC) data and the Iowa Trauma Registry data. A manuscript is fully drafted and undergoing internal revisions and will be submitted to *Journal of Occupational and Environmental Medicine* by spring 2023.

Study 2. A hazard assessment checklist was designed to measure hazards for acute traumatic injuries on row crop farms. The HAC data were collected on 103 row crop farms in southeastern Iowa between June 2019 and March 2020. A manuscript describing HAC development and inter-rater reliability is in press with the *Journal of Agricultural Safety and Health* (Faust et al., in press). Another paper examining how farm, farm operator, and study recruitment call characteristics improved HAC completion is under review with co-authors and scheduled for submission in early spring 2023. The last paper examining the association between hazard scores and farm injuries is being drafted and scheduled for submission in late Spring 2023.

2. Specific Objectives**Study 1**

Nationwide Workers' Compensation Claims. We accessed Nationwide Insurance's Workers' Compensation claims filed by policy owners of small agricultural operations from 2010-2016, and analyzed the following variables: policy number, type of claims (medical claims, temporary, permanent partial and total disability claims, and death-related claims), specific body part injured, cause of injury, nature of injury, and cost of these specific claims. Costs were provided in terms of the direct paid loss in terms of the workers' compensation payments that were made, the expense incurred for the claim, and amount of workers' compensation reserves. Regression models estimated costs associated with various types of claims and the likelihood of injuries to various body parts, causes, and their nature.

Iowa Trauma Registry and Workers' Compensation Claims. Agricultural injuries were captured from the Iowa Trauma Registry by: 1) using the at-farm location tick box collected by hospitals, and 2) identifying a selected group of ICD-9 codes which based on prior research have high probability of being farm-related. We obtained from the Iowa Division of Workers' Compensation all agricultural claims using the Standard Industrial Classification (SIC) codes.

Agricultural injuries captured from the statewide WC and Trauma from 2005-2014 were linked using the following common variables: age, gender, residence zip code, and date of injury. A total of 2,398 unique injuries from the Iowa Trauma Registry (ITR) and 3,419 unique injuries from Iowa Workers' Compensation (WC) were found. There was very little overlap between the two sources. Specifically, only 110 cases were identified in both data sources, representing 4.4% of the ITR and 3.1% of the WC cases. We constructed

Logistic regression models to compare injuries associated with the inclusion in each data source, and to probabilistically predict which data source captured an agricultural injury given the injury characteristics and worker demographics.

Study 2

The objectives of Study 2 were to: (1) develop a new tool to identify and characterize farm hazards that increase injury risk to farmers and farm workers, and report the inter-rater reliability of the new tool when administered on row-crop farms in Iowa, (2) examine how characteristics of the farm operator, farm location, and timing of recruitment contact impact the probability that farmers will engage with investigators seeking to recruit them into a research study involving the collection of data on farm hazards and related injuries, and (3) examine the association between farm hazards collected on row crop farms and injuries to farm operators and farm workers.

3. Significant Results

Study 1 Findings

Nationwide Insurance Claims. A total of 1059 claims from 2010-2016 were identified from 14 U.S. states. Costs of agricultural injury claims exceeded \$21 million. About 2/3 were medical claims, and 1/3 death/disability claims. Mean expenditures for the body part injured and cause and nature of injury varied by the type of claim. Medical claims resulting from head, face, and neck injuries resulted in a mean expenditure of \$3,242, while the same injuries for disability/death-related claims was \$70,361. The most common body part injured was the distal upper extremity. Falling or flying objects and collisions were the most expensive and common causes of injury. We published these findings in the *International Journal of Environmental Research and Public Health* (Baidwan et al., 2021).

Comparison of Injuries in Trauma Registry and Workers' Compensation. A total of 5690 unique cases were captured from the ITR and WC state databases. This corresponded to an average annual rate of about 260 injuries per 100,000 agricultural workers. In general, older injured agricultural workers (65+) had a higher probability of being in the ITR, while younger injured agricultural workers were more likely found in WC. Young agricultural workers injured in motor vehicle traffic incidents were more likely to be found in WC, but after age 25, these injuries were more likely to be found in the ITR. In contrast, machinery injuries were more likely found in the ITR across age. Only 110 records from these two state-based databases were successfully linked based on age, gender, residence zip code, and date of injury. Based on predictive models, In general, older injured agricultural workers (65+) had a higher probability of being in the ITR, while younger injured agricultural workers were more likely found in WC. Young agricultural workers injured in motor vehicle traffic incidents were more likely to be found in WC, but after age 25, these injuries were more likely to be found in the ITR. In contrast, machinery injuries were more likely found in the ITR across age.

Study 2 Findings

Objective 1: Inter-rater reliability (estimated using Cohen's weighted Kappa values) was high for all sections (self-propelled vehicles, powered-portable implements, fixed machinery/equipment, inside buildings/structures, fall areas, portable ladders) and items of the HAC. Average weighted Kappa values for the six HAC sections ranged between 0.86 (indicating a strong level of agreement) and 0.94 (indicating almost perfect agreement).

Objective 2: Farm operators who were contacted during the planting and harvest season in the evening hours, and who farmed in a non-metropolitan county, had the highest predicted probability of being screened for study participation among the 12 farm season, time of day, and rural-urban continuum code (RUCC) combinations examined (predicted probability = 0.285, 95% CI: 0.189, 0.383). Farm operators who were contacted during the growing season, during daytime hours, and who farmed in a metropolitan county were most likely to enroll in the study with HAC completion among the 12 farm season, time of day, and RUCC combinations examined (predicted probability = 0.166 95% CI: 0.079, 0.253).

Objective 3: With a 10% improvement in the HAC hazard score, there was a 26% reduction in fatal and nonfatal injuries occurring to farm operators and farm workers on row crop farms, adjusting for farm acreage ($p=0.04$).

4. Key Outcomes

Study 1: Three administrative data sources for agricultural injuries – private insurance, a public state-level workers' compensation program, and a state trauma-registry - were found to provide valuable information about costs, cause, and nature of injuries. Little overlap in cases was identified in the state-level data sources that would theoretically cover the same populations. Hence, comprehensive surveillance would require multiple data sources. Furthermore, findings suggest that studies involving targeted research questions could select one data source especially when resources are limited.

Study 2: A hazard assessment checklist designed to measure hazards for acute traumatic injuries on row crop farms had high inter-rater reliability and shows how safety improvements can reduce fatal and nonfatal injuries on farms. The ability to monitor injury-related hazards over time using an empirically driven tool will contribute significantly to injury prevention efforts in an industry with consistently high rates of fatal and nonfatal injury and where routine surveillance of injury hazards is not currently being conducted on national or regional levels.

5. Robustness and Unbiased Results

Study 1

Robust Modeling. We explored various robust analytic models to address various model assumptions, including pursuing statistical analyses that accommodated non-normal data such (e.g., log-gamma regression models) and within-policy and -state correlations.

Underreporting of agricultural injuries. We have explored multiple methods to capture agricultural injuries beyond those identified using the farm-related checkbox in the Iowa Trauma Registry and the use of industry codes in the state WC data. We included ICD codes that have a high probability of being farm-related based on prior literature, and 2) inspected narrative descriptions of individual cases.

Linking techniques. Successful linkage of datasets may be challenging due to missing data or errors in data entry. We used both deterministic and probabilistic linkages, as well as sensitivity analysis to identify the most robust linking methods.

Study 2

Study Power. We were sufficiently powered to use the hazard assessment checklist to examine the association between farm safety scores and injury rates. While our power analysis found that 75 farm operations would be sufficient, we were able to enroll 103.

Validity of Hazard Assessment Checklist (HAC). We recognize that new tools need to undergo validity and reliability testing. In the absence of a gold standard, we assessed inter-rater reliability of the HAC, in which two members of the research team conducted hazard assessments on the same 52 farms. Based on the literature and consultation with our project biostatistician, we needed 28 farms to sufficiently estimate Cohen's weighted Kappa values.

B.3. Competitive Revisions/Administrative Supplements

None

B.4. What opportunities for training and professional development did the project provide?

While this Center does not serve the mission of training and providing professional development for Center personnel, seven graduate students have provided time and expertise to several activities within the Surveillance project over this six-year project period.

Navneet Baidwan, PhD graduate at the University of Minnesota Midwest Center for Occupational Health and Safety (MCOHS) and post-doctoral fellow at the University of Alabama, was mentored to analyze and write a paper on the costs of agricultural injuries using a private insurance Workers' Compensation dataset (Baidwan et al., 2021).

Rebekah Estes, MS student at the University of Iowa in Occupational and Environmental Health with a focus in Agricultural Safety and Health, conducted farm site visits with the hazard assessment checklist. She, maintained the participant tracking database, entered all data from the hazard assessment checklist, and participated in data cleaning. Ms. Estes presented findings from Study 2 at the Agricultural Safety and Health Council of America (ASCHA) Safety Summit in March 2020.

Kayla Faust, PhD candidate and then post-doctoral fellow at the University of Iowa in Occupational and Environmental Health, conducted her dissertation research on agricultural injuries. For the study, she participated in the development and refinement of the hazard assessment checklist (HAC), conducted farm site visits using the HAC, entered and cleaned the HAC data, and first-authored the paper currently in press with the Journal of Agricultural Safety and Health (Faust et al., in press). Kayla also presented Study 2 findings at the Annual International Meeting of the American Society of Agricultural and Biological Engineers in July 2020.

Virgil Jackson, MPH student in Epidemiology at the University of Iowa, conducted literature reviews, assisted in the development and refinement of the hazard assessment checklist, organized the farmer recruitment data from Farm Journal, and conducted farm site visits using the HAC.

Adam Moskowitz, PhD student in Environmental Health Sciences at the University of Minnesota MCOHS, has co-authored a manuscript currently in draft focused on examining the overlap of agricultural injuries found in two statewide databases, the Iowa Trauma Registry and Workers' Compensation.

Victor Soupene, PhD student in Epidemiology at the University of Iowa, earned his Master's degree in Agricultural Safety and Health at the University of Iowa. Dr. Soupene conducted the analysis and first-authored the Study 2, Objective 2 paper currently under review by co-authors. He also presented Study 2 findings at the student session of the University of Iowa College of Public Health Research Week poster session in November 2022.

Erik Boonstra, PhD student in Biostatistics at the University of Iowa, has conducted all analyses for Study 1 and Objectives 1 and 3 of Study 2. He has contributed to conference presentations and paper-writing.

Students from the University of Minnesota have Individualized Development Plans. University of Iowa students who are trainees of the Heartland Center for Occupational Health and Safety (Faust, Estes, Soupene), which is a NIOSH-funded Education and Research Center, have IDPs. Their participation in this study enhanced their career training, providing them with field and project experience relevant to future productivity in public health.

The surveillance team members often attend multiple training events throughout the year, including attending National Occupational Injury Research Symposium, American Society of Agricultural and Biological Engineers, and the Agricultural Safety and Health Council of America.

B.5. How did you disseminate the results to communities of interest?

Findings of this research study have been disseminated to the research community through professional conferences and manuscripts. Additional dissemination efforts can be found in the Outreach Core.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

Nothing to report

G. PRODUCTS

C.1. Publications, conference papers, and presentations

PUBLICATION Citations

2021

Baidwan NK, Ramirez MR, Gerr F, Boonstra D, Cavanaugh JE, Casteel C.: [2021] Cost, Severity and Prevalence of Agricultural-Related Injury Workers' Compensation Claims in Farming Operations from 14 U.S. States. *International Journal of Environmental Research and Public Health*. 18(8):4309. PMID: PMC8072536 DOI: <https://doi.org/10.3390/ijerph18084309>

2022

Faust K, Casteel C, Gerr F, Cavanaugh JE, Boonstra DE, Anthony TR, Soupene VA, Ramirez MR: [2022] Development of a Checklist to Identify Injury Hazards on Row Crop Farms in the Midwestern United States. *Journal of Agricultural Safety and Health*. 29(1), in press.

Conference Papers and Presentations

CONFERENCE PAPER Citations

2018

Baidwan NK, Gerr F, Casteel C, Ramirez M.: [2018] Farm-related injuries: Cost and risk estimations by the type of injury claims. National Occupational Injury Research Symposium; Morgantown, WV.

2020

Estes RK, Casteel C, Faust K, Gerr F, Ramirez MR: [2020] JA:2021-7. Compliance with recommended safety standards among high-risk farm equipment. Agricultural Safety and Health Council of America (ASHCA), 2020 Safety Summit. (Virtual Lightning talk)

Faust K, Casteel C, Ramirez MR, Estes RK, Gerr F: [2020] Compliance with recommended safety standards among row crop farms in Iowa. American Society of Agricultural and Biological Engineers, 2020 Conference. Virtual.

2022

Soupene VA, Cavanaugh JE, Casteel C, Boonstra DE, Moskowitz A, Ramirez MR. Recruitment of farmers into a research study to assess farm hazards. University of Iowa College of Public Health Research Week, Nov.

C.2. Website(s) or other Internet site(s) – include URL(s)

<https://gpcah.public-health.uiowa.edu/surveillance-workers-compensation/>

GPCAH Center Projects

C.3. Technologies or techniques

Nothing to report

C.4. Inventions, patent applications, and/or licenses

Nothing to report

C.5. Other products and resource sharing

Category	Explanation
2022	
Other	Shiny app. Instruments or Equipment. An <i>R Studio Shiny</i> web application was developed from Study 1. This app calculates the predicted probabilities of an agricultural injury being captured in Workers' Compensation or Iowa Trauma Registry based on user-specified profiles of the worker and injury. Confidence intervals are also produced for the probabilities.
Other	Hazard Assessment Checklist (HAC) and Field Manual. HAC: Evaluation Instrument, Field Manual: Educational aid or curricula. The HAC is a new tool for surveillance of agricultural injury risk factors. It includes hazards related to: self-propelled vehicles (e.g., tractors, combines), powered portable implements (e.g., planters, augers), fixed machinery and equipment (e.g., feed mills, conveyors), farm buildings and structures (e.g., grain bins, shops), fall risks (e.g., elevated platforms, grain storage), and portable equipment associated with fall risk. Within each of these sections, 3-7 individual items assess compliance with recommended safety guidelines (e.g., American Society of Agricultural and Biological Engineers, Iowa Department of Transportation) or OSHA safety standards.
Other	Hazard Assessment Checklist (HAC) App and Associated Training. HAC app: Instruments or Equipment, app Training: Educational aid or curricula. The hazard assessment checklist was converted into a web-based data collection application (app) designed for smartphone users. The app was pilot tested, and app training was piloted with 18 farmers/ranchers, agribusiness professionals, researchers, safety and health professionals (including regulators), and healthcare providers. App training was conducted in two parts. Part 1 was an asynchronous version that teaches users how to download the app, log into it, complete a data use agreement that allows the GPCAH access to the data for surveillance purposes, navigate the app, and submit the data. Users are also provided an overview of the app material, section layouts, and scoring scheme with resources. Part 2 of the training was a synchronous, live version that provides a demonstration of identifying hazards and how to score them with cases from the field, provides tips for successfully conducting farm visits and completing the app items, and allows users to ask the trainer questions. See https://gpcah.public-health.uiowa.edu/farm-safety-app/

D. PARTICIPANTS

D.1. What individuals have worked on the project?

This information is provided only in the OVERALL component, in concurrence with guidance from our Program Officer.

D.2 Personnel updates

- a. Level of Effort: No
- b. New Senior/Key Personnel: No
- c. Changes in Other Support: No
- d. New Other Significant Contributors: No

E. IMPACT**E.1 - What is the impact on the development of human resources, if applicable?**

Nothing to report

E.2 – What is the impact on physical, institution, or information resources that form infrastructure?

Describe ways, if any, in which the project made an impact, or is likely to make an impact, on physical, institutional, and information resources that form infrastructure, including:

Not applicable

F. CHANGES**F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures**

Nothing to report

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

Nothing to report

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

Nothing to report

G. Special Reporting Requirements**G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements**

Nothing to Report

G.2 Responsible Conduct of Research

Nothing to report

G.3 Mentor's Research Report or Sponsor Comments

Nothing to report

G.4 Human Subjects

G.4.a Does the project involve human subjects?

No

G.4.b Inclusion Enrollment Data

Not applicable

G.4.c ClinicalTrials.gov

Not applicable

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?

No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?

No

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?

No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?

No

G.8 Project/Performance Sites

The University of Iowa, 105 Jessup Hall, Iowa City, IA 52242-1316
Congressional District IA-002
UEI: Z1H9VJS8NG16

University of Minnesota, 200 Oak Street SE, Minneapolis, MN 55455
Congressional District MN-05
UEI: KABJZBBJ4B54

G.9 Foreign Component

No foreign component

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

Not applicable

G.11 Program Income

Is program income anticipated during the next budget period?

Not applicable

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?

Not applicable

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

The goal of this surveillance project is to improve the science of agricultural injury surveillance by improving methods that track injuries and hazards through a collection of data systems. The first study examines the information in multiple existing systems (workers' compensation, insurance, and trauma registry), and the second looks at generating new data and relating safety observations to injury outcomes.

Our first set of studies demonstrated the need to use multiple secondary data sources to maximize our understanding of agricultural injuries and their characteristics. In one analysis, we used *private insurance* data to obtain unique information about costs of claims. A total of 1000 workers' compensation claims from 2010 to 2016 were collected from an insurance company covering small to medium-sized farm operations from 14 U.S. states, which captured total costs that exceeded \$21 million. Two-thirds of these claims were medical only, while about one-third were death/disability claims. The most common body part injured was the distal upper extremity. Falling or flying objects and collisions were the most expensive and common causes of injury. A second analysis focused agricultural injury cases captured in two *statewide* datasets: Iowa's Trauma Registry (ITR) and Iowa's Workers' Compensation (IWC) system. A total of 2,508 agricultural injuries were reported in the ITR, while 3,529 claims were reported in the IWC database over the same period. Only 110 cases were identified in both data sources. In general, older injured agricultural workers (65+) were more likely found in the ITR, while younger injured agricultural workers were more likely found in IWC. Young agricultural workers injured in motor vehicle traffic incidents were more likely to be found in IWC, but after age 25, these injuries were more likely to be found in the ITR. In contrast, machinery injuries were more likely found in the ITR across age. These studies demonstrate the value of using multiple datasets to conduct comprehensive surveillance of agricultural injuries.

In the second study, investigators developed a hazard assessment checklist (HAC) to identify injury-related hazards on row crop farms and then collected information on the frequency of injuries to farm operators and farm workers. The HAC includes documentation of hazards related to: self-propelled vehicles (e.g., tractors, combines), powered portable implements (e.g., planters, augers), fixed machinery and equipment (e.g., feed mills, conveyors), farm buildings and structures (e.g., grain bins, shops), fall risks (e.g., elevated platforms, grain storage), and portable equipment associated with fall risk. Within each of these sections, 3-7 individual items were assessed for compliance with recommended safety guidelines (e.g., American Society of Agricultural and Biological Engineers, Iowa Department of Transportation) or OSHA safety standards. We found that all sections and items of the HAC had very high inter-rater reliability. The HAC can be completed in 1-1½ hours and requires about three hours of training, two hours of which are spent in field training. While it also requires a user with some knowledge of farming practices and agricultural safety, the HAC is simple

and straightforward to complete and requires minimal training time. We found that as a hazard score calculated from the HAC improves, the rate of fatal and nonfatal injuries to farm operators and farm workers decreases. The HAC was also digitized into a mobile app format for faster data entry.

Future directions for the HAC include expanding the tool beyond row crop operations and developing it for multiple users with a goal of sustainability. Future research should focus on developing and evaluating dissemination protocols to maximize use of the Hazard Assessment Checklist in organizations that serve, regulate or market products or services to farms. Ultimately, the ability to monitor injury-related hazards over time using an empirically driven tool will contribute significantly to injury prevention efforts in an industry with consistently high rates of fatal and nonfatal injury.

B. COVER PAGE

Project Title: Great Plains Center for Agricultural Health	
Component Title: Pilot / Feasibility Projects Program	
Component Project Lead: Fethke, Nathan	
Grant Number: 5 U54OH007548	Project/Grant Period: 9/30/16 - 9/29/22
Reporting Period: 9/30/16 – 9/29/22	Date Submitted:
Program Director/ Principal Investigator T. Renee Anthony, BS, MS, PhD Ph: 319-335-4429 Email: renee-anthony@uiowa.edu	Administrative Official Information Wendy Beaver Executive Director, Division of Sponsored Programs 2 Gilmore Hall Iowa City, IA 52242 Ph: 319-335-2123 Email: nih@uiowa.edu
Change of Contact PD/PI: N/A	
Human Subjects: Yes	Vertebrate Animals: No
hESC: No	Inventions/Patents: No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Aim 1: Maximize the Center's impact on agricultural safety and health within the region by funding up to four pilot/feasibility projects each year in the nine-state region and in other states with similar agricultural production processes.

Aim 2a: Enhance the scope of services, test new outreach strategies, and expand the capabilities of community-based agricultural safety and health practitioners and organizations by providing pilot grant funding to those who demonstrate a clear commitment to the safety and health of agricultural workers.

Aim 2b: Support career development and explore new research possibilities with future agricultural safety and health professionals by providing pilot funding to new investigators and qualified academic scholars who demonstrate a commitment to agricultural safety and health.

Aim 3: Provide ongoing mentorship to pilot project investigators by offering administrative support and technical/scientific consultation to improve their capacity to impact the health and safety of agricultural workers.

B.2. What did you accomplish under these goals?

The Great Plains Center for Agricultural Health (GPCAH) Pilot/Feasibility Projects Program ("Program" hereafter) was **funded with the start of Year 2** (i.e., 2017-2018) of the 2016-2022 funding cycle. Dr. Fred Gerr, Professor Emeritus in the Department of Occupational and Environmental Health at the University of Iowa, served as PI of the Program during Years 2-4 of the funding cycle. During Year 4, approval was requested and granted for a change in Program PI to Dr. Nathan Fethke, Associate Professor in the Department of Occupational and Environmental Health at the University of Iowa. This change became effective on February 1, 2020. In addition, the role of Pilot/Feasibility Projects Program Coordinator shifted through Jenna Gibbs in Years 2-3, H. Russ Foushee in Years 4-5, and Dr. Kathryn Crawford in Year 6.

From September 2017 through September 2022, the Program awarded \$430,992 across 16 pilot projects (9 academic-track, 7 community-track). We received and reviewed 69 applications during that time (34 academic-track, 35 community-track), yielding an overall success rate of 23% (26% academic-track, 20% community-track). For comparison, during the previous center funding cycle (i.e., 2011-2016), the Program received and reviewed 67 applications and made 22 awards. Thus, progress during the current cycle is comparable to that of the previous cycle, with a similar number of applications per year (13.8/year vs. 13.4/year, on average) but somewhat fewer applications funded per year (3.2/year vs. 4.4/year, on average). The decrease in the average number of applications funded per year is a consequence of larger requested budgets (on average) among those applications selected for funding.

Regional Reach. All but six applications received were from academic investigators or community project directors affiliated with institutions or organizations within i) states historically served by the GPCAH (including the Dakotas) or ii) states with similar agricultural practices to those within states historically served by the GPCAH but in which NIOSH AFF coverage is low (i.e., Indiana and Ohio). Our process for making funding decisions allows for funding of applications originating from outside the GPCAH region but at a lower priority relative to applications originating from the GPCAH region, given the same scientific review scores. Three pilot grants were funded outside of our original region (IN, OH, MI) but to high-scoring projects addressing hazards relevant to GPCAH operations.

We developed and implemented a communications plan to broaden the regional dissemination of Program requests for proposals (RFPs) with the intent to encourage greater numbers of applications from individuals and organizations other than the University of Iowa. In comparison to past dissemination approaches, the communications plan emphasized more frequent use of GPCAH social media channels (e.g., Twitter and

Facebook) during periods of application solicitation. In addition, formal grant writing workshops were held online (2018, hosted by AgriSafe, with the Central States Center for Agricultural Safety and Health co-instructing), at regional meetings/conferences (Missouri Rural Health Association, Ohio Rural Health Association, Midwest Rural Agricultural Safety and Health conferences), and via Zoom. Of the 69 applications received, 12 (17%) were from individuals affiliated with the University of Iowa. Of the 16 awards made during the 2016-2022 funding cycle, two (13%) were to investigators affiliated with the University of Iowa (Liang, 2020-2021; Davis, 2021-2022; see details below). *Thus, the proportion of awardees affiliated with the GPCAH home institution has declined from 40% during the 2006-2011 funding cycle, to 23% during the 2011-2016 funding cycle, to 13% during the 2016-2022 funding cycle. This demonstrates our success in increasing the Program's regional reach.* Equally important, several applications funded in the 2016-2022 funding cycle originated from states with no prior history of Program funding.

Academic-Track Awardee Characteristics. A key goal of the Program was to support investigators new to the field of agricultural safety and health (ASH). Of the nine academic-track awardees, four were junior faculty (University of Iowa, Iowa State University, University of Minnesota, University of Illinois), two were graduate students (University of Iowa, Ohio State University), and one was an undergraduate honors student (Purdue University). The program also supported one mid-career faculty with no prior history of ASH-related research (Michigan State University), and one state epidemiologist (Minnesota Department of Health).

Community-Track Awardee Characteristics. A key goal of the Program was to support regional organizations in their efforts to develop, implement, evaluate, and deliver evidence-based ASH services (e.g., educational programming for agricultural workers). Of the seven community-track awardees, three were affiliated with state agricultural extension programs (Iowa State University Extension [2], Minnesota State Extension), two with regional ASH intermediary organizations (Iowa Harm Reduction Coalition, Ag Safety & Health Alliance), one with a regional community college (National Education Center for Agricultural Safety at Northeast Iowa Community College), and one within a unit of a state government (Minnesota Department of Agriculture).

Key Outcomes or Other Achievements

Program success was measured primarily through awardees' reporting of project progress, outputs, and outcomes in their mid-project, final project and 2-year follow-up reports.

- The *academic-track* supported publishable work (14 peer-reviewed manuscripts), presentations and posters at regional and national scientific meetings, and graduate student research. The number of peer-reviewed manuscripts from pilot projects during the 2016-2022 funding cycle was more than double that of the 2011-2016 funding cycle.

Although our academic-track awardees were and continue to be productive, none reported successfully competing for additional federal funding. We believe this circumstance is directly related to the limited NIOSH extramural funding allocated to investigator-initiated research awards (i.e., R and K awards). Solutions to this problem are not apparent in the absence of a meaningful increase to the Congressional appropriations for NIOSH, which is beyond our control.

- The *community-track* provided a unique mechanism for the Center to reach regional agricultural populations in creative and impactful ways. In addition to the development, delivery, and evaluation of educational/training programs focused on persistent hazards (e.g., anhydrous ammonia), community-track awardees responded to the threat of infectious disease transmission associated with the COVID-19 pandemic. Many community-track pilot projects addressed communication and stigma around issues of mental health and suicide among agricultural workers.

Reports from awardees demonstrate the highly personal impact of these activities. The "Airing out Farm Stress" project, for example, included GPCAH-sponsored radio spots that reached at least 100,000 listeners and podcasts that achieved at least 33,000 "listens" through various platforms (e.g., Apple Podcasts). The radio spots and podcasts were produced by Don Wick of the Red River Farm Network (RRFN) for its "TransFARMation" series, who said "*I've been in this business for 38 years, generally doing stories about profitability and markets, and production – not feelings. I've never seen anything with the traction [TransFARMation] has had.*" Mr. Wick also relayed the following encounter: "*I had someone come up to me after [a seminar about mental health at an*

Advanced Crop Advisors Workshop in Fargo] with tears in his eyes, thanking us for doing this podcast. There's a lot of pain out there and I think folks appreciate the fact that they're not alone in this fight." Importantly, the project team was awarded a \$500k USDA/NIFA grant to expand and continue this work.

- The Program provided resources to address important topics not included in Center-funded research projects but that were significant to agricultural workers in the region. GPCAH needs assessment activities, ongoing appraisal of NIOSH priority topics for ASH extramural research and translation, and discussion with the GPCAH Regional Advisory Committee was used to tailor Program RFPs to encourage applications of high potential impact relative to regional ASH needs. The majority of applications received focused on mental health (37%), safety (23%), and chemical hazards (19%), and seven applications focused specifically on vulnerable agricultural populations. The majority of funded pilot projects examined mental health, with topics including opioid overdose prevention, the effectiveness of a text messaging intervention, development of a mental health farm podcast, using state surveillance to develop risk metrics, examining the effect of cooperatives in reducing mental health stressors, and leveraging data from the National Violent Death Reporting System to examine differences in suicide rates across farming, forestry, and fishing occupations. One project targeting vulnerable workers (H-2A visa holders in Ohio) was funded.
- Across the 2016-2022 funding cycle, nearly 5,500 individuals received safety and health guidance from pilot project awardees and were, thus, directly impacted by the Program. Pilot projects generated 39 media stories and 30 conference abstracts and presentations.

Project outputs by year are provided in the table, below.

	Y2 ^a (17-18)	Y3 (18-19)	Y4 (19-20)	Y5 (20-21)	Y6 (21-22)
Academic-track applications	3	9	7	5	10
New academic-track awards	1	1	2	3	2
Community-track applications	8	7	11	7	2
New community-track awards	2	3	1	1	0
Peer-reviewed Publications	2 ^b	3	3	0	6
Abstracts & conference presentations			1	4	1
Trainings & workshops (# participants)	14 (483)	18 (963)	95 (4,376)	150	
Theses and dissertations		1		1	
Press releases, media stories, podcasts		19	1	1	1
Educational aids or curricula		6			4
Websites or online materials		1	3		
Additional funding received			1	1	

^a The Program was not funded during Y1 (2016-17).

^b Includes one manuscript published in 2016-2017, when the Program was not operating

Funded Pilot/Feasibility Project Descriptions and Outputs/Outcomes

Year 1 (2016-2017) – Program was not funded to begin the 2016-2022 funding cycle

Year 2 (2017-2018) – 11 applications received, 3 funded (1 academic-track, 2 community-track)

Hydrogen sulfide exposure and impact on swine barn dust induced lung inflammation (academic-track; PI: Charavaryamath, Assistant Professor, Iowa State University, Ames, IA; *not human subjects research*). This toxicology study examined potential linkages to lung inflammation resulting from co-exposures to hydrogen sulfide and barn dust. Center funding is acknowledged in six peer-reviewed publications. The study also resulted in five conference presentations, two invited seminars, and one doctoral dissertation.

Agritourism destination safety and health best-practices workshop (community-track; PI: Hoyle, Iowa State University Extension, Ames, IA; *not human subjects research*). To provide effective interventions for the prevention of agriculture injury and illness on agritourism destinations, the *Visit Iowa Farms Program* worked with the Iowa State Pesticide Safety Education Program and the Center for Food

Security and Public Health to coordinate three agritourism destination safety and health best practices workshops across Iowa: 81 persons attended the workshops. The team developed agritourism safety resources, which are freely available on the ISU Extension website.

Anhydrous ammonia emergency response program (community-track; PI: Neenan, National Education Center for Agricultural Safety, Northeast Iowa Community College, Peosta, IA; *not human subjects research*). This project developed and implemented an interactive education program for farmers, ranchers, and their families in the GPCAH region including rural North Dakota, Iowa, Missouri, Nebraska, and Minnesota. The team conducted >10 training events, attended by >400 persons, including one immediately following an MRASH conference.

Year 3 (2018-2019) – 12 received, 4 funded (1 academic-track, 3 community-track)

Growing resiliency in tough times (GRITT): A text-messaging mental health intervention for farmers (academic-track; PI: Holmstrom, Associate Professor, Michigan State University, East Lansing, MI; *human subjects research*). A text messaging-based mental health intervention was developed to educate agricultural workers about (i) farm-related stress and (ii) coping strategies and resources to manage that stress. The intervention was tested to assess feasibility, usability, and acceptability. Reductions in perceived stigma surrounding mental health, farm stress, and the use of maladaptive coping strategies were also examined.

Train-the-trainer program to promote safe respirator use for farmers and pesticide applicators (community-track; PI: Hoidal, Minnesota State Extension, Minneapolis, MN; *not human subjects research*). This project developed and delivered a series of train-the-trainer respirator safety and fit testing workshops across the state of Minnesota. Additionally, the project team developed a portfolio of outreach materials to be used by rural healthcare professionals, extension educators, agricultural co-op health and safety managers, and other state-based pesticide safety education programs. The team conducted six workshops resulting in 36 trained respirator fit testers who have performed >800 fit tests in Minnesota, filling a critical gap in the region.

Airing out farm stress (community-track; PI: Moynihan, Minnesota Department of Agriculture, St. Paul, MN; *not human subjects research*). This project examined how to bring attention to stresses inherent in farming and how it can affect the mental, physical, and emotional well-being of agricultural workers and farm family members. The team used radio programming on the Red Rivers Farm Network to air five 60-second programs that each reached a listening audience of more than 100,000 farmers in ND, SD, and MN. Each program was complemented by a 12-15 min. podcast, with >33,000 “listens.” Evaluation included tracking audience interactions via social media, podcast downloads, and requests for access to stories and materials. Impacts include a recent (2021) \$500k grant from the USDA through its NIFA program to expand and sustain this important network.

Opioid crisis response in farm communities: overdose prevention and training for farmers and agricultural workers (community-track; PI: Ziegenhorn/Novak, Iowa Harm Reduction Coalition, Cedar Rapids, IA; *not human subjects research*). This project conducted and evaluated opioid prevention training and outreach with agricultural employees and migrant farmworkers. The team conducted six community “train-the-trainer” sessions with over 120 farmers and agricultural employees and partnered with the Proteus Migrant Health Program to conduct six migrant health outreach sessions to 50 migrant farmworkers. The team used a community-engaged, peer-to-peer approach to adapt an established opioid overdose prevention training for agricultural populations. Pre- and post-assessments were conducted for evaluation purposes. At least 12 media stories highlighted the team’s work. (Funding for this important project was supported from GPCAH *Emerging Issues*.)

Year 4 (2019-2020) – 18 received, 3 funded (2 academic-track, 1 community-track)

The impact of drought conditions on occupational psychosocial stress among a Midwest farmers cohort (academic-track; PI: Berman, Assistant Professor, University of Minnesota, Minneapolis, MN; *not human subjects research*). This project used an existing survey of 518 Midwestern farmers across a 4-year period and a case-crossover longitudinal study design to estimate the association between drought

conditions and occupational psychosocial stress. Study results were published in *Science of the Total Environment* and were highlighted on the drought.gov landing page (<https://www.drought.gov/news/links-between-drought-and-increased-psychosocial-stress-among-us-farmers>).

Public health agriculture-related mental health research (academic-track; PI: Zabel, Center for Occupational Health and Safety, Minnesota Department of Public Health, St. Paul, MN; *not human subjects research*). Seven new indicators of mental health status for the farming community were developed, including suicide, mental health hospitalizations, and self-reported mental health status. Dissemination consisted of posting data on the Minnesota Department of Health (MDH) public web site, posting modifiable data on the Minnesota Injury Data Access System (MIDAS) portal, and distribution to partners and stakeholders, both within MN and nationwide. Collaborations were strengthened with the Minnesota Department of Agriculture, the MDH Suicide Prevention Unit, and the MN Suicide Prevention Task Force.

Stress on the farm: strategies to help each other (community-track; PI: Brown, Iowa State University Extension, Ames, IA; *not human subjects research*). This pilot project offered a culturally relevant suicide prevention “gatekeeper” training to the agricultural community in Iowa. The project provided 95 gatekeeper suicide prevention trainings in 87 Iowa communities, in conjunction with Iowa State University Extension and Outreach and Farm Bill meetings sponsored by the Farm Service Agency. These meetings trained approximately 4,376 agriculture producers and landowners in an intervention strategy to identify persons at risk of suicide and refer them to treatment or supporting services as needed. Risk and protective factors of suicide were also addressed. During this project period, Dr. Brown received a USDA NIFA grant for *Farm and Ranch Wellness: The Next Steps* (USDA NIFA 2019-70028-30436) extending this pilot research.

Year 5 (2020-2021) – 12 received, 4 funded (3 academic-track, 1 community-track)

Examining the role of agricultural cooperatives in protecting farmers’ mental health (academic-track; PI: Liang, PhD candidate, University of Iowa, Iowa City, IA; *human subjects research*). Cooperatives provide farmer members market stability, technical support, and support networks, but the effects of these programs on mental health are not well understood. Non-cooperative farmers may use similar programs from farmer support organizations, agricultural extension offices, and agribusiness. This project examined associations between variables describing cooperative membership, social support, and programs accessed and outcome variables capturing levels of stress and depression. The project was a component of the PI’s dissertation research.

Preventing workplace injury in pig production systems: applying behavior change interventions for safe animal handling (academic-track; PI: Rudolphi, Assistant Professor, University of Illinois, Urbana-Champaign, IL; *human subjects research*). This study investigates the use of two communication channels (poster in workplace and digital message to personal device) to inform and remind workers about safety and health in their daily work. Workers view visual and written prompts about worker safety and safe animal handling and some workers receive additional information by text or email message. Topics include worker mental health and injury prevention. The goal of the study is to determine which communication channels are preferred by workers and which delivery methods are effective at changing worker behavior. Results will identify best practices regarding educating workers on existing workplace hazards.

Understanding how to collaborate with cooperative extension to disseminate agricultural safety and health programs and information: a mixed-methods study (academic-track; PI: Kapur, undergraduate honors student, Purdue University, West Lafayette, IN; *not human subjects research*). Increasingly, Extension Educators convene community health coalitions and connect communities to public health faculty. Because they are members of the community, they have success translating science to communities. The purpose of this study was to support future partnerships with Extension Educators by understanding their current practices, assessing the feasibility of a partnership, and identifying potential barriers and facilitators.

Respiratory protection training following COVID-19: developing and testing interactive educational resources in the ag health and safety classroom (community-track; PI: Sheridan, Ag Health and Safety Alliance, Greenville, IA; *not human subjects research*). In response to the COVID-19 pandemic, NIOSH and the NIOSH Ag Centers generated evidence-based guidance for agricultural workers on how to deal with potential PPE shortages and plan for similar events. This pilot project developed new evidence-based interactive infographic resources about respirator use in agriculture, strategies to address current or future PPE shortages, and proper use/prolonged storage of N95 respirators. These resources were piloted among ~150 agricultural students, health care professionals, and safety managers. Evaluation results will be used to revise the resources for broader, national use. After engaging with these resources, participants felt more prepared to address respiratory health challenges and PPE shortages in similar future crisis or public health emergencies.

Year 6 (2021-2022) – 12 received, 2 funded (2 academic-track)

Uncounted and invisible: the lives and health of H-2A workers in Ohio. (academic-track; PI: Kline, PhD candidate, The Ohio State University, Columbus, OH; *human subjects research*). This project examined the health of Mexican H-2A workers in Ohio. The H-2A visa is not transferable among farms, making this workforce immobile and vulnerable. The project used mixed-methods – including a survey of H-2A workers, theoretically-informed multivariate regression models for data analysis, and supplementary qualitative research – to document this population’s health challenges. Within Mexico, the most common sending states to Ohio are Guanajuato, Chiapas, Hidalgo, Veracruz and Oaxaca. The H-2A experience varied greatly depending on the sector (nursery vs. agriculture) and grower, and to a lesser extent size of farm and years participating in the program. With a sample of 284 participants, this the largest survey of H-2A workers in the country. Results supported the PI’s doctoral dissertation (completed July 2022).

Identifying circumstances leading to suicide for farming, fishing, and forestry workers. (academic-track; PI: Davis, Research Assistant Professor, University of Iowa, Iowa City, IA; *not human subjects research*). This research used the National Violent Death Reporting System to identify occupation specific risk factors of suicide for farmers and farm workers. Suicide rates across specific occupations within farming, fishing, and forestry were calculated. We identified farmers and fishing and hunting workers to have the highest rates of suicide among those in agriculture occupations. Relative to other workers, farm workers were less likely to have mental health treatment and farmers were more likely to have financial problems before a death from suicide. Farmers and Agricultural workers are two distinct groups that showed different circumstances contributing to their deaths from suicide.

ROBUST AND UNBIASED RESULTS

The **Pilot/Feasibility Program** relies on a formal review process to evaluate the scientific merit of submitted proposals, with feedback given to all applicants, including those not funded. Mentoring to review and guide applicants is available prior to submission to enhance the scientific merit, and ongoing communications with pilot grantees is formalized to ensure robust and unbiased results in these studies. The process includes many formal review procedures, including assessments of the responsiveness of pilot grant submissions, incorporating multiple peer-reviews in scoring, and thorough examinations of conflicts of interest—to ensure fiduciary responsibility of pilot grant funds.

B.3. Competitive Revisions/Administrative Supplements

None

B.4. What opportunities for training and professional development did the project provide?

The GPCAH Pilot/Feasibility Program Project specifically mentors and provides training opportunities to persons new to agricultural safety and health field, using the grant application and funding process. When the project began, there was no formal individualized development plan incorporated into this process. Below highlights students whose educational experiences incorporated GPCAH pilot funding to complete thesis/dissertations.

Progress of Pilot Grant Recipients from previous funding cycle include:

- **Ashley Kates** received a pilot grant in 2014, when she was a postdoctoral trainee (supervisor was Nonnenmann, now the PI of the Air Quality project). She was a postdoctoral trainee at the University of Wisconsin, Department of Medicine, 2016-2020 where she continued her research on bacterial infectious disease. She is currently a scientist at the University of Wisconsin-Madison.
- **Josie Rudolphi** (PhD 2017) successfully competed for two GPCAH pilot grant awards, first in 2014 (Identifying agricultural behaviors of Iowa's young farmers), and again in 2016 (Increasing the use of hearing protection among young adult swine confinement workers)/ Dr. Rudolphi defended her dissertation in the summer of 2017 (<http://ir.uiowa.edu/etd/5617/>), and these pilot grant awards provided critical resources for the successful completion her doctoral dissertation. She successfully competed for a third GPCAH pilot grant award in 2020 (Preventing workplace injury in pig production systems: applying behavior change interventions for safe animal handling). She was an Associate Research Scientist at the Marshfield Clinic (WI), with activities focusing on the protection of children and young adult agricultural workers. She is currently an assistant professor at University of Illinois Urbana-Champaign in the College of Agricultural, Consumer and Environment Sciences.
- **Ashlee Johannes** was a 2015 grant recipient who received a MS in Agricultural Safety & Health at the University of Iowa in 2016 (<https://doi.org/10.17077/etd.ix4v75zd>). She worked in the field of public health as the communications coordinator at the University of Iowa Hydrosciences and Engineering Department; where she facilitated community engagement to reduce vulnerable populations' impacts from environmental hazards in her role on two grant-funded projects (The Iowa Watershed Approach and The Iowa Superfund Research Program). She is currently the Assistant Director of Development for Health Care Philanthropy with the University of Iowa Center for Advancement.
- **Christie De Vito** (MS, 2017) participated in a 2016 GPCAH pilot grant (Noise induced hearing loss simulation and hearing protection device fit testing). She collected field data to assess the effectiveness of various hearing protection devices among farmers. These data were used in support of her master's thesis (<http://ir.uiowa.edu/etd/5457/>). Ms. De Vito has served as an Environmental, Health, and Safety Specialist at a major aerospace company, and is now a Principal EHS Engineer working at Northrop Grumman.
- **Maya Ramaswamy** received a GPCAH pilot grant award in 2016, when she was a doctoral student in Occupational and Environmental Health at the University of Iowa. In 2018, she successfully defended her dissertation (<https://ir.uiowa.edu/etd/6251/>) which included data from this pilot grant. In summer 2018, she began a two-year fellowship with CDC as an EIS officer at the National Center for Emerging and Zoonotic Infectious Diseases Division of Preparedness and Emerging Infections.

In this project period, the following students participated in GPCAH pilot grants activities:

- **Yanni Liang** (PhD 2021) received a pilot grant, and she integrated the research from her 2020 pilot grant into her dissertation <https://doi.org/10.17077/etd.006295>. She received a 2019 David L. Boren Fellowship and spent a year studying Khmer in Cambodia. She is currently an epidemiologist at the University of Wisconsin.
- **Denusha Shrestha** participated in the pilot grant from **Charavaryamath**, Iowa State University Dept. of Biomedical Sciences. **Shrestha** was a graduate research assistant who received a PhD in 2022 from Iowa State University, and the thesis included this funded project (<https://dr.lib.iastate.edu/server/api/core/bitstreams/a95a2cb3-e179-4554-ba0e-d37ecf866f69/content>).
- **N. Kapur**, an undergraduate student at Purdue University, received a 2021 pilot grant.
- **Anisa Kline** is a PhD candidate in the Geography Dept. at Ohio State University where she is expected to graduate in May 2023. Her dissertation integrates data collected in her 2021 pilot grant. Her dissertation is titled, "Uncounted and Invisible: H2A workers in Ohio"

Finally, in 2018, three of the four awarded pilot grants support the work of new and beginning investigators (Moynihan, Holmstrom, Ziegenhorn / Novak) – defined as those in the field of agricultural health and safety for fewer than 5 years.

B.5. How did you disseminate the results to communities of interest?

Findings from pilot project PIs were shared via their networks, through publications and presentations (C.1), and through press releases and subsequent media coverage (C.5) coordinated through the P&E Core.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

Not applicable

H. PRODUCTS**C.1. Publications, conference papers, and presentations****Publications during the 2016-2022 Funding Cycle from Pilot Grants Awarded during the 2016-2022 Funding Cycle****2018**

Nordgren TM, Charavaryamath C. [2018] Agriculture occupational exposures and factors affecting health effects. *Curr Allergy Asthma Rep.* 18(12):65. PMID: PMC6644660 (<https://doi.org/10.1007/s11882-018-0820-8>) [2017 Pilot Grant]

2019

Bhat SM, Massey N, Karriker LA, Singh B, Charavaryamath C.: [2019] Ethyl pyruvate reduces organic dust-induced airway inflammation by targeting HMGB1-RAGE signaling. *Respir Res.* 20(1):1-19. PMID: PMC6364446 (<https://doi.org/10.1186/s12931-019-0992-3>) [2017 Pilot Grant]

Massey N, Puttachary S, Bhat S, et al.: [2019] HMGB1-RAGE signaling plays a role in organic dust-induced microglial activation and neuroinflammation. *Tox Sci.* 169(2):579-592. PMID: PMC6542342 (<https://doi.org/10.1093/toxsci/kfz071>) [2017 Pilot Grant]

2021

Berman JD, Ramirez MR, Bell JE, Bilotta R, Gerr F, Fethke NB. [2021] The association between drought conditions and increased occupational psychosocial stress among U.S. farmers: An occupational cohort study. *Sci Total Environ.* 2021 Dec 1;798:149245 [2019 Pilot Grant]

Bhat SM, Shrestha D, Massey N, Karriker LA, Kanthasamy AG, Charavaryamath C. [2021] Organic dust exposure induces stress response and mitochondrial dysfunction in monocytic cells. *Histochem Cell Biol.* 155(6):699-718. PMID: PMC8195852 (<https://doi.org/10.1007/s00418-021-01978-x>) [2017 Pilot Grant]

Liang Y, Wang K, Janssen B, Casteel C, Nonnenmann M, Rohlman DS. [2021]. Examination of symptoms of depression among cooperative dairy farmers. *Int J Environ Res Public Health.* 8(7):3657. PMID: PMC8037613 (<https://doi.org/10.3390/ijerph18073657>) [2020 Pilot Grant]

Massey N, Shrestha D, Bhat SM, Kondru N, Charli A, Karriker LA, Kanthasamy AG, Charavaryamath C: [2021] Organic dust-induced mitochondrial dysfunction could be targeted via cGAS-STING or cytoplasmic NOX-2 inhibition using microglial cells and brain slice culture models. *Cell Tissue Res.* 384(2):465-486. PMID: PMC8154696 (<https://doi.org/10.1007/s00441-021-03422-x>) [2017 Pilot Grant]

Shrestha D, Bhat SM, Massey N, Maldonado CS, Rumbelha WK, Charavaryamath C: [2021] Pre-exposure to hydrogen sulfide modulates the innate inflammatory response to organic dust. *Cell Tissue Res.* PMID: 33409657 [2017 Pilot Grant]

2022

Liang Y, Casteel C, Janssen B, Wang K, Rohlman DS. [In press] Organizational resources and social support influences on stress and depression: A comparison among cooperative and non-cooperative farmers. *Journal of Agromedicine* (in press, <https://doi.org/10.1080/1059924X.2022.2134243>) [2020 Pilot Grant]

Publications Reported during the 2016-2022 Funding Cycle from Pilot Grants Awarded during the 2011-2016 Funding Cycle

2016

Jennissen CA, Harland KK, Denning GM: [2016] Characteristics of side-by-side vehicle crashes and related injuries as determined using newspaper reports from nine US states. *Safety*. Apr. 2(2):10. PMID: PMC9380433 (<https://doi.org/10.3390/safety2020010>) [2012 Pilot Grant]

2017

Schneberger D, DeVasure JM, Baily KL, Romberger DJ, Wyatt TA. [Pilot Grant] **Effect of low-level CO₂ on innate inflammatory protein response to organic dust from swine confinement barns.** *Journal of Occupational Medicine and Toxicology*. 2017, 12(9). PMID: PMC5366145 [2013 Pilot Grant]

2018

Khan KM, Evans SS, Bielko SL, Rohlman DS. Efficacy of technology-based interventions to increase the use of hearing protections among adolescent farmworkers. *International Journal of Audiology*. Feb 2018, 57(2):124-124. PMID: PMC6987960 [2013 Pilot Grant]

Rudolphi JM, Campo S, Gerr F, Rohlman DS. **Social and individual influences on tractor operating practices of young adult agricultural workers.** *The Journal of Adolescent Health*. May 2018, 62(5):605-611. PMID: PMC8189782. [2014 Pilot Project]

2019

Kates AE, Dalman M, Torner JC, et al.: [2019] The nasal and oropharyngeal microbiomes of healthy livestock workers. *Plos One*. 14(3):e0212949. PMID: PMC6413945 (<https://doi.org/10.1371/journal.pone.0212949>). [2014 Pilot Grant]

Conference Papers and Presentations

CONFERENCE PAPER Citation**2018**

Rudolphi J: [2018]. Comparison of three interventions to increase hearing protection use in swine facilities. International Society of Agricultural Safety and Health Conference (ISASH). Jun. Halifax, N.S., Canada.

Gibbs J and Rautiainen R: [2018] Pilot Grant Writing Tips for Community-Based Organizations. GPCAH-hosted Webinar with 36 participants on Jun. 6.

Neenan D: [2018] Anhydrous ammonia trainings held. Lakota American, Lakota, ND, Jun. 12. Link unavailable.

Neenan D: [2018] Anhydrous ammonia trainings held for local firemen and EMS. Griggs County Courier, McVile, ND. Jun. 11. Link unavailable.

Neenan D: [2018] Anhydrous ammonia trainings held for locals. McVile Messenger McVile, ND, Jun. 18. Link unavailable.

Hoyle S: [2018] Agritourism Best Practices for Safety Training Packet. Developed for three agritourism destination safety and health best practices workshops in Iowa.

Meyer K and Chase C: [2018] Agritourism destination safety and health best practices workshop. This workshop was hosted by Iowa State University Extension and funded by the GPCAH Pilot Projects Program. Three workshops were hosted in three counties (Blackhawk, Johnson, Polk) to 73 attendees.
Gibbs J and Gerr F: [2018] Rural community outreach pilot grant writing workshop: Examples in agricultural health and safety. This workshop served to provide pilot grant writing guidance for community outreach groups. The workshop was held at the Missouri Rural Health Association Meeting in Camdenton, MO on August 21 2018, and at the Ohio Rural Health Association Conference in Mt. Sterling, OH on August 28, 2018. The workshop was delivered to 80 individuals. In addition, the workshop materials were used by J. Rudolphi during the Child Agricultural Injury Prevention Workshop in Marshfield, WI on Aug. 13. [Pilots and E&P Core]
Neenan D: [2018] Anhydrous safety training for firefighters and emergency responders (58 attendees). MRASH Conference, Nov. 29. Council Bluffs, IA. [Pilots and E&P Core]
2019
Iowa Harm Reduction Coalition, Zeighorn S, and Novak N: [2019] Promotion of naloxone and training to reverse overdoses. They trained 381 rural or agricultural participants in 67 communities, disseminated 3,784 naloxone kits, and reached at least 315 additional people through secondary distribution. The team also collaborated with the Proteus Migrant Health Program. Many participants indicated they would pass overdose reversal and other risk reduction supplies onto others. These efforts resulted in at least 315 additional secondary recipients of overdose prevention and other risk reduction supplies.
Holmstrom A: [2019] Addressing Stress with Text. Mental Health Roundtable Flashtalk. International Society for Agricultural Safety and Health Conference (ISASH); Des Moines, IA, Jun. 24-27.
Shrestha D, Mahadev-Bhat S, Massey N, Santana C, Rumbelha WP, Karriker LA, Charavaryamath C: [2019] Hydrogen sulfide exposure modulates innate responses to lipopolysaccharide and organic dust. Presented at the American Thoracic Society's annual meeting, Dallas, TX, May 17-22.
Meyer K: [2019] Agritourism destination safety and health best practices workshops. International Society for Agricultural Safety and Health Conference (ISASH); Des Moines, IA, Jun. 24-27.
Charavaryamat C, Wyatt T, Nonnenmann MW, and Schneberger D: [2019] Agricultural Organic Dust-Induced Respiratory Disease. International Society for Agricultural Safety and Health Conference (ISASH); Des Moines, IA, Jun. 24-27. (Panel)
Hoidal N: [2019]. Breathing Room: Building Capacity for Respirator Fit Testing Panel Discussion Panel Member. North Central Region Pesticide Applicator Certification and Training Workshop (PACT). Jul. 22-24. Duluth, MN. (2018 Pilot Grant)
Gibbs J and Gerr F: [2019] Rural community outreach pilot grant writing workshop: Examples in agricultural health and safety. This workshop (65 attendees) served to provide pilot grant writing guidance for community outreach groups at the Illinois Rural Health Association, Champaign, IL. Aug. 7. [Pilots and E&P Core]
Moynihan M: [2019] Panelist for webinar titled The farmer mental health crisis: Understanding a vulnerable population. American Psychological Association. Aug. 26. At The farmer mental health crisis: Understanding a vulnerable population (apa.org) (2018 Pilot Grant)
Shrestha D, Mahadev-Bhat S, Massey N, Santana C, Rumbelha WP, Karriker LA, Charavaryamath C: [2019] Hydrogen sulfide exposure modulates innate responses to lipopolysaccharide and organic dust. Oral presentation at Iowa State University, Ames, IA.
Fethke N and Anthony T: [2019] Community outreach grant writing skills for rural health professionals. Midwest Rural and Agricultural Safety and Health Conference, Marshalltown, IA. Nov. 13.

Brown DN, Santiago AD: [2019] Responding to behavioral and mental needs among rural lowans and farming communities. National Association for Rural Mental Health Annual Conference. Santa Fe, New Mexico. (2019 Pilot Grant)
Brown DN: [2019] Stress on the farm: Strategies to help each other. Iowa Farmers Union 2019 State Convention: Farming in a Climate of Change. Given to farmers at: Grinnell, IA, Des Moines IA, Cedar Falls, IA, Storm Lake IA. (2019 Pilot Grant)
Liang Y, Rohlman DS: [2019] Behavioral Health Needs and Resources among Cooperative Dairy Farmers. International Society for Agricultural Safety and Health Conference (ISASH); Des Moines IA June 24-27 (Poster).
2020
Brown DN, Dunnegan D, Day D: [2020] Suicide prevention and the agricultural community. Midwest Rural Agricultural Safety and Health (MRASH) Conference. Nov.17-20. (2019 Pilot Grant)
Brown DN: [2020] Responding to behavioral health needs among rural lowans and farming communities. Iowa Institute for Cooperatives Winter Meeting. Cedar Falls, IA, Storm Lake, IA. (2019 Pilot Grant)
Berman JD: [2020] Exploring the association between drought and health: psychosocial stress in farmers. International Society of Environmental Epidemiology (ISEE). Poster/Oral Presentation. Aug. 2020.
Berman JD: [2020] The Existing Challenges and Opportunities in Drought and Health Research. Society for Epidemiological Research. Poster/Oral Presentation. Dec. 2020.
Brown DN: [2020]. Responding to the behavioral and mental health needs of Iowa agribusiness. North Central Cooperative Extension Association Speed Meeting on Mental and Behavioral Health. Virtual. (2019 Pilot Grant)
Moynihan M: [2020] Trying Times: Tools to Understand and Alleviate Farm Stress. 2020 SARE Farmers Forum at Northern Plains Sustainable Agriculture Conference. January 21-23, 2020. At https://www.youtube.com/watch?v=PlnZdhmbfr4&list=PLQLK9r1ZBhhFE9SoxG1v-zKTLlfrezEpO&index=9 (2018 Pilot Grant)
2021
Berman JD: [2021] The association between drought conditions and occupational psychosocial stress among Midwestern U.S. farmers: an occupational cohort study. International Society of Environmental Epidemiology (ISEE). Poster/Oral Presentation. Aug.
2022
Smith S, Hamann C, Schwab-Reese LM, Peek-Asa C: [2022] Toward a better understanding of collaboration with cooperative extension in the dissemination of agricultural safety and health programs. A presentation in the Purdue University Spring HHS Research Event. West Lafayette, IN. Mar.
Davis J: [2022] Using the National Violent Death Reporting System to determine Occupation Specific Risk Factors for Suicide: An example using Farming, Fishing, and Forestry Workers. 3rd International Symposium to Advance Total Worker Health Conference Bethesda, MD. Oct. 11-14.

C.2. Website(s) or other Internet site(s) – include URL(s)

<https://gpcah.public-health.uiowa.edu/gpcah-pilot-grant-program/>

GPCAH Center Projects

C.3. Technologies or techniques

Nothing to report

C.4. Inventions, patent applications, and/or licenses

Nothing to report

C.5. Other products and resource sharing

Category	Explanation
2017	
Educational aids or curricula	Cheyney M, Gibbs JL, Menscher R, Klemuk S: Noise-Induced Hearing Loss Simulator [2017]. I-Pad App. Presented at Triumph of Ag Expo, Omaha NE (March 2017) and Farm Progress Show, Decatur IL (August 2017). This application was developed with real-life farm recordings. To participate, individuals can click on several farming scenarios within the app and listen to what it would be like to experience mild, moderate, and several noise-induced hearing loss during those situations. The farmers used simulator while wearing noise-reduction headphones at farm shows.
Educational aids or curricula	Vose R. [2017]. Grain and Livestock Producer Guide for Healthy Hearing Habits. Iowa Speech and Language Association Convention. Iowa City, IA. October 2017. This helpful guide was developed for farmers to independently implement healthy hearing habits on their farm. The guide provides awareness, education, and prevention of noise induced hearing loss to grain and livestock producers. The guide will be distributed as anticipatory guidance by rural audiologists and clinicians during scheduled visits and hearing evaluation appointments.
Other	Ramaswamy R and Gibbs J: [2017] Pilot study looks at musculoskeletal symptoms among beginning farmers. Alive and Well Newsletter. March. Available at https://www.public-health.uiowa.edu/gpcah/alive-and-well/
Other	Rudolphi J: [2017] Occupational safety & health of young adult agricultural workers. Available at. PhD Dissertation. University of Iowa. May. Available at http://ir.uiowa.edu/etd/5617/
Other	De Vito C: [2017] Comparison of personal attenuation ratings attained by agricultural and industrial workers for four hearing protection types using the 3M E-A-RFIT dual validation system. MS Thesis. University of Iowa. May. Available at http://ir.uiowa.edu/etd/5457/
2018	
Educational aids or curricula	Hoidal N: [2018] Train-the-trainer program to promote safe respirator use for farmers and pesticide applicators The project resulted in 36 trained fit testers who have conducted almost 800 fit tests. Additional products include an interactive map of fit testing locations and a toolkit of outreach materials at https://extension.umn.edu/pesticide-safety-certification-resources/commercial-noncommercial-pesticide-applicators#respirator-resources-1089714
Other	Ramaswamy M: [2018] Assessing occupational health among transitional agricultural workforces: a mixed methods study among U.S. beginning farmers and South Indian tea harvesting workers. PhD Dissertation. University of Iowa. May. Available at https://ir.uiowa.edu/etd/6251/
Other	Meyer K and Chase C: [2018] Agritourism destination safety and health best practices workshops were featured in the Iowa State University Extension and Outreach Newsletter. Developed checklist materials for course attendees and others to download (items 15680-15685 at https://store.extension.iastate.edu/product/15680)
Other	Staff Writer: [2018] Anhydrous Ammonia Safety Training offered to public. UNMC Newsroom Newsletter. Oct. 30. At https://www.unmc.edu/newsroom/2018/10/30/anhydrous-ammonia-safety-training-offered-to-public/

Other	Staff Writer: [2018] Anhydrous Ammonia Safety Training in Council Bluffs, IA. University of Nebraska-Lincoln. CropWatch Magazine. Nov. 1. At https://cropwatch.unl.edu/2018/anhydrous-safety
Other	IHRC: [2018] Promotion of overdose protection and naloxone access. Instagram post. Nov. 13. At https://www.instagram.com/p/BqliwmlhwUk/
Other	Meyer K and Adcock L: [2018] Workshop offers agritourism safety and best practices information. Iowa State University Extension and Outreach Newsletter. Dec. 20. At https://www.extension.iastate.edu/news/workshop-offers-agritourism-safety-and-best-practices-information
Other	Gibbs J: [2018] Press release: Mental health a priority during national farm safety week. This press release resulted in news articles featured in three media outlets, including Harvest News and Farm Futures Magazine. [Pilots and E&P Core]
2019	
Other	IowaHRC: [2019] Promotion of naloxone and training to reverse overdoses. Instagram Post. Feb. 18. At https://www.instagram.com/p/BuG_pp2BkSP/
Audio	TransFARMation podcast: [2019] How Not to Let the Farm Wreck Your Marriage. Apr. 3 Interview with B Rudolph about transitioning the family business. At https://www.rfn.com/podcast/2019/04/03/transfarmation/ The podcasts repository is available at the Red Rivers Farm Network website . The series reached well over 100,000 radio listeners on 19 stations in North Dakota, South Dakota, and Minnesota. The team enhanced the reach of this effort by creating deeper, complimentary 10- to 15-minute podcasts for each topic. As of mid-March 2020, almost 33,000 people had listened to GPCAH-sponsored episodes, while total listenership for all 25 episodes was more than 64,500.
Audio	TransFARMation podcast: [2019] There is Life after Farming. Apr 19. Interview with R Koenen about moving to a new career. At https://www.rfn.com/podcast/2019/04/19/transfarmation-life-beyond-the-farm/
Other	IowaHRC: [2019] Promotion of safety checks for opioid users. Instagram post. April 25. At https://www.instagram.com/p/BwsHJJUhx6u/
Audio	TransFARMation podcast: [2019] A Survivor's Journey. May 6. Interview with T Gillie about surviving after her husband's suicide. At https://www.rfn.com/podcast/2019/05/06/a-survivors-journey/
Audio	Crann T and Burks M: [2019] Interview with M Moynihan titled Podcast tackles 'how to not let the farm wreck your marriage' and other farm stresses. MPRnews. May 6. At https://www.mprnews.org/story/2019/05/06/atc-podcast-tackles-how-to-not-let-the-farm-wreck-your-marriage-and-other-farm-stresses
Audio	TransFARMation podcast: [2019] The Ostrich Syndrome. May 20. Interview with T Matthews about ideas for farmers who are struggling. At https://www.rfn.com/podcast/2019/05/20/transfarmation-the-ostrich-syndrome/
Other	Blanchard, SK: [2019] Why Drug Dealers Are an Under-Utilized Anti-Overdose Resource. Filter. May 28. At https://filtermag.org/why-drug-dealers-are-an-under-utilized-anti-overdose-resource/
Audio	TransFARMation podcast: [2019] It's OK to Not Be OK. Interview with D Kramer about his experiences with farm stress. Jun. 3. At https://www.rfn.com/podcast/2019/06/03/transfarmation-its-ok-to-not-be-ok/
Audio	TransFARMation podcast: [2019] Shifting the Conversation about Mental Health. Jun 17. Interview with D Zahradka about his son's suicide. At https://www.rfn.com/podcast/2019/06/17/transfarmation-shifting-the-conversationabout-mental-health/
Other	Yager A: [2019] 'Complicated issue:' Local officials, advocates discuss impacts

	of needle exchanges. Telegraph Herald, Dubuque, IA. Jun. 30. At https://www.telegraphherald.com/news/tri-state/article_cdf52e49-7636-5bf7-9b3f-9ad7f04645ac.html
Other	Brooks J: [2019] News article on TransFARMAtion podcast titled In hard times, farmers try to help each other through. StarTribune, Minneapolis, MN. Aug. 10. At https://www.startribune.com/in-hard-times-farmers-try-to-help-each-other-through/533196972/
Other	Patterson J: [2019] Great Plains Pilot Grant: Making a Difference. Farm Families Alive and Well Newsletter 25(4):4.Sept. 2019. At https://gpcah.public-health.uiowa.edu/wp-content/uploads/2019/09/Alive-Well-Newsletter-September-2019_Finalforweb.pdf
Other	Staff Writer: [2019] Iowa Harm Reduction Coalition works to prevent overdose deaths. Iowa Cattleman. Sept. At https://lsc-pagepro.mydigitalpublication.com/publication/?i=613912&article_id=3462774&view=articleBrowser&ver=html5
Other	O'Leary J: [2019] Home Field Advantage: Matt Kroul Exemplifies the ANF Spirit. Iowa Magazine. Sept. At https://magazine.foriowa.org/story.php?ed=true&storyid=1863
Other	Henderson OK: [2019] Two statewide officials trained to respond to opioid overdoses. Radio Iowa. Dec. 2. At https://www.radioiowa.com/2019/12/02/two-statewide-officials-trained-to-respond-to-opioid-overdoses/
Other	Mercado M: [2019] Iowa Organization Offers Free Access to Naloxone. WHO- 13, Des Moines, IA. Dec 2. At https://whotv.com/news/iowa-organization-offers-free-access-to-opioid-overdose-reversing-drug/
Other	Boshart R: [2019] Naloxone training at Iowa Capitol. Sioux City Journal, Sioux City, IA. Dec. 2. At https://siouxcityjournal.com/naloxone-training-at-iowa-capitol/image_ee066d01-37e7-5493-bdb5-55e47186199b.html
Other	Mercado M: [2019] Iowa Organization Offers Free Access to Opioid Overdose Reversal Drug. KDSM-TV, Des Moines, IA. Dec. 3. At https://kds17.com/news/local/iowa-organization-offers-free-access-to-opioid-overdose-reversal-drug
Other	Joens P: [2019] With opioids taking scores of Iowa lives each year, state officials learn how to administer naloxone. The Des Moines Register, Des Moines, IA. Dec. 6. At https://www.desmoinesregister.com/story/news/health/2019/12/02/narcan-naloxone-iowa-opioid-crisis-overdoses-responses/2588043001/
Other	Staff Writer: [2019] New state program mails free opioid overdose-reversal kits to Iowans. The Gazette, Cedar Rapids, IA. Dec. 27. At https://www.thegazette.com/subject/news/health/new-state-program-mails-free-opioid-overdose-reversal-naloxone-kits-to-iowans-20191227
2020	
Other	Patterson J: [2020] Press Release: Improve the safety and health of upper Midwestern farmers and agricultural workers with a \$30,000 pilot grant award. Announcement promoting GPCAH pilot grant awards. April 1. At https://gpcah.public-health.uiowa.edu/6043-2/ [Pilots and E&P Core]
2021	
Other	Liang Y: [2021] Social connectedness and mental health among Midwest farmers. PhD Dissertation. University of Iowa. Dec. https://iro.uiowa.edu/esploro/outputs/doctoral/9984210642102771
Other	Patterson J: [2021] Apply for \$30,000 GPCAH Pilot Grants and let your research soar. Press release (March 25, 2021) accompanied by 11 posts on Facebook that reached 749 individuals and 2,119 individuals via Twitter -- prior to the application deadline on Jul. 1. https://gpcah.public-health.uiowa.edu/apply-for-a-gpcah-30000-pilot-grant-award-today-and-let-your-agricultural-research-soar/ [Pilots and E&P Core]

Other	Gibbs J: [2021] New interactive informational resources: Guidance for farmers when using respirators in agriculture. Farm Families Alive and Well Newsletter. 27(4): Sept. https://gpcah.public-health.uiowa.edu/wp-content/uploads/2021/09/Alive-Well-September-2021.pdf . [Pilots and E&P Core]
Other	Patterson J: [2021] Drought can lead to more than the summertime blues in farmers. Farm Families Alive and Well Newsletter. 27(4): Sept. https://gpcah.public-health.uiowa.edu/wp-content/uploads/2021/09/Alive-Well-September-2021.pdf . [Pilots and E&P Core]
Other	Moynihhan M: [2021] Bend, Don't Break – Managing Stress in Agriculture. U.S. Department of Agriculture (\$599,605). Project #MINW-2021-09291 . Minnesota Dept. of Agriculture. Nov.
Other	Patterson J: [2021] Drought can lead to more than the summertime blues in farmers. Press release. Sept. 17. https://gpcah.public-health.uiowa.edu/drought-can-lead-to-more-than-the-summertime-blues-in-farmers/ [Pilots and E&P Core]
2022	
Other	Patterson J: (2022) GPCAH Funds Multiple Pilot Projects per Year Intended to Promote Innovative Outreach and Research Efforts Targeting the Prevention of Injury and Illness Resulting from Agricultural Work Exposures. Apr. 26, 2022. At https://gpcah.public-health.uiowa.edu/can-your-community-organization-use-up-to-30000-to-prevent-injury-and-illness-on-the-farm-apply-for-a-great-plains-center-for-agricultural-health-gpcah-pilot-grant/ . The Loop https://medcom.uiowa.edu/theloop/announcements/gpcah-accepting-proposals-for-pilot-project-funding and University of Iowa College of Public Health News https://www.public-health.uiowa.edu/news-items/gpcah-pilot-grant-program-accepting-applications/ . It was also in the Alive and Well Newsletter and shared by the Extension Foundation. https://connect.extension.org/blog/gpcah-acadenuc-and-community-pilot-grants-due-dec-1 [Pilots and E&P Core]
Audio	Crawford K: [2022] FarmSafe Podcast: Pilot Spotlight – Stress on the Farm: Strategies to Help Each Other (Guest: David Brown, Pilot) [Audio podcast episode]. In FarmSafe. Apr. 20. At https://gpcah.public-health.uiowa.edu/farmsafe/ [Pilots and E&P Core]
Audio	Crawford K: [2022] FarmSafe Podcast: Pilot Spotlight –Airing out Farm Stress (Guest: Meg Moynihhan, Pilot) [Audio podcast episode]. In FarmSafe. May 4. At https://gpcah.public-health.uiowa.edu/farmsafe/ [Pilots and E&P Core]
Audio	Crawford K: [2022] FarmSafe Podcast: Pilot Spotlight – Examining Support Systems for Farmers' Mental Health (Guest: Yanni Liang, Pilot) [Audio podcast episode]. In FarmSafe. May 18. At https://gpcah.public-health.uiowa.edu/farmsafe/ [Pilots and E&P Core]
Other	Shrestha D: [2022] Targeting NRF2 to rescue organic dust and hydrogen sulfide exposure induced lung inflammation and loss of epithelial barrier function (PhD Thesis) Iowa State University. At https://dr.lib.iastate.edu/server/api/core/bitstreams/a95a2cb3-e179-4554-ba0e-d37ecf866f69/content
Audio	Crawford K: [2022] FarmSafe Podcast: Pilot Spotlight – Job Demands and Health Outcomes for Beginning Farmers (Guests: Maya Ramaswamy, Pilot) [Audio podcast episode]. In FarmSafe. Jun. 1. At https://gpcah.public-health.uiowa.edu/farmsafe/ [Pilots and E&P Core]
Other	Patterson J: [2022] GPCAH Pilot Grants are Available to Develop a New Line of Research Inquiry for Preventing Injury and Illness on the Farm. Alive & Well Newsletter. 28(4):7. Sept. https://gpcah.public-health.uiowa.edu/wp-content/uploads/2022/08/Alive-Well-Newsletter-September-2022.pdf [Pilots and E&P Core]

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

This information is provided only in the OVERALL component, in concurrence with guidance from our Program Officer.

D.2 Personnel updates

- a. Level of Effort: No
- b. New Senior/Key Personnel: No
- c. Changes in Other Support: No
- d. New Other Significant Contributors: No

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

Nothing to report

E.2 – What is the impact on physical, institutional, or information resources that form infrastructure?

Not applicable

F. CHANGES

F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures

Nothing to report

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

Nothing to report

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

Nothing to report

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements

Nothing to report

G.2 Responsible Conduct of Research

Nothing to report

G.3 Mentor's Research Report or Sponsor Comments

Nothing to report

G.4 Human Subjects

G.4.a Does the project involve human subjects?

Yes – Pilot grant awardees submit their own approval of human subjects prior to release of funding. The four pilot projects that enrolled subjects were:

- Y3: Growing resiliency in tough times (GRITT) (Holstrom, PI) – Enrolled 133
- Y5: Examining the role of agricultural cooperatives in protecting farmers' mental health (Liang, PI) – Enrolled 95 women, 212 men
- Y5: Preventing workplace injury in pig production systems: applying behavior change interventions for safe animal handling (Rudolphi, PI) – Enrolled 11 women, 19 men
- Y6: Uncounted and invisible: The lives and health of H-2A workers in Ohio (Kline, PI) – Enrolled 284

G.4.b Inclusion Enrollment Data

Table to follow

Cumulative Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

Study Title: Enrollment over all Studies in the Great Plains Center for Agricultural Health, 2016-22

Comments: This incorporates all enrolled subjects from 4 pilot projects with IRB (Holstrom, Liang, Rudolphi, Kline)

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native										0
Asian										0
Native Hawaiian or Other Pacific Islander										0
Black or African American										0
White	68	59								127
More Than One Race										0
Unknown or Not Reported				1		284	107	234		626
Total	68	59	0	1	0	284	107	234	0	753

G.4.c ClinicalTrials.gov
Not applicable

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?

No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?

No new GPCAH personnel have needed new training on the conduct of human subject's research. All funded Pilot Grant Projects are reviewed for human subjects' relevance, and assurances are made by the GPCAH project coordinator/investigator that human subjects research training is completed for projects determined to be IRB relevant.

G.6 Human Embryonic Stem Cells (HESCS)

No human embryonic stem cells.

G.7 Vertebrate Animals

No. One project (Charavaryamath, Iowa State University) was approved by their Institutional Animal Care and Use Committee (IACUC, 11/21/17).

G.8 Project/Performance Sites

The University of Iowa, 105 Jessup Hall, Iowa City, IA 52242-1316
 Congressional District IA-002
 UEI: Z1H9VJS8NG16

G.9 Foreign Component

No foreign component

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

NO – See Center Overall, where the total center-wide unobligated balance is discussed.

G.11 Program Income

Not applicable

G.12 F&A Costs

Not applicable

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

The GPCAH Pilot/Feasibility Project Program provided funds to academic investigators and community-based organizations who could investigate critical hazards, test new outreach strategies, and expand the capabilities of current agricultural safety and health expertise to improve worker health and safety in our region and beyond. Over five years (2017-2022), we received and reviewed 69 applications and funded 16 projects.

We awarded nine academic grants. These included grants submitted by and supported four early-career faculty and three students. The other two academic grants supported two researchers with no agricultural health and safety experience, which brought their unique skills to address agricultural hazards. From these projects and those ending the previous funding cycle, 14 peer-reviewed publications were generated,

sharing findings on topics including effects of hog-barn dust and gases on airway inflammation and mental health intervention strategies.

We awarded seven community-track awardees, three were affiliated with state agricultural extension programs (Iowa State University Extension [2], Minnesota State Extension), two with regional agricultural safety and health intermediary organizations (Iowa Harm Reduction Coalition, Ag Safety & Health Alliance), one with a regional community college (National Education Center for Agricultural Safety at Northeast Iowa Community College), and one within a unit of a state government (Minnesota Department of Agriculture).

Pilot project funding provided research experience to students (three doctoral students, one undergraduate) who now apply these skills to improving worker health. Project funds also supported early career investigation ideas of four professionals (IA, MI, MN) new to agricultural health and safety. Interviews with several pilot project awardees are hosted on the FarmSafe podcast to share lessons learned. Results from pilot project programs generated 39 media stories, investigators made 30 conference presentations/abstracts, and pilot efforts trained nearly 5500 individuals with safety and health information, including ammonia safety (577), suicide prevention (3000), opioid overdose prevention (381), and respirator fit testing (36 trained to reach 800 farmers).

Two awardees have since received USDA/NIFA grants to expand their work to reduce the stigma and impacts of farm stressors on mental health. One of these built on the pilot-funded episodes of the Red River Farm Network *TransFARMation* series, which received initial sponsorship to continue the season beyond the initial episodes and is now rebooting for new discussions. Other radio stations have sought guidance from this team to develop their own regional radio show to focus on reduce mental health stigma using members of their local communities.

A. COVER PAGE

Project Title: The Great Plains Center for Agricultural Health	
Component Title: Outreach Core Component Project Lead: Rohlman, Diane	
Grant Number: 5 U54OH007548	Project/Grant Period: 9/30/16 - 9/29/22
Reporting Period: 9/30/16 – 9/29/22	Date Submitted:
Program Director/ Principal Investigator T. Renee Anthony, BS, MS, PhD Ph: 319-335-4429 Email: renee-anthony@uiowa.edu	Administrative Official Information Wendy Beaver Executive Director, Division of Sponsored Programs 2 Gilmore Hall Iowa City, IA 52242 Ph: 319-335-2123 Email: nih@uiowa.edu
Change of Contact PD/PI: N/A	
Human Subjects: Yes HS Exempt: No	Vertebrate Animals: No
hESC: No	Inventions/Patents: No

B. COMPONENT ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Aim 1: (Educate) Increase impact of our national training program in agricultural safety and health through improved access to collaboratively developed content, educational materials, and curriculum. We will develop a web-based, asynchronous, digital learning platform to enhance delivery of the next generation of *Agricultural Safety and Health: The Core Course* (previously titled the Building Capacity Course). The GPCAH will tailor training modules to the specific safety and health needs of specialized stakeholder populations (e.g., first responders, insurance risk assessors, veterinarians). We will formalize a national network of agricultural educators who have delivered this training to their local and regional stakeholders.

Aim 2: (Translate) Translate scientific findings and experiential narratives into culturally appropriate messages to prevent injury and illness and to protect agricultural workers. The Outreach Core will obtain key findings from GPCAH project investigators and develop effective messages and materials that emphasize prevention for audiences throughout the agricultural sector.

Aim 3: (Communicate) Improve awareness of agricultural injury and illness as a preventable public health burden through a multi-modal communication strategy. The Outreach Core will disseminate prevention messages through multiple channels to reach a broad audience that includes farmers, agricultural support organizations, agricultural news media, and the agricultural safety and health community.

B.2. What did you accomplish under these goals?

We are presenting the major activities, significant results, and key outcomes for the outreach project by aim. Following this is a discussion of how the approaches taken assured robust and unbiased results.

AIM 1: EDUCATE

GPCAH Agricultural Safety and Health: Core Course. A primary activity of the Outreach Core was to design, develop, and disseminate agricultural safety and health (ASH) curriculum. During this project period, the *Core Course* has been delivered annually by the GPCAH to 180 trainees. We have used a train-the-trainer model to support new sites offering the *Core Course*. We have created a network of agricultural educators and continuously evaluated and updated the curriculum to maintain relevance. We developed common evaluation metrics (e.g., exam questions, demographics) that were implemented across sites.

The GPCAH has worked to develop and deliver ASH education three new sites during the 2016-22 cycle: (1) University of Missouri, Kansas City, School of Pharmacy; (2) Dordt University, undergraduate Agriculture Program; and (3) Dalhousie University, Nova Scotia, undergraduate Agricultural Program. In 2019, the University of Missouri-Kansas City offered a new course, *PHAR 7223: Rural Health & Agricultural Medicine* to introduce health professional students to agricultural health and rural medicine to prepare them to serve rural populations. In Fall 2021, the *Core Course* was delivered in partnership with Farm Safety Nova Scotia for first-year college students in the Agricultural Farm Management program at Dalhousie University. They have created a new course that will be offered in Fall 2023. Dordt University also adopted our online modules as part of their undergraduate curriculum.

Online Training Modules and Course Content. Originally designed as a classroom-based course, this project period focused on expanding the *Core Course* to include educational content in multiple formats (in person, online training modules, video/podcasts) and to include interactive activities, case studies, and tours of local agricultural operations. Research findings and outreach materials developed by the GPCAH and other AgFF centers were integrated into course content and online modules throughout the project period to enhance the diffusion of new research findings into farming operations. During the current funding cycle, we translated the classroom curriculum into asynchronous online training modules, specifically on Lung Disease (2017), Skin Disorders (2018), Overview of AgFF (2019), Physical Agents (2019), PPE for Ag (2019),

Biological Risk Management (2020), Transportation Hazards (2021), and Livestock Handling (2022). Individual online modules have been completed 1,413 times between Sept 2017 and Oct 2022. Evaluation data demonstrates increases in knowledge (94%) of participants as well as satisfaction (94%) and relevance of the module content (85%). Ninety-three percent would recommend the online module to others, and 92% report the intend to implement at least one thing they learned in the training. These modules have been adopted by other sites (TX, MO, DAL, NE, Dordt) and were critical to our transition to an online format during the global COVID pandemic.

AIM 2: TRANSLATE

The second goal of the Outreach Core was to *translate* scientific findings and experiential narratives into audience-appropriate safety and health messages. Various multimedia products were developed. Topics were determined by NIOSH priorities, regional needs assessments, and emerging issues and also included the translation of evidence-based findings from both research and pilot projects. We applied the *Social Ecological Model* to identify catalysts at the individual, institutional, community, and policy levels that influence the knowledge, attitudes, and practices of agricultural workers throughout the region. These evidence-based materials target a range of audiences, including children and adult farmers, healthcare providers, and intermediary organizations that serve rural communities.

Based on growing evidence that using a narrative, or storytelling, technique can improve safety behaviors or outcomes, the GPCAH Outreach Core employed qualitative interviews and narrative storytelling to develop prevention messages in the *Telling the Story* project (tellingthestoryproject.org) and monthly *Safety Watch* columns distributed through Lee Agri-Media outlets (e.g., *Iowa Farmer Today*). Narrative messages have been linked with improved safety behaviors and have been found to humanize public health messaging, which otherwise often takes an abstract, “one size fits all” approach. The narratives were combined with evidence-based findings to make prevention messages more relevant and compelling to farmers and, therefore, more likely to be adopted.

Telling the Story (TTS) is a collaborative project with the Central States Center for Agricultural Safety and Health (CS-CASH), the Upper Midwest Agricultural Safety and Health Center (UMASH), and the National Farm Medicine Center to convey the story of agricultural safety. The GPCAH took the lead on conducting interviews and incident investigations, leaning on skills developed from NIOSH FACE investigation expertise in our Center. Prevention messaging developed through this activity incorporated elements of traditional incident investigation with experiential content provided by individuals (farmers, agricultural workers, and family and community) directly affected by farm injuries, near-miss incidents, and fatalities. The resulting messages used first-person, narrative accounts to emphasize the impact of injury incidents on families and communities. Eleven stories (including videos) and three vignettes are available on the website which has had > 28,167 visits (through Apr 2022). The website features articles, vignettes, and cartoons by agricultural cartoonist Rick Friday, and stories include prevention resources. Topics include hydrogen sulfide gas released during agitation or transfer of stored manure, ATV incidents, falls, and farming with disabilities. During the COVID pandemic, the project focused on sharing stories of rural community members and why they were vaccinated. Press kits and resources for agricultural educators (e.g., discussion guides for educators, 4-H, and FFA leaders) are available to educators and the public on this web page.

Safety Watch is a monthly column in a printed trade newspaper that farmers subscribe to throughout our region. The GPCAH Outreach team has partnered with the editorial staff at *Iowa Farmer Today* and Iowa's Center for Agricultural Safety and Health (I-CASH) to generate over 89 *Safety Watch* columns since 2015 (72 in our 6-year project period). These monthly columns are featured in *Iowa Farmer Today*, *Missouri Farmer Today*, *Illinois Farmer Today*, and *Midwest Marketer*. They are also available through online Lee Agri-Media channels. The articles disseminate research findings from GPCAH, narratives from *Telling the Story*, and news and resources from our partner organizations (such as I-CASH and other AgFF Centers). We maintain a repository of these articles on our website as well (see C.5 for article list).

Outreach Toolkits have been developed to address suggestions from the GPCAH Regional Advisory Committee. To assist our regional partners deliver outreach activities on new and timely, the Outreach Core has compiled toolkits that compile both train-the-trainer information and how-to tutorials, along with ready to print materials, to magnify the reach of our existing outreach activities. Feedback from the RAC guided the topic selection and format of these toolkits. During this project period, we prepared toolkits on Rural Roadway Safety, Gas Monitor Use, and Hearing Protection. These kits include pamphlets and handouts, visual displays, and a mini curriculum to help partners talk about safety and health topics and appropriately respond to questions on topics that might be new to them. Activities targeting different audiences have been piloted in the field by GPCAH prior to inclusion in these kits.

AIM 3: COMMUNICATE AND DISSEMINATE

Partnering with Intermediary Organizations

The GPCAH has established long-standing partnerships with intermediary organizations that disseminate our research findings directly to farmers/producers and agricultural workers. These include NIOSH-funded Heartland Education and Research Center, the Total Worker Health Center/Healthier Workforce Center of the Midwest, CDC-funded Injury Prevention Research Center, state-funded I-CASH, national AgFF Centers, extension, Ag Health and Safety Alliance (AgHSA), the AgriSafe Network, and other organizations. Examples include the distribution of GPCAH products by I-CASH through all Iowa State University Extension and Outreach and Farm Service Agency Offices as part of their Seasonal Campaigns, tracking subsequent requests for materials by local extension offices and Chambers of Commerce. Campaign materials describing the best lighting and marking practices for farm equipment were sent to all Extension offices in Missouri. GPCAH members have also presented in the AgriSafe Nurse Scholars program, the Rural Prep Grand Rounds Program, and National Children's Center for Rural and Agricultural Health and Safety workshops on protecting youth on the farm. This led to the development of three teaching kits used for training rural healthcare providers (Organophosphate Pesticide Poisoning and Prevention, Mental Health in Rural Communities, Farm Safety for Children).

In addition to participating in the *Core Course*, the international Gear Up for Ag™ program offered by AgHSA provides training for students enrolled in agriculture programs nationally and internationally. This collaboration is an excellent example of how the GPCAH transfers evidence-based findings to intermediary organizations for adoption, adaption, integration, and sustainability. Integrated into the classroom and available as part of their online resources, GPCAH content has been delivered to thousands of young agricultural workers (e.g., respiratory protection, hearing conservation, manure gas safety, cold weather hazards, COVID, highly pathogenic avian influenza, TTS materials). As part of their training, students were surveyed to learn more about their current farm activities, safety behaviors, and any health and safety concerns. This information is critical to understand current work practices and to identify potential interventions. They also delivered respirator fit test training to students in the UMKC and GPCAH core courses and participants at the PACT conference. They have provided presentations/training (e.g., respiratory protection to poultry workers and at the Pesticide Applicator Certification Training conference, manure gas safety using our Outreach Kit and supplies) throughout the region (e.g., Clay County, IA Farm Bureau Annual Meeting). They are developing a *Respirator Fit Test Capacity Building Guide for Pesticides Handlers* that will be translated into Spanish. Center resources are regularly featured by the AgHSA as part of the "AI in the Afternoon" weekly radio show on KTOE and the Dairy Signal live broadcast specifically for the Professional Dairy Producers,™ and this group has contributed their expertise from these training events to the GPCAH FarmSafe podcast, and worked with GPCAH investigators to generate peer-reviewed publications to share lessons learned from their educational activities.

Communicate and Disseminate Findings

The GPCAH communicates to farmers and their advocates using multiple formats to reach a broad audience (agricultural workers, practitioners, journalists, producer groups, equipment/input dealers) across our nine-state region). This includes traditional newsprint, in-person interactions, and online. The goal of our communication is to *reinforce prevention as the key strategy to reduce agricultural illness and injury*. Center

staff communicate directly with farmers at fairs and farm shows using targeted, interactive messaging as well as through farm news media (e.g., *Safety Watch*). We attended a range of outreach events -- including farm shows (21), conferences (21), agricultural safety days (17), and local events (3) -- in all states throughout our region, prioritizing states with fewer ASH resources. We collaborate with intermediary organizations and other AgFF centers in our region. Topics for outreach activities are coordinated and selected to best address audience needs. Heartland ERC trainees often accompany the Outreach staff and may use this opportunity for data collection or experiential learning events. The GPCAH also engaged farmers and other stakeholders in agriculture via social media and web-based outreach. Finally, Center personnel communicate timely prevention messages via monthly *Safety Watch* column and quarterly *Alive and Well* newsletter. Aim 3 responds to the NORA 2008 National AFF Agenda Goal 3.3 by using innovative and proven communication, education, and social marketing.

In 2012, the **Evaluators, Coordinators, and Outreach (ECO)** group was launched with the goal to enhance cross-center collaboration by sharing resources/training and workgroups focused on collective outreach campaigns. The group meets regularly and provides a network to enhance center collaboration and public communications for national AgFF safety and health initiatives. GPCAH Outreach staff along with the P&E staff contributed to the *Awareness workgroup*, compiling information and messages for two national safety campaigns (National Farm Safety and Health Week; Ag Safety Awareness Program Week), and to the *YouTube Channel workgroup*, a peer-reviewed channel for AgFF-produced educational videos, where our Center has analyzed this multi-center effort to contribute to peer-reviewed publications (Wickman et al. 2021; Beseler et al. 2022). The ECO group convened safety and health experts across centers to coordinate responses to significant emerging issues, including COVID-19, natural disasters, and mental health.

ROBUST AND UNBIASED RESULTS

All materials, communications, and curricula that were developed and distributed by the Outreach Core go through a rigorous multi-level evaluation process. This includes internal review by scientists and outreach specialists in the GPCAH and external review by *Regional Advisory Committee* members during quarterly meetings. This group includes health care providers, personnel from other NIOSH AFF centers, extension agents, and other agricultural health and safety advocates. In addition, members of the agricultural community provided feedback during outreach events, including through structured surveys.

For the *Core Course*, evaluation metrics (e.g., pre- and post-test scores, course evaluations) were obtained and used to assess the consistency of the *Core Course* materials and instructional format. Feedback was reviewed annually and used to indicate where improvements were needed. Course materials were also available to our partners, to maintain consistency across educational sites. Online modules went through a rigorous review process to ensure the content accuracy. A content expert was selected to lead the development of a particular topic and draft the initial material. All content was reviewed internally by faculty and staff with expertise in safety and health and followed by external review by additional content experts. This feedback was then incorporated into the training content, which was then reviewed again internally.

In addition, the Outreach Core employed theoretical frameworks to guide our activities and ensure scientific rigor in all outputs. This includes the use of the Social Ecological Model (SEM), a well-tested model for health promotion, which provided a structure to identify specific influencers within a complex sociocultural system. The SEM has been widely applied to health promotion interventions in a variety of disciplines but had not been applied to agricultural safety and health interventions when we started this project. Similarly, based on growing evidence that using a narrative, or storytelling, technique can improve safety behaviors or outcomes, the GPCAH Outreach Core has employed qualitative interviews and narrative storytelling to develop prevention messages in *Telling the Story* and in the *Safety Watch* columns in *Iowa Farmer Today*. Narrative messages have been linked with improved safety behaviors and have been found to humanize public health messaging, which otherwise often takes an abstract, "one size fits all" approach. The use of tested theoretical frameworks, although novel in occupational safety and health, are used to provide rigorously evaluated outputs.

B.3. Competitive Revisions/Administrative Supplements

None

B.4. What opportunities for training and professional development did the project provide?

While this Center does not serve the mission of training and providing professional development for Center personnel, one undergraduate (Grissinger) and eight graduate (Bentley, Morley, Morrison, Proctor, Ralphs, Rudolphi, Soupene, Thornton) students and a post-doc (Crawford) participated in a variety of outreach activities throughout this project period. Their expertise and skills were developed to contribute to outreach, including developing educational materials (Morrison), surveying feedback on training content (Soupene), making outreach materials (Crawford, Grissinger), and participating in outreach demonstrations and educational events.

INDIVIDUAL DEVELOPMENT PLANS AT UI'S COLLEGE OF PUBLIC HEALTH

Beginning in 2019, formal Individual Development Plans (IDPs) were developed by graduate research assistants in conjunction with their academic advisors, following structure developed by the NIOSH Heartland ERC (<https://www.youtube.com/watch?v=W0k4TPucZXo>). Plans were reviewed between students and advisor both prior to summer conferences and prior to the last semester of coursework.

B.5. How did you disseminate the results to communities of interest?**AIM 1: EDUCATE**

The *Agricultural Safety and Health: Core Course* materials are publicly available at www.gpcah.org/asheducation and have been provided to other AgFF centers, community colleges, and agricultural education programs both nationally and internationally. A rigorous evaluation program was used to assess knowledge and practice changes among course trainees, and we have developed common evaluation metrics (e.g., exam questions, demographics) that were implemented across sites. Feedback across all sites include: 80% agree/strongly agree that their ability to anticipate, diagnose, treat, or prevent agricultural injury/illness improved because of taking the course; 85% agree/strongly agree that the information they received helped them address the occupational hazards of their community; and 70% agree/strongly agree they feel confident when recommending personal protective equipment for the farming population. Online educational modules were disseminated to our partners and have been integrated into their training programs. These modules are included in the SAY National Clearinghouse, aligned with the Agricultural, Food & Natural Resources (AFNR) Career Content Standards used by agricultural educators. During this project period, three sites have developed a new course or integrated GPCAH agricultural safety and health information into their curriculum. Course promotion occurs through the GPCAH website, health and safety organization contacts, social media posts, and newsletters. General continuing education credit is available, in addition to continuing education for physicians, nurses, emergency medical services, and veterinarians. All course participants receive online resources containing lectures provided during the course, supplemental readings, and local and national resources. After completing the course, several participants continue to engage with the GPCAH. This includes submitting a pilot grant proposal, requesting outreach materials, adapting curriculum into their programs, providing media interviews, or inviting an instructor to present at a local or national events (e.g., presentation at AgSafe Alberta Growing Farm Safety webinar series, the Gear Up for Ag Safety™ program offered by AgHSA is now regularly offered at Dordt University).

Evaluation data from the *Core Course*, online modules, and survey of course alumni (trainees who took the *Core Course* between 2012-2018) were sent out in Mar 2020. Due to COVID, responses were limited, and alumni who took the *Core Course* between 2012 -2022 were resurveyed in 2022. These surveys provided feedback on the content and delivery formats (in person and online), relevance of the material, and demonstrated increased knowledge. Most participants would recommend the *Core Course* and online

modules, and many reported they intended to implement at least one thing they learned in the training. Core Course participants reported personal and organizational impacts after completing the course, including implementing a health or safety program in the workplace, incorporating changes into practice, sharing course materials or using them in classroom settings, and increasing discussions with stakeholders about agricultural safety and health

Feedback from *Core Course* participants demonstrate the impact and relevance of the curriculum:

- *I found the course to be a great learning opportunity for me on many levels. Being a nurse, a farmer, and living in a rural area the course touched all aspects of my life and passions. The course material would be beneficial to so many populations. I plan to use the knowledge obtained from this course in work and personal life. I also hope to spread the knowledge I learned from this course to those in my community...*
- *... As a health care provider, I received beneficial information regarding the diseases and disorders I see in a rural population. Without having any farming experience, I was able to easily keep up. I highly recommend this course for those who practice with the rural community.*
- *The presentations by farmers themselves added a real human perspective to the material we were learning.*
- *Crucial as a future pharmacist to learn your community/population and how to serve your community and improve their overall health.*

AIM 2: TRANSLATE

The GPCAH Outreach Core has developed multimedia products that combined the translation of evidence-based findings and experiential narratives (storytelling) into communication tools. Materials targeted a range of audiences including, agricultural workers, children and adult farmers, healthcare providers, and intermediary organizations that serve rural communities. Topics were determined by NIOSH priorities, regional needs assessments, and emerging issues and included the translation of evidence-based findings from research and pilot projects.

Storytelling or experiential narratives were included in the *Telling the Story* (TTS) project and media products (e.g., Safety Watch column distributed through Lee Agri-Media outlets). TTS has led to stories and videos available on the website which has had > 28,164 (through Apr 2022) visits. The TTS project was featured as a plenary panel during the 2018 MRASH conference, was presented as a roundtable at the 2019 ISASH conference and has been integrated into the *Core Course*. The project has been covered by numerous media outlets, including *Iowa Farmer Today*, *Ag Industry News*, *Brownfield Ag News*, and *RFD-TV*. Press kits and resources for agricultural educators (e.g., discussion guides for educators, 4-H, and FFA leaders) are available. Monthly Safety Watch columns are featured in *Iowa Farmer Today*, *Missouri Farmer Today*, *Illinois Farmer Today*, and *Midwest Marketer* (reaching over 72,000 farm families in the GPCAH region). They are also available through online Lee Agri-Media channels (circulation >341,000). The articles disseminate research findings from GPCAH, narratives from *Telling the Story*, and news and resources from our partner organizations (such as I-CASH and other AgFF Centers). GPCAH Outreach Core staff and staff from partner centers have been featured and interviewed by external media.

The Ag Health and Safety Alliance (AgHSA) disseminates pamphlets, posters, and other outreach products generated by the GPCAH by integrated materials into the Gear Up for Ag Safety™ program offered nationally and internationally to undergraduates in agricultural programs.

Research findings and outreach materials developed by the GPCAH and other AgFF centers have been integrated into course content and online modules. For example, surveillance data from the Rural Roadway project (Greenan et al., 2016; Harland et al., 2014; Ramirez et al., 2016) have been integrated into an interactive activity (*Kahoot*) using a scenario developed by the Kentucky AgFF Center (Cole, n.d.) to demonstrate the burden and need for interventions addressing farm equipment crashes. Information about crash characteristics and the impact of state policies that follow ASABE lighting and marking standards to reduce crashes is presented. We developed an interactive game (“pin the light on the tractor”) used at in-

person events with children and adults and have created poster/brochures for extension, classrooms, and others. Materials are available at no cost and have been disseminated through our network of agricultural educators and adopted by other organizations. Details on operating these activities are incorporated into our Outreach Toolkits, available to all to adopt and use.

AIM 3: COMMUNICATE

The Outreach Core continued to expand the Center's partnerships and reach through a comprehensive communication strategy that directly engages farmers at agricultural events to improve their health and safety knowledge (interpersonal influence) and the broad dissemination of information through web-based, direct mail, and media outlets (community/society level influence). The communication strategy leveraged resources and expertise through continued collaborations with other centers housed administratively alongside the GPCAH that address agricultural health and safety (e.g., NIOSH-funded Heartland Education and Research Center and Total Worker Health Center, CDC-funded Injury Prevention Research Center, state-funded I-CASH), and national AgFF Centers to cross-disseminate information, develop articles for publication in trade journals, and provide public service announcements, and partnerships with intermediary organizations who have integrated our materials into their programming and educational activities. For example, in 2019, I-CASH distributed 5000 GPCAH hearing protection informational cards through all Iowa State University Extension and Outreach and Farm Service Agency Offices as part of their Seasonal Campaign. Subsequently, an additional 150 cards and sets of earplugs *were requested* by and provided to the Louisa County Extension office for use in their agricultural programming. The Chamber of Commerce Agricultural Committee in Le Mars, IA asked for materials to display at their county fair and other events. Over 30,000 people visited the display at the county fair. We also partnered on I-CASH's annual *Stay Safe, Take a Break* campaign. During harvest, Iowa FFA and 4-H chapters put together bags of health and safety information, including GPCAH materials, and delivered them to producers who were working in the fields. Nine hundred bags were distributed across the state of Iowa. A similar campaign, but on Rural Roadway Safety that was based on Center research findings, was conducted in Missouri. Campaign materials describing the best lighting and marking practices for farm equipment were sent to all Extension offices in Missouri. Invited presentations with partners have led to the development of on demand, asynchronous content in the AgriSafe Nurse Scholars program, the Rural Prep Grand Rounds Program, and the National Children's Center for Rural and Agricultural Health and Safety. This led to the development of three teaching kits used for training rural healthcare providers (Organophosphate Pesticide Poisoning and Prevention, Mental Health in Rural Communities, Farm Safety for Children).

Through their Gear Up for Ag™ training, the AgHSA has trained over 3,400 high school and college students, incorporated GPCAH content and materials into their training, disseminated print materials from the GPCAH, developed additional co-branded content, and integrated GPCAH materials into their online content. This online program serves as an additional avenue to promote and share GPCAH outreach materials *even after* the live portion of the program was completed. In 2021-2022, approximately three quarters (76%) of Gear Up for Ag™ participants also enrolled in the Gear Up for Ag™ online portion and viewed the resources later. The GPCAH worked with the AgHSA to evaluate the Gear Up for AG program™ and collect information about current safety behaviors and concerns. These findings are disseminated through conference presentations and peer-reviewed publications. AgHSA also delivered content in the *Core Course* at Iowa and Missouri. They provided respirator fit test training to students in the Missouri and GPCAH core courses and participants at the PACT conference (~60 individuals) and are developing a *Respirator Fit Test Capacity Building Guide* to focus specifically on chemical (pesticides) handling. They have partnered with Migrant Clinician's Network to translate this guide to Spanish and plan to use the guide in upcoming presentations. Additional AgHSA presentations/training were conducted throughout the region (>1,300 participants). These include sessions on respiratory protection provided to 86 workers at a local poultry company. The training included an overview of the respiratory system, how agricultural respiratory hazards can cause acute and chronic symptoms, methods of prevention, and demonstration of proper PPE use. The presentation also included an overview of the GPCAH and other available resources. The AgHSA also presented Manure Gas Safety using our Outreach Kit (and monitors) at the national Pesticide Applicator

Certification and Training (PACT, 2021) conference. Center resources are regularly featured by the AgHSA as part of the “AI in the Afternoon” weekly radio show on KTOE and the Dairy Signal podcast. This radio show has transitioned to a podcast format with weekly episodes available on Facebook live and on the AgHSA website to be viewed on demand. The Dairy Signal Podcast is based on a live broadcast with significant time allotted for direct Q&A with producers. It is produced by the Professional Dairy Producers™ a producer-led and membership-based organization with over 5,000 members.

GPCAH staff have provided outreach at a variety of events across the country in an effort to meet farmers and their advocates “where they are”. These events range in scope from large regional and national farm shows that attract thousands of attendees (4-6 per year) and national meetings/conventions (2-4 per year) to local events that allow more thorough engagement with the community (2-6 per year). Online outreach activities were added as events transitioned to virtual events during the pandemic. Examples include:

- *National and Regional Farm Shows/Events:* Farm Progress Show (Boone, IA and Decatur, IL); Minnesota Farmfest (Redwood Falls, MN); Big Iron Farm Show (West Fargo, ND); Sioux Falls Farm Show (Sioux Falls, SD); Dakotafest (Mitchell, SD); Triumph of Ag Expo (Omaha, NE); Iowa Pork Congress (Des Moines, IA); Western Farm Show (Kansas City, MO); World Dairy Expo (Madison, WI); County Fairs; Ag Safety Days; and Gear Up for Ag Safety programs around the region.
- *Meetings and Conventions:* National Association of Extension 4-H Youth Development Annual Conference; National Association of County Agricultural Agents Annual Meeting; National FFA Convention; International Society for Agricultural Safety and Health Conference; National Ag in the Classroom conference; National Council of Agricultural Employers Ag Employer Forum; Agricultural Safety and Health Council of America Safety Summit; Midwest Rural and Agricultural Safety and Health Conference.
- *Virtual Events:* UMASH Online Expo: A 20/20 Look at Ag Health, Safety, and Wellness; 2020 and 2021 MRASH Conferences; 2020 and 2021 ISASH conferences; 2020 ASHCA Online Safety Summit.

Safety Watch columns, 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). AgUpdate.com and CattleSeller.com (reaching 500,000 Midwest producers) disseminate research findings from GPCAH, narratives from *Telling the Story*, and news and resources from our partner organizations. The *Farm Families Alive and Well* Newsletter is distributed quarterly to more than 1600 farmers, agricultural professionals, extension agents, elected officials, and safety and health practitioners nationally. The newsletter, in collaboration with I-CASH, is an important way to communicate Center activities, including calls for pilot grants, promotion of the *Core Course*, and study recruitment opportunities, and to disseminate research findings that are suitable to integrate into practice.

The GPCAH website has been updated to include all outreach materials curated by topic, links to *Safety Watch* columns and the new TTS website, and information about Outreach staff activities at farm shows and conferences. GPCAH also makes active use of Facebook and Twitter, regularly amplifying prevention information for emerging issues such as manure gas hazards and generating community dialog about incidents related in *Safety Watch* columns and TTS outputs.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

Not applicable

C.1. Publications, conference papers, and presentations**PUBLICATIONS Citations****2017**

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*. 17(1):3931. PMC6987961 DOI: [10.22605/rrh3931](https://doi.org/10.22605/rrh3931)

Janssen B, Nonnenmann, M: [2017] New Institutional Theory and a Culture of Safety in Agriculture. *Journal of Agromedicine*. 22(1): 47-55. PMC5763477. DOI: [10.1080/1059924X.2016.1249444](https://doi.org/10.1080/1059924X.2016.1249444)

Janssen B and Nonnenmann M: [2017] Public Health Science in Agriculture: Farmers' Perspectives on Respiratory Protection Research. *Journal of Rural Studies*. 55:122-130. DOI:[10.1016/j.jrurstud.2017.08.008](https://doi.org/10.1016/j.jrurstud.2017.08.008)

2019

Donham KJ, Meppelink SM, Kelly KM, Rohlman DS: [2019] Health indicators of a cohort of Midwest Dairy Farmers: Health outcomes of participants in the Certified Safe Farm Program. *Journal of Agromedicine*, 24(3):228-238. PMID: 30849293. DOI: <https://doi.org/10.1080/1059924x.2019.1591316>

Scott-Harp D, Peek-Asa C, Rohlman DS, Janssen B: [2019] More than time and money: A mixed-methods study of the barriers to safer cattle handling practices. *American Journal of Industrial Medicine*, 62(11):978-985. PMC7069494. DOI: <https://doi.org/10.1002/ajim.23043>

2021

Wickman A, Duysen E, Cheyney M, Pennington W, Mazur J, Yoder A: [2021] Development of an educational YouTube channel: A collaboration between U.S. Agricultural Safety and Health Centers. *Journal of Agromedicine*. 26(1):75-84 PMID: PMC8117175. DOI: <https://doi.org/10.1080/1059924x.2020.1845269>

Gibbs JL, Walls K, Sheridan C, Sullivan D, Cheyney M, Janssen B, Rohlman DS: [2021] Evaluation of Self-Reported Agricultural Tasks, Safety Concerns, and Health and Safety Behaviors of Young Adults in U.S. Collegiate Agricultural Programs. *Safety*. 7(2):44. Jun. PMC8455168 (Open access)

Conference Papers and Presentations**CONFERENCE Papers****2020**

Ploeckelman M, Duysen E, Heilberger S, Yoder A, Leonard S: [2020] JA:2021-24. Telling the Story–Using Storytelling to disseminate agricultural safety and health messaging. *Journal of Agromedicine*, 25(3):249-250. (Published abstract)

Soupe V, Cheyney ML, Arora K, Rohlman DS, Anthony TR: [2020] JA:2021-37. Perspectives and Concerns on Agricultural Safety among Community College Students, *Journal of Agromedicine*. 2020 Dec; 25(3): 260-261. (Published abstract)

CONFERENCE Presentations**2018**

Heilberger S, Duysen E, Leonard S, Ploeckelman M, Yoder A: [2018] Telling the Story Project. International Society for Agricultural Safety and Health Annual Conference, Halifax, N.S., Jun 25-28.

Janssen B: [2018] Investing in farm safety: agricultural lenders as public health partners. ISASH Conference, Halifax, N.S., Jun 22-24.

Scott-Harp D, Rohlman D, Peek-Asa C, Janssen B: [2018] Barriers to the adoption of safe beef handling practices, equipment, and facilities in Iowa. ISASH Conference, Halifax, N.S., Jun 22-24.

Rohlman D, Salzwedel M, Jepsen D: [2018] Working Youth Plenary Panel. Child Agricultural Injury Prevention Workshop, Marshfield, WI. Aug 13. 60 attendees.
Morley E: [2018] Healthcare seeking behaviors among Midwest farmers. MRASH Conference, Council Bluffs, IA. Nov 27-28.
Rohlman D: [2018] Review of targeted safety and health interventions for youth working in agriculture, 2010-2017. MRASH Conference, Council Bluffs, IA. Nov 27-28.
Heiberger S, Duysen E, Leonard S, Ploeckelman M, Yoder A: [2018] Telling the Story Project (plenary panel). MRASH Conference, Council Bluffs, IA, Nov 27- 28.
2019
Rohlman DS: [2019] Let's Talk About Mental Health. 2019 Compeer Financial Women's Seminar, Compeer Financial. In 4 IL locations: Macomb, Galena, Ottawa, and Edwards.
Duysen E, Yoder A, Leonard S, Heiberger S, Ploeckelman M: [2019] Telling the Story: Using Storytelling to Disseminate Agricultural Safety and Health Messaging. World Social Marketing Conference; Edinburgh, Scotland. Jun.
Rohlman D: [2019] Child Agricultural Injury Prevention Workshop. International Society for Agricultural Safety and Health Conference (ISASH), Des Moines, IA. Jun 22-3.
Heiberger, Duysen, Ploeckelman, Leonard, Yoder: [2019] Promoting Behavior Change through Storytelling. International Society for Agricultural Safety and Health Conference (ISASH), Des Moines, IA. Jun 24-27.
Rohlman D, Simmes D, Buhl K, Forsyth P: [2019] One Sip Can Kill: Helping medical professionals recognize paraquat poisoning. International Society for Agricultural Safety and Health Conference (ISASH), Des Moines, IA. Jun 24-27.
Janssen B, Donham K, Swanson J, Leinenkugel K, Schaefer K: [2019] Leveraging Statewide Partnerships to Promote Agricultural Safety & Health. International Society for Agricultural Safety and Health Conference (ISASH), Des Moines, IA, Jun 24-27.
Rohlman DS: [2019] Farm Health and Safety. Joint meeting of the North American Fruit Explorers and the Northern Nut Growers Association Conference, Iowa City, IA. Jul 28-31.
Janssen B: [2019] Mental Health. AAA Conference. Vancouver, Canada. Nov 22.
2020
Duysen E, Heiberger S, Leonard S, Ploeckelman M, Yoder A: [2020] Telling the Story – Using Storytelling to Disseminate Agricultural Safety and Health Messaging. ASHCA Summit 2020, (virtual) Lightning Talk. Sept 17.
Rohlman DS. [2020] Farmer Mental Health. Iowa Psychiatric Society, Fall CME Conference. Oct 23.
Rohlman, DS: [2020] Training for Agricultural Safety and Health Professionals: Developing a Sustainable Program. NORA Council Meeting. Nov 3. Online.
Duysen E, Cheyney M, and Schossow M: [2020] Striving to Conduct Effective Agricultural Safety and Health Outreach During a Pandemic: From John Deere Masks to Plexiglass. MRASH 2020 Online Anytime roundtable; discussed on Tuesday Nov 17.
Soupene V, Rohlman DS: [2020] Assessing Pesticide Education Interventions using Kirkpatrick's Evaluation Model: A Narrative Literature Review. Midwest Rural Agricultural Safety and Health (MRASH) Conference Poster Presentation. Nov 17-20.
Soupene V, Cheyney M, Arora K, Rohlman DS, Anthony TR: [2020] Perspectives and Concerns on Agricultural Safety among Community College Students. Midwest Rural Agricultural Safety and Health (MRASH) Conference Poster Presentation. Nov 17-20.
Rohlman D: [2020] Network with the Professionals, Coffee Talk. Midwest Rural Agricultural Safety and Health (MRASH) Conference. Nov 17-20.
Liang Y, Janssen B, Rohlman DS: [2020] Using Mixed Methods to Examine Symptoms of Depression among Cooperative Dairy Farmers. Midwest Rural Agricultural Safety and Health (MRASH) Conference Poster Presentation. Nov 17-20.

Janssen B: [2020] Moderator for Changing Behaviors with Changing Demographics Panel Discussion. Midwest Rural Agricultural Safety and Health (MRASH) Conference. Nov 17-20.	
2021	
Rohlman DS, Mohling K, Nonnenmann M, Morrison L, Cheyney M: [2021] Training Current and Future Safety and Health Professionals: A Sustainable Online Training for Agricultural Safety and Health Professionals. Agricultural Safety & Health Council of America (ASHCA) Virtual Conference. Mar 22-24.	
Rohlman DS, Salzwedel M: [2021] Dairy Signal & Supervisor Training: Keeping Teens Safe on the Farm. Professional Dairy Producers. May 12.	
Rohlman DS: [2021] Mental Health of Agricultural Workers. University of Iowa Rural and Public Health Psychiatry Seminar Series. Jun 22.	
Rohlman DS: [2021] Working Youth Panel. Child Agricultural Safety and Health Workshop: Protecting the Future of Agriculture Conference. Sept 28.	
Rohlman DS: [2021] Conference Session Facilitator. Child Agricultural Safety and Health Workshop: Protecting the Future of Agriculture. Sept 14, 21, 28.	
Rohlman D: [2021] Network with the Professionals, Coffee Talk. Midwest Rural Agricultural Safety and Health (MRASH) Conference. Nov 10.	
Rohlman D: [2021] Research to Practice at the University of Iowa College of Public Health. Summit Session on Capacity Building, International Association for Workplace Health Professionals. Nov 17.	
2022	
Bentley M, Cheyney M, Rohlman DS. (2022). Young workers in agriculture – what do they know about workplace safety? North American Agricultural Safety Summit, Agricultural Safety & Health Council of America, Las Vegas, Nevada. Mar 29.	
Crawford K, Morrison L, Nonnenmann M, Mohling K, Rohlman DS. (2022). Evaluation of New Agricultural Safety and Health Asynchronous Online Training Modules. North American Agricultural Safety Summit, Agricultural Safety & Health Council of America, Las Vegas, Nevada. Mar 29	
Heiberger S, Duysen E, Leonard S, Ploeckelman M, Yoder A: [2022] Telling a story to save a life: Creating an impactful first-person narrative. International Society for Agricultural Health and Safety Conference, Fort Collins, CO. Jun 12-16,	
Rohlman DS. (2022). Protecting and Promoting the Health of Young Agricultural Workers: The Role of Employers and Supervisor. National Farm Safety and Health Week, AgriSafe. Sept 21.	
Rohlman DS. (2022). Working Youth Panel. Child Agricultural Safety and Health Workshop: Protecting the Future of Agriculture Conference. Sept 28.	
Stevens H, Rohlman DS. (2022). Pesticides and Adolescents: Keeping Them Safe. Science Cafe, Environmental Health Sciences Research Center. Nov 10.	
C.2. Website(s) or other Internet site(s) – include URL(s)	
https://gpcah.public-health.uiowa.edu/education/	GPCAH educational resources and activities landing page
https://tellingthestoryproject.org	Landing page for the Telling the Story Project, a collaboration between GPCAH, UMASH, CS-CASH, and the National Farm Medicine Center

C.3. Technologies or techniques

Nothing to report

C.4. Inventions, patent applications, and/or licenses

Nothing to report

C.5. Other products and resource sharing

Category	Explanation
2017	
Educational aids or curricula	Following the Agricultural Educators workshop held at the University of Iowa, the curriculum for Agricultural Safety and Health: the Core Course was disseminated and made available to all NIOSH AFF centers and other institutional partners. These materials have been adopted by other sites offering ASH training. All are available at: https://gpcah.public-health.uiowa.edu/asheducation/iowa-core-curriculum/
Educational aids or curricula	Hearing loss prevention resources were redesigned, and new resources were developed, to improve hearing loss prevention education and outreach efforts. This resource package includes: <ul style="list-style-type: none"> • “Your EARS are just as important as these EARS” three-panel display • “Hearing Loss Among Farmers 4x9” handout (4 versions for adults) • “Hearing Loss among Farmers and Agricultural workers” fact sheet • “Hearing Protection: What type is best for you” 4x9” handout • “Protect Your Ears” 4x9” handout and 2x6”bookmark for children • Youth hearing loss prevention presentation • Youth hair cell model activity These materials have been used by GPCAH at regional farm shows, ag safety days, and national conventions, and are featured in the Gear Up for Ag Safety program (implemented through the Ag Health and Safety Alliance). They have been widely adopted regionally and nationally by other Ag Centers, healthcare providers, agricultural safety and health organizations, community colleges, rural community groups, and online information hubs. They are available at: https://gpcah.public-health.uiowa.edu/outreach-2/topics/hearing-loss-prevention/
Educational aids or curricula	Whole Body Vibration Display. (English). This educational display discusses whole body vibration (WBV), health effects associated with WBV, and provides some information regarding which types of farm vehicles report the highest levels of WBV. The display was presented to more than 200 individual farmers at the World Dairy Expo, Madison, WI, Oct 6, 2017; Big Iron Farm Show, West Fargo, ND, Sept 12-14, 2017; Farm Progress Show, Decatur, IL, Aug 29-31, 2017; and Minnesota Farmfest, Redwood Falls, MN, Aug 1-3, 2017
Other	Rohlman DS: OEH: 6110 Rural Health and Agricultural Medicine. Semester long course attended by graduate students at the University of Iowa, Spring 2017.
Other	Janssen B: OEH: 6120 Topics in Agriculture and Rural Health: Hot Topics and Developing Communication Methods. Semester long course attended by graduate students at the University of Iowa, Spring 2017

Other	Rural Health and Agricultural Medicine OEH:6110/Ag Safety and Health: The Core Course. University of Iowa. Attended by graduate students and professionals. This course is offered both for graduate school credit at the University of Iowa and for continuing education for healthcare providers, EMS, public health professionals, veterinarians, and other health and safety occupations. Summer 2017.
Other	<p>Educational exhibits were presented on Whole Body Vibration and Heat Illness Prevention at farm shows in the GPCAH region</p> <ul style="list-style-type: none"> • Minnesota Farmfest (Redwood Falls, MN) • Farm Progress Show (Decatur, IL) • Big Iron Farm Show (West Fargo, ND) <p>Demonstration of an iPad based Noise-Induced Hearing Loss Simulator was also presented at</p> <ul style="list-style-type: none"> • Triumph of Ag Expo, Omaha NE (Mar 2017) • Farm Progress Show, Decatur IL (Aug 2017)
Other	Rudolphi, J: [2017] Occupational Safety and Health of Young Agricultural Workers. PhD Dissertation, May 2017.
Other	<i>Farm Families Alive and Well</i> Newsletter is published quarterly in collaboration with the I-CASH. While both Centers contribute to all newsletters, the Dec 2016 and Mar 2017 issues were more focused on GPCAH activities.
Other	<p><i>Safety Watch</i> is a monthly agricultural safety and health column published in Iowa Farmer Today, Illinois Farmer today, Midwest Marketer, and other Lee Agrimedia print publications, as well as their online site: agnewsupdate.com. They are archived at https://gpcah.public-health.uiowa.edu/safety-watch-2-2/.</p> <ul style="list-style-type: none"> • Janssen B: <i>Farming with Diabetes Requires Balancing Act</i>, Iowa Farmer Today, Oct 2016 • Leonard S: <i>Producers Respond to H₂S Deaths</i>, Iowa Farmer Today, Nov 2016 • Janssen B: <i>Suicide Rate Among Farmers at Historic High</i>, Iowa Farmer Today, Dec 2016* • Leonard S: <i>Winter Repair Work Presents Stability Risks</i>, Iowa Farmer Today, Jan 2017 • Janssen B: <i>Small Steps Affect Beginning Farmers' Safety</i>, Iowa Farmer Today, Feb 2017 • Leonard S: <i>Plan Now for Safe Manure Handling</i>. Iowa Farmer Today, Mar 2017 • Janssen B: <i>Standard Expands Respiratory Protection</i>. Iowa Farmer Today, Apr 2017 • Leonard S: <i>Safe Travel Means Busting Some Myths</i>. Iowa Farmer Today, May 2017 • Janssen B: <i>Expect the Unexpected When Handling Livestock</i>. Iowa Farmer Today, Jun 2017 • Leonard S: <i>Simple Mistake Means Shortcut to ER</i>. Iowa Farmer Today, Jul 2017 • Janssen B: <i>Long Hours May Have Hidden Consequences</i>. Iowa Farmer Today, Aug 2017 • Leonard S: <i>Farmer's Ordeal Began with an ATV Rollover</i>. Iowa Farmer Today, Sept 2017 <p>* <i>Suicide Rate Among Farmers at Historic High</i> was reprinted by The Grand Island Independent and the Center for Rural Affairs and was highlighted on Harvest Public Media, Iowa Public Radio.</p>
2018	

Educational aids or curricula	Cold Weather Hazards Display. (English). This display presents information about some cold weather hazards, such as ice (slips/trips/falls), wind chill (frostbite and hypothermia). The display was presented to more than 100 individual farmers at the Sioux Falls Farm Show (Sioux Falls, SD, Jan 24-26, 2018) and the Western Farm Show (Kansas City, MO, Feb 23-25, 2018)
Educational aids or curricula	Beat the Heat Display. (English). This display presents information about heat illness prevention. The display was presented to more than 250 individual farmers at the Minnesota Farmfest, Redwood Falls, MN, Aug 1-3, 2017; and the Farm Progress Show, Decatur, IL, Aug 29-31, 2017; and Minnesota Farmfest, Redwood Falls, MN, Aug 1-3, 2017
Educational aids or curricula	Asynchronous online training modules were developed and made available online at https://agsafetyhealth.training-source.org/ . These modules feature multimedia content and contain pre- and post-training evaluation tests. <ul style="list-style-type: none"> • Gerr F, Morrison L, Rohlman DS, Nonnenmann M, Mohling K: [2017] <i>Occupational Diseases of the Lungs in Agricultural Settings</i> [online module]. Training Source. • Gerr F, Morrison L, Rohlman DS, Nonnenmann M, Morrison L, Mohling K: [2018] <i>Occupational Skin Disorders in Agriculture</i> [online module]. Training Source.
Educational aids or curricula	Ploeckelman M, Duysen E, Yoder A, Leonard S, Heiberger S. (2018). Discussion Guides for Telling the Story Project. Two discussion guides were developed by the Telling the Story project team to be used by educators, 4-H and FFA leaders, and managers. The guides may be used to start a conversation about agricultural safety. In 2018, two discussion guides were generated on stories about manure gas safety and on the risk associated with taking short cuts. Both guides are available on the website https://tellingthestoryproject.org/discussion-guides/ .
Educational aids or curricula	Vose R. [2017]. Grain and Livestock Producer Guide for Healthy Hearing Habits. Iowa Speech and Language Association Convention. Iowa City, IA. Oct 2017. This helpful guide was developed for farmers to independently implement healthy hearing habits on their farm. The guide provides awareness, education, and prevention of noise induced hearing loss to grain and livestock producers. The guide will be distributed as anticipatory guidance by rural audiologists and clinicians during scheduled visits and hearing evaluation appointments.
Educational aids or curricula	“Safety Signs for Farm Youth” presentation and handout were developed to teach youth the meaning of the symbols that are found on hazard labels located on farm equipment and supplies and what they should do when they encounter those symbols. This curricula has been presented to thousands of elementary youth at agricultural safety days and to demonstrated to graduate students and professionals participating in the Agricultural Safety and Health Core Course at the University of Iowa.
Educational aids or curricula	Lawnmower Safety training focused on PPE needed when using a lawnmower and safe(r) mowing procedures on hills and near roads was developed. This presentation was delivered to over 200 elementary school students at agricultural safety days.
Other	Fethke N, Gibbs J, Crawford K, Alba LG. (2018). Vibracion de todo cuerpo (Whole Body Vibration). Educational poster, presenting health effects and recommendations for prevention, in Spanish. Available at https://gpcah.public-health.uiowa.edu/resources-in-spanish/
Other	Grey M. (2018). Overview from 40,000 Feet: Immigrant Farmworker Health and Safety Pre-conference Workshop. MRASH Conference, Nov 27-28, 2018. Council Bluffs, IA.
Other	OEH: 6110 Rural Health and Agricultural Medicine. Semester long course attended by graduate students at the University of Iowa, Spring 2018.

Other	OEH: 6120 Topics in Agriculture and Rural Health: The Rural Mental Health Crisis. Semester long course attended by graduate students at the University of Iowa, Spring 2018.
Other	Rural Health and Agricultural Medicine OEH:6110/Ag Safety and Health: The Core Course. University of Iowa. Attended by graduate students and professionals. This course is offered both for graduate school credit at the University of Iowa and for continuing education for healthcare providers, EMS, public health professionals, veterinarians, and other health and safety occupations. Summer 2018.
Other	Janssen, B: [2018] Grain Handling Safety lecture, given during the Workers Memorial Day Observation in Iowa City, IA. Apr 27, 2018.
Other	Educational exhibits were presented on Whole Body Vibration and Cold Weather Hazards at farm shows in the GPCAH region <ul style="list-style-type: none"> • World Dairy Expo (Madison, WI) • Sioux Falls Farm Show (Sioux Falls, SD) • Western Farm Show (Kansas City, MO)
Other	GPCAH outreach staff presented at two Ag Safety Days on the topics of Lawnmower Safety and Recognizing Hazard Warning Symbols.
Other	Cheyney M, Janssen B, Rohlman D. Roadway Safety Regional Campaign materials. In 2018, the Outreach Core organized a packet of roadway safety materials and recommendations to share with regional Extension offices. The intervention was evaluated with a survey tool.
Other	Heiberger S, Duysen E, Leonard S, Ploeckelman M, Yoder A: [2018] Press Release: Telling the Story Project. This successful press release has resulted in features in 30 media outlets, including the U.S News and World Report, the Omaha World Herald, The Muscatine Journal, This Week in Agribusiness, AgUpdate, and an interview on RFD-TV.
Other	The Telling the Story Project launched its website in Jun 2018. For the purposes of this report, GPCAH has only reported the media stories that involve interviews of GPCAH faculty and staff. <ul style="list-style-type: none"> • Charis-Carlson J: [2018] Down on the farm. In the Midwest, injured agriculture workers are telling their stories to help others avoid the same fate. US News and World Report (Interview with S Leonard about Telling the Story Project). Oct 2018. • Prochnow J: [2018] New program through UI center seeks to end farming-related accidents. Daily Iowan (Interview with S Leonard about Telling the Story Project). Sept 2018. • Eckland M: [2018] Muscatine farmer shares safety stories through new online project. Muscatine Journal (Interview with S Leonard about Telling the Story Project). Sept 2018. • Larson D: [2018] Tell a story, save a life. Storm Lake Pilot Journal (Interview with S Leonard about Telling the Story Project). Aug 2018. • Todd B: [2018] Website aims to share stories of injury on the farm. Post Bulletin Agrinews (Interview with S Leonard about Telling the Story Project). Aug 2018. • Branch R: [2018] Tell a story, save a life. Farmers encourages to share their farm accident stories. Brownfield Ag Radio Network (Interview with S Leonard about Telling the Story Project). Jul 2018. • Staff Reporter: [2018] New project helps farmers share stories, safety messages. Wisconsin State Farmer (Interview with S Leonard about Telling the Story Project). Jun 2018. • Flammini D: [2018] Farmers sharing safety stories. Farms.com (Interview with S Leonard about Telling the Story Project). Jun 2018.

Audio or video	Telling the Story with Stephanie Leonard. RFD-TV (Interview with S Leonard about Telling the Story Project). Jul 2018. https://www.youtube.com/watch?v=2umi0F4e650&t=4s
Other	Gibbs J, Janssen B, Rohlman: [2018] Guest Editorial: Slow down during Farm Safety Week, Mar 2-9, 2018. g National Farm Safety & Health Week on Sept 16-22. Published in 4 newspapers in Mar 2018: Charles City Press, Charles City, IA; Tama News-Herald, Tama, IA; Mount Vernon Sun, Mt. Vernon, IA; Sigourney News Review, Sigourney, IA.
Other	<i>Farm Families Alive and Well</i> Newsletter is published quarterly in collaboration with the I-CASH. While both Centers contribute to all newsletters, the Dec 2017 and Mar 2018 issues were more focused on GPCAH activities.
Other	<i>Safety Watch</i> is a monthly agricultural safety and health column published in Iowa Farmer Today, Illinois Farmer today, Midwest Marketer, and other Lee Agrimedia print publications, as well as their online site: agnupdate.com . They are archived at https://gpcah.public-health.uiowa.edu/safety-watch-2/ . <ul style="list-style-type: none"> • Janssen B: <i>Youth Groups Encourage Farmer Safety</i>. Iowa Farmer Today, Oct 2017. • Leonard S: <i>Farm Film Reaches Rural Classrooms, Urban Theaters</i>. Iowa Farmer Today, Nov 2017. • Janssen B: <i>Farm Couple Honored for Safety Work after Experiencing Tragedy</i>. Iowa Farmer Today, Dec 2017. • Leonard S: <i>Story of Survival Sparks Changes on Hog Operation</i>. Iowa Farmer Today, Jan 2018. • Janssen B: <i>Farm Safety Doesn't Happen by Accident</i>. Iowa Farmer Today, Feb 2018. • Leonard S: <i>Elders show importance of eye protection</i>. Iowa/Illinois/Missouri Farmer Today, Mar 2018. • Janssen B: <i>Think about spring training before spring planting begins</i>. Iowa/Illinois/Missouri Farmer Today, Apr 2018. • Leonard S: <i>Safe handling can prevent hardship with hay bales</i>. Iowa/Illinois/Missouri Farmer Today, May 2018. • Janssen B: <i>Dairy promotes safety from farm to table</i>. Iowa/Illinois/Missouri Farmer Today, Jun 2018. • Leonard S: <i>Telling the story</i>. Iowa/Illinois/Missouri Farmer Today, Jul 2018. • Janssen B: <i>ATVs not made for roadway, even when state laws allow</i>. Iowa/Illinois/Missouri Farmer Today, Aug 2018. • Leonard S: <i>Think twice: 30 years later, a survivor offers plea to farmers</i>. Iowa/Illinois/Missouri Farmer Today, Sept 2018.
2019	
Educational aids or curricula	Rohlman DS: [2019] Grand Rounds: Agricultural Exposures: Organophosphate Pesticide Poisoning and Prevention. Rural Prep. Presented online Jan 24, 2019. (Teaching kit to host a team-based, active learning event). Available at https://ruralprep.org/agricultural-exposures-organophosphate-pesticide-poisoning-and-prevention/

Educational aids or curricula	<p>Asynchronous online training modules were developed and made available online at https://agsafetyhealth.training-source.org/. These modules feature multimedia content and contain pre- and post-training evaluation tests.</p> <ul style="list-style-type: none"> • Gibbs JL, Nonnenmann M, Gerr F, Morrison L, Rohlman DS, Mohling K: [2019] <i>PPE for Agricultural Health</i> [online module]. • Gibbs JL, Nonnenmann M, Gerr F, Morrison L, Rohlman DS, Mohling K: [2019] <i>Physical Agents for Agricultural Health</i> [online module]. • Rohlman DS, Nonnenmann M, Gerr F, Morrison L, Mohling K: [2019] <i>Overview: Agriculture, Forestry, Fishing</i> [online module].
Other	LaDuca L, Hartwig M, Janssen B. (2018). Determining rural health clinic data gaps in Iowa. Agricultural Safety and Health Networking Reception, Jun 11, 2018. Iowa City, IA.
Other	Rohlman D, Duysen E, Grafft L, Wickman A, McCandels J, Guin S, Sheridan C, Mohling K, Morely E. (2018). From past to future: education for agricultural safety and health professionals. Agricultural Safety and Health Networking Reception, Jun 11, 2018. Iowa City, IA.
Other	Janssen B, Godwin K, Altmaier R, Mohling M, Olson G, Scott-Harp D. (2018). Community-based distribution of seasonal farm hazard education. Agricultural Safety and Health Networking Reception, Jun 11, 2018. Iowa City, IA.
Other	Morely E, Rohlman D, Mohling K, Cheyney M, Arora K, Gerr F, Nonnenmann M. (2018). Evaluation and dissemination of an agricultural safety and health education program. Agricultural Safety and Health Networking Reception, Jun 11, 2018. Iowa City, IA.
Other	Cheyney M: [2019] Hearing loss prevention and roadway safety displays, Gear up for Safety (in collaboration with Ag Health and Safety Alliance), Sauk Community College, Dixon, IL. Apr 4, 2019
Other	Janssen B: [2019] Rural Health Disparities lecture, given to Department of Community and Behavioral Health, Health, Equity, and Social Justice Class, University of Iowa, Iowa City, IA. Spring 2019. Attended by graduate students.
Other	Janssen B: [2019] Food, Farming, and Health lecture, given to Department of Community and Behavioral Health, Health, Work, and Environment Class, University of Iowa, Iowa City, IA. Spring 2019. Attended by undergraduate students.
Other	Janssen B: [2019] Food, Farming, and Health. Health, Work, and Environment course. University of Iowa. Iowa City, IA. Attended by undergraduate students.
Other	Janssen B: Course in OEH: 6120 Topics in Agriculture and Rural Health: The Culture of Agriculture. Full semester course attended by graduate students at the University of Iowa. [Fall 2018]
Other	Rohlman D: [2019] Course in OEH: 6110 Rural Health and Agricultural Medicine. Attended by graduate students.
Other	Rohlman D: [2019] Course in OEH: 6120 Topics in Agriculture and Rural Health: Research Methods in Rural Health. Attended by graduate students.
Other	Rohlman D: [2019] Neurobehavioral effects of organophosphorus pesticides, with a focus on rodent in vivo, background on pesticide use and human exposure. E-lecture, Utrecht University, Germany.
Other	Rohlman DS: [2019] Introduction to Rural Health & Agrimedecine Agricultural Regulations in Occupational Safety and Health in Agriculture Introduction to Hierarchy of Controls in PHARM 7489 Rural Health & Agrimedecine course. University of Missouri – Kansas City. Guest Lecturer. Attended by graduate students.

Other	Rural Health and Agricultural Medicine OEH:6110/Ag Safety and Health: The Core Course. University of Iowa. Attended by graduate students and professionals. This course is offered both for graduate school credit at the University of Iowa and for continuing education for healthcare providers, EMS, public health professionals, veterinarians, and other health and safety occupations. Summer 2019.
Audio or Video	Maass, A: [2019] Farmer mental health. Gray TV (Interview with B Janssen on farmer mental health). Jul 15, 2019.
Other	Leonard S: [2019] Safety Watch: Mowing mistakes on slopes can claim lives, limbs & Mowing reminders, Iowa Farmer Today, Jul 2019. At http://bit.ly/30Z3KWm
Other	Rohlman DS: [2019] Lecture series (Behavioral Health and Total Farmer Health; Introduction to Agricultural Safety and Health; Pesticide Exposure; Transportation Hazards in Agriculture) in PHARM 7489 – Special topics in Pharmacy: Rural Health and Agricultural Medicine course. University of Missouri – Kansas City. Guest Lecturer.
Other	Donnelle, E: [2019] Farmers and mental health. DSM Register (Interview with B Janssen on farm economic stress). Apr 12, 2019. At https://www.desmoinesregister.com/story/money/agriculture/2019/04/12/iowa-farmers-unable-to-get-operating-loans-agriculture-economy-downturn-struggles-tariffs-prices-ag/2339163002/
Other	Greenberg, J: [2019] Farm Suicide rates (fact checking Cory Booker). PolitiFact (Interview with B Janssen about rates of farm suicide). Mar 20, 2019. At http://www.politifact.com/factchecks/2019/mar/21/cory-booker/farmer-suicides-high-
Other	Anthony TR: [2019] Ag related incidents - West Texas Fertilizer explosion; Grain Dust Haysville KS. Death at Work. Seminar attended by 11 undergraduate students (4 contact hours)
Other	Janssen B: [2019] Agriculture, Anthropology, and Public Health lecture, given to Anthropology Department, Contemporary World Problems Class, University of Iowa, Iowa City, IA. Spring 2019. Attended by 200 undergraduate students.
Other	Janssen B: [2019] Hazards Associated with Livestock. Rural Health and Agricultural Medicine. University of Iowa. Seminar attended by 5 graduate students.
Other	Leonard S: [2019] Agricultural Fatalities and Injuries: Telling the Story. A look at the NIOSH FACE Program and Collaborative Telling the Story Project. Agricultural Health and Safety, the Core Course; Iowa City, IA, Jun 2019.
Other	Cheyney M: [2019] Rural Roadway Safety – Lighting and Marking. Know before You Go, Iowa Corn Growers meeting, Urbana, IA, Aug 1, 2019.
Other	Janssen B: [2019] Local Food: Sustainable Jobs and Healthy People? Lecture, given to Department of Community and Behavioral Health, Fundamentals of Public Health Class, University of Iowa, Iowa City, IA. Spring 2019. Attended by 150 undergraduate students.
Other	Staff Writer: [2019] Farmer mental health. The Daily Skimm (Interview with B Janssen on farmer mental health). Jun 1, 2019.
Other	Greenberg, J: [2019] Farm Suicide rates (fact checking Cory Booker). PolitiFact (Interview with B Janssen about rates of farm suicide). Mar 20, 2019.
Other	Local Food Initiative: [2019] Mental Health Awareness Month: Learn about how you can support mental health for farmers. Department of Natural Resources and Parks Blog. May 29, 2019. https://kingcountygreen.com/2019/05/29/mental-health-awareness-month-learn-about-how-you-can-support-mental-health-for-farmers/
Other	Rohlman D: [2019] Child Agricultural Injury Prevention Workshop. International Society for Agricultural Safety and Health Conference (ISASH); Des Moines, IA, Jun 22-3, 2019.

Other	Agricultural Safety and Health Core Course: [2019] The 40-hour course completed by 34 attendees. Instruction provided by multiple GPCAH faculty and staff along with regional advisors (Sheridan, Neenan) and veterinary expertise from Iowa State (Bickett-Weddle, Iowa City, IA), Jun 10-14, 2019.
Other	Leonard S: [2019] Safety Watch: Chronic pain and medication, Article in Iowa Farmer Today, Jun 2019. At https://www.agupdate.com/iowafarmertoday/news/state-and-regional/doctor-can-help-reduce-physical-toll-of-farm-work/article_b5512358-8873-11e9-92d8-5b774423bce4.html
Other	Cheyney M: [2019] Hearing Loss Prevention. NECAS Farm Safety Day, Peosta, IA, Jul 9, 2019. 100 Elementary students.
Other	Harrold, B: [2019] Farm stress. Iowa Farmer Today (Interview with B Janssen about suicide prevention) Mar 4, 2019. At https://www.agupdate.com/missourifarmertoday/news/state-and-regional/resources-help-rural-residents-address-suicide/article_02304c38-4668-11e9-bb2c-4f8247036626.html
Other	Gibbs J: [2019] Cold Weather Hazards. Western Farm Show, Kansas City, MO. Feb 22- 24, 2019.
Other	Patterson J: [2019] Press release about how studies may underreport farm injuries. Sept 9, 2019
Other	UNMC Staff Writer: [2019] UNMC's Agricultural safety and health center to co-host a child agricultural injury prevention workshop in Des Moines, Jun 23-24. UNMC Newsroom. May 21, 2019. Article promotes the conference cohosted by GPCAH. https://www.unmc.edu/news.cfm?match=23884
Other	Cheyney M: [2019] AFF Outreach Materials for Ag Agents (Exhibit). National Association of County Agricultural Agents (NCAA) Annual Meeting, Fort Wayne, IN. Sept 8-10, 2019.
Other	Mayfield, N: [2019] Farm Stress. Eastern Iowa Farmer Magazine, pg. 62-65 (Interview with B Janssen about farm stress). Mar 15, 2019. At https://www.yumpu.com/en/document/read/62450488/eastern-iowa-farmer-spring-2019
Other	Leonard S: [2019] Safety Watch: Man counts good fortune following ATV accident, Iowa Farmer Today, May 2019. At http://bit.ly/2LIF8P5
Other	Janssen B: [2019]. Rollover protection a critical safety strategy for small farms. Iowa Farmer Today. Apr 2019. https://gpcah.public-health.uiowa.edu/wp-content/uploads/2019/04/2019-4-13-Rollover-protection.pdf
Other	Cheyney M: [2019] Manure Gas Monitors (educational display). International Society for Agricultural Safety and Health Conference (ISASH); Des Moines, IA, Jun 25-27, 2019.
Other	Cheyney M: [2019] Whole Body Vibration and others (educational display). Ohio Farm Science Review, London, OH. Sept 17-19, 2019.
Audio or Video	Janssen B: [2019] Workers' Memorial Day. Interview for KCRG TV 9 (ABC). Apr 2019.
Other	Cheyney M: [2019] Rural Roadway Safety (educational display). Collaborative booth with National Children's Center and UMASH at Minnesota Farmfest, Redwood Falls, MN. Aug 6-8, 2019.
Other	Cheyney M: [2019] Safety Signs. Poweshiek County Farm Safety Day, Brooklyn, IA, May 23, 2019. 354 Elementary students.
Other	Cheyney M: [2019] Hearing Loss Prevention. NECAS Farm Safety Day, Peosta, IA, Jun 12, 2019. 120 Elementary students.

Audio or Video	Staff Personnel: [2019] Telegraph Herald, Agricultural safety course. Jun 12, 2019. Interview with D Rohlman about the Agricultural Safety Core Course. YouTube video at https://www.youtube.com/watch?feature=youtu.be&v=4ocVTUcC_cE&app=desktop+-+dialog
Audio or Video	Scheinblum, A: [2019] Workers' Memorial Day. KCRG (ABC) TV 9 (Talk an interview with B Janssen on remembering workplace deaths). Apr 26, 2019. At https://www.kcrg.com/content/news/Workers-Memorial-Day-honors-lowans-that-died-in-workplace-accidents-509129731.html
Other	Page, K: [2019] Farmer mental health. Iowa Watch (Interview with B Janssen on mental health providers). Jun 6, 2019. At https://www.iowawatch.org/2019/07/23/mental-health-care-providers-in-flood-stricken-rural-areas-short-handed-but-expecting-more-demand/
Other	<i>Farm Families Alive and Well</i> Newsletter is published quarterly in collaboration with the I-CASH. While both Centers contribute to all newsletters, the Dec 2018 and Mar 2019 issues were more focused on GPCAH activities.
Other	<p><i>Safety Watch</i> is a monthly agricultural safety and health column published in Iowa Farmer Today, Illinois Farmer today, Midwest Marketer, and other Lee Agrimedia print publications, as well as their online site: agnupdate.com. They are archived at https://gpcah.public-health.uiowa.edu/safety-watch-2-2/.</p> <ul style="list-style-type: none"> • Janssen B. <i>Prevent grain related injuries</i>. Iowa/Illinois/Missouri Farmer Today, Oct 2018. • Leonard S. <i>Recent H2S cattle deaths a reminder for precautions</i>. Iowa/Illinois/Missouri Farmer Today, Nov 2018. • Janssen B. <i>Expert recommends SOPs for safety</i>. Iowa/Illinois/Missouri Farmer Today, Dec 2018. • Leonard S. <i>Tale of the ring neck and the 'safety lady'</i>. Iowa/Illinois/Missouri Farmer Today, Jan 2019. • Janssen B. <i>Suicide prevention is a community-wide effort</i>. Iowa/Illinois/Missouri Farmer Today, Feb 2019. • Leonard S: <i>Bolting beef: Broadcaster shares run-in with steer that broke her hand</i>, Iowa Farmer Today, Mar 2019. • Janssen B: <i>Rollover protection a critical safety strategy for small farms</i>. Iowa Farmer Today. Apr 2019. • Leonard S: <i>Man counts good fortune following ATV accident</i>, Iowa Farmer Today, May 2019. • Janssen B: <i>Doctor can help reduce physical toll of farm work</i>. Iowa Farmer Today. Jun 2019. • Leonard S: <i>Mowing mistakes on slopes can claim lives, limbs & Mowing reminders</i>, Iowa Farmer Today, Jul 2019. • Janssen B: <i>Recent deaths reinforce need for safe driving, ROPS</i>, Iowa Farmer Today, Aug 2019. • Guse B, Leonard S: <i>'Two minutes' - Farmer touts safety mantra years after close call</i>, Iowa Farmer Today, Sept 2019.
2020	
Educational aids or curricula	<p>Asynchronous online training modules were developed and made available online at https://agsafetyhealth.training-source.org/. These modules feature multimedia content and contain pre- and post-training evaluation tests.</p> <ul style="list-style-type: none"> • Bickett-Weddle D, Nonnenmann M, Morrison L, Rohlman DS, Mohling K: [2020] <i>Biological Risk Management</i> [online module]. • Janssen B, Bickett-Weddle D, Rood K, Rohlman DS, Nonnenmann M, Morrison L,

	Mohling K: [2020] <i>Livestock Handling</i> [online module].
Educational aids or curricula	Rohlman DS: [2019] Grand Rounds: Mental Health in Rural Communities. Rural Prep. Presented online on Nov 21, 2019. (Teaching kit to host a team-based, active learning event)
Other	<p><i>Safety Watch</i> is a monthly agricultural safety and health column published in Iowa Farmer Today, Illinois Farmer today, Midwest Marketer, and other Lee Agrimedia print publications, as well as their online site: agnupdate.com. They are archived at https://gpcah.public-health.uiowa.edu/safety-watch-2-2/.</p> <ul style="list-style-type: none"> • Janssen B: <i>No matter the ladder, keep safety in mind</i>. Iowa Farmer Today, Oct 2019. • Leonard S: <i>Safety Watch: Safety acronym invites farmers to Consider All Risks, in Each situation</i>. Iowa Farmer Today, Nov 2019. • Janssen B: <i>Don't rely on luck to get through next emergency</i>. Iowa Farmer Today, Dec 2019. • Leonard S: <i>Simple kits are first step to address radon hazard in homes</i>. Iowa Farmer Today, Jan 2020. • Janssen B: <i>Youths may be key to safer farms</i>. Iowa Farmer Today, Feb 2020. • Leonard S: <i>Face masks have different purposes, protective levels</i>. Iowa Farmer Today, Mar 2020. • Janssen B: <i>Preventing rural crashes critical amid health crisis</i>. Iowa Farmer Today, Apr 2020. • Leonard S: <i>Choose Safety: As states open, take steps to protect each other</i>. Iowa Farmer Today, May 2020. (*Trending article) • Janssen B: <i>Science matters in agriculture and public health</i>. Iowa Farmer Today, Jun 2020. • Leonard S: <i>Covid upsurge demands all-hands effort</i>. Iowa Farmer Today, Jul 2020. (*Trending article) (Article reprinted by a Monticello church for newsletter) • Janssen B: <i>Resources available for COVID-19 stress management</i>. Iowa Farmer Today, Aug 2020. • Leonard S: <i>Case count: Iowa leads as COVID rates rise in Midwest</i>. Iowa Farmer Today, Sept 2020. (*Trending article)
Other	Janssen B: [2019] Lecture on grain bin entry safety policies, given to SW Community College (15 agricultural students, Creston, IA. Oct 3, 2019.
Other	<i>Farm Families Alive and Well</i> Newsletter is published quarterly in collaboration with the I-CASH. While both Centers contribute to all newsletters, the Dec 2019 and Mar 2020 issues were more focused on GPCAH activities.
Educational aids or curricula	Core Course materials for live classes are available for download at: www.gpcah.org/asheducation
Other	Rohlman D: [2020] Course in OEH: 6110 Rural Health and Agricultural Medicine. University of Iowa. Full-semester course attended by graduate students.
Other	Janssen B: [Fall 2019] Course in OEH: 6120 Topics in Agriculture and Rural Health: Global Agricultural Systems. University of Iowa. Attended by graduate students.
Other	Janssen B: [Fall 2019] Course in CPH: 4200 Agriculture, Food Systems & Sustainability. University of Iowa. Attended by undergraduate students.
Other	Janssen B: [2019] Rural Health Disparities. Health, Equity, and Social Justice. University of Iowa, Iowa City, IA. Academic panel member. Attended by graduate students.

Other	Janssen B: [2019] Agriculture, Anthropology, and Public Health lecture, given to Anthropology Department, Contemporary World Problems Class, University of Iowa, Iowa City, IA. Fall 2019. Attended by undergraduate students.
Other	Janssen B: [2019] Lecture on grain bin entry safety policies, given to SW Community College, Creston, IA. Oct 3, 2019. Attended by agricultural students.
Other	Cheyney, M: [2020] COVID-19 resources, Manure Gas Safety (educational display), UMASH Online Expo: A 20/20 Look at Ag Health, Safety and Wellness, Aug 11-13, 2020.
Other	Staff Writers: [2019] How the University of Iowa Helps Farmers. IowaNow, Includes link to GPCAH resources on mental health. At https://magazine.foriowa.org/story.php?ed=true&storyid=1863
Other	Janssen B: [2019] Rural Health Disparities. Health, Equity, and Social Justice. University of Iowa, Iowa City, IA. Academic panel member. Attended by graduate students.
Other	Cheyney M: [2019] Roadway Safety, Manure Gas Monitors, Hearing loss prevention, Mental Health Resources for Iowa, Whole Body Vibration (educational displays), Gear Up for Safety (in collaboration with Ag Health and Safety Alliance), Kirkwood Community College, Cedar Rapids, IA. Oct 2, 2019.
Other	Janssen B: [2019] Rural Health Disparities lecture, given to Department of Community and Behavioral Health, Health, Equity, and Social Justice Class, University of Iowa, Iowa City, IA. Spring 2019. Attended by 20 graduate students.
Other	Leonard S: [2019] Brad. Article for Telling the Story Project about his injury from machinery entanglement. At https://tellingthestoryproject.org/brad/
Audio or Video	Michaels S: [2020] Interview on Ag Safety and Health. WAND-TV, Decatur, IL. Jan 30, 2020.
Other	Leonard S: [2019] David. Article for Telling the Story Project about his injury while riding an ATV. At https://tellingthestoryproject.org/david/
Other	Janssen B: [2019] Lecture on "Sustainability and Safety in Agriculture," given to Vintage Cooperative (35 community members), Iowa City, IA. Jan 8, 2020.
Other	Janssen B: [2019] Local Food: Sustainable Jobs and Healthy People? Fundamentals of Public Health. University of Iowa, Iowa City, IA. Lecture attended by undergraduate students
Other	Janssen B: [2019] Food, Farming, and Health lecture, given to Department of Community and Behavioral Health, Health, Work, and Environment Class, University of Iowa, Iowa City, IA. Spring 2019. Attended by 75 undergraduate students.
Other	Janssen B: [2019] Food, Farming, and Health. Health, Work, and Environment course. University of Iowa. Iowa City, IA. Lecture attended by undergraduate students.
Other	Rohlman DS: [2020] Behavioral and Emotional Health / Total Farmer Health in UMKC 7223 Rural Health & Agrimedicine course. University of Missouri – Kansas City. Guest Lecturer. Attended by graduate students.
Other	Rohlman DS: [2020] Introduction to Rural Health & Agrimedicine Agricultural Regulations in Occupational Safety and Health in Agriculture Introduction to Hierarchy of Controls in UMKC 7223 Rural Health & Agrimedicine course. University of Missouri – Kansas City. Guest Lecturer. Attended by graduate students.
Other	Rohlman D: [2020] Course in OEH: 6120 Topics in Agriculture and Rural Health: Mental Health in Rural Communities. University of Iowa. Full-semester course attended by graduate students.

Other	Janssen B: [2019] Agriculture, Anthropology, and Public Health. Contemporary World Problems. University of Iowa. Iowa City, IA. Lecture attended by undergraduate students.
Other	Janssen B: Course in CPH: 4200 Agriculture and the Environment. Full semester course attended by undergraduate students at the University of Iowa.. [Fall 2018]
Other	Rohlman D: [2019] Course in Rural Health and Agricultural Medicine. 5 graduate students, 45 contact hours Spring 2019.
Other	Rohlman D: [2019] Course in Topics in Agriculture and Rural Health: Research Methods in Rural Health. 5 graduate students. 15 contact hours. Spring 2019.
Other	Rohlman D: [2019] Neurobehavioral effects of organophosphorus pesticides, with a focus on rodent in vivo, background on pesticide use and human exposure. E-lecture, Utrecht University (30 mins).
Other	Rohlman DS: [2020] Pesticide and Transportation in UMKC 7223 Rural Health & Agrimedecine course. University of Missouri – Kansas City. Guest Lecturer. Attended by graduate students.
Other	Janssen B: [2019] Agriculture, Anthropology, and Public Health lecture, given to Anthropology Department, Contemporary World Problems Class, University of Iowa, Iowa City, IA. Fall 2019. Attended by 200 undergraduate students.
Other	Janssen B: [2019] Keynote Lecture on local food systems, given to Local Food Symposium (75 undergraduate students and community members), Grinnell College, Grinnell, IA. Oct 31, 2019.
Other	Rohlman DS: [2019] Let's Talk About Mental Health. Dairy Girl Network Behavioral Health Mini-Series, Dairy Girl Network, Iowa City, Iowa. (Invited Lecturer)
Other	Chadde, S: [2020] Farmer mental health. Midwest Center for Investigative Reporting (Interview with B Janssen on farmer mental health). USA Today, Mar 9, 2020.
Other	Reed P: [2019] University of Iowa researchers say many farming-related injuries are under reported. KCRG.com. Nov. 25, 2019. Interview with C Peek-Asa about farm injuries.
Other	New "Start the Conversation" resources developed by the P&E Core for healthcare providers to display in clinics and use during patient visits. Each resource package contains posters (11x17"), trifold brochures, 4x9" information cards, and 4x6" postcards. Topics developed: <ul style="list-style-type: none"> • Skin Cancer and Farmers • Hearing Loss Among Farmers • Whole Body Vibration • Winter Hazard: Fall Prevention These materials were piloted at the Midwest Rural and Agricultural Safety and Health Conference, Marshalltown, IA. Nov. 12-14, 2019. The Winter Hazard: Fall Prevention resources were mailed to rural healthcare providers in Iowa, Missouri and Ohio in Feb 2020. The distribution program was halted in Mar 2020 due to the COVID pandemic.
Other	Janssen B: [2019] Lecture on "Sustainability and Safety in Agriculture," given to Iowa City Rotary Club Meeting (75 Rotary members), Iowa City, IA. Nov 7, 2019.
Other	Rohlman DS: [2020] College of Public Health Week Spotlight: Around the World in 60 Minutes – Research in Global Health. Sept 21, 2020.
Other	Rural Health and Agricultural Medicine OEH:6110/Ag Safety and Health: The Core Course. University of Iowa. Attended by graduate students and professionals. This course is offered both for graduate school credit at the University of Iowa and for continuing education for healthcare providers, EMS, public health professionals, veterinarians, and other health and safety occupations. Summer 2020.

Other	Geiger, D: [2019] Farmer mental health. Agribusiness Report (Interview with B Janssen on the mental health of farmers). May 20, 2019.
Other	Cheyney M: [2019] Hearing loss prevention (educational display), National FFA Convention & Expo, Indianapolis, IN. Oct 31-Nov 2, 2019.
Other	Interview on WAND-TV Ag Reporter, Sarah Michaels, on Ag Safety and Health for Jan 30, 2020.
Other	Iowa Ag Connection: [2019] Marshalltown Conference to Focus on Disaster Response, Recovery. Oct 18, 2019. Story includes interview with B Janssen on the MRASH conference. At http://www.iowaagconnection.com/story-state.php?id=1141&yr=2019
Other	Staff Writer: [2019] University of Iowa researchers say many farming-related injuries are under reported. Dec 6, 2019. Interview with C Peek-Asa on farm injuries. At https://www.public-health.uiowa.edu/news-items/peek-asa-discusses-farm-injuries/ and at https://www.public-health.uiowa.edu/digest/?date=1575590400 .
Other	Yost R: [2019] Farming is Risky Business. Keloland.com. Jan 13, 2020. Article discusses the 2015 GPCAH study on agriculture injuries and fatalities in 12 Midwestern states from 2005 to 2012. At https://www.keloland.com/keloland-com-original/farming-is-risky-business/
Other	Leonard S: [2019] Susan. Article for Telling the Story Project about her injury from handling livestock. At https://tellingthestoryproject.org/susan/
Other	Leonard S and Nelson J: [2019] Jerry and Julie. Article for Telling the Story Project about their exposure to hydrogen sulfide. At https://tellingthestoryproject.org/jerry/
Other	Cheyney M: [2019] Lecture on overview of ag safety and health topics, given to Women Land & Legacy, Walcott, IA. Dec 6, 2019.
Other	Insight on Business: [2019] The Newshour with Michael Libbe: Farm Injuries – A Workplace Issue: [Podcast]. Nov 26, 2019. Interview with C Peek-Asa on farm injuries. At https://insightadvertising.typepad.com/insight_on_business/page/6/
Other	Thornton, K: [2020] Rural Residents' Perception of Off-Road Vehicle Insurance Coverage. MS Thesis, May 2020.
Other	Janssen B: [2020] Interview with Steve Gravelle about COVID-19 and Spring planting. The Gazette, Mar 25, 2020.
Other	Janssen B: [2020] Interview with Charis-Carlson about COVID-19 and local food. US News and World Report, Mar 19, 2020.
2021	
Educational aids or curricula	Rohlman DS: [2021] Grand Rounds: Youth and Agriculture. Rural Prep. Presented online Jan 28, 2021. (Teaching kit to host a team-based, active learning event) https://ruralprep.org/farm-safety-for-children/
Educational aids or curricula	Asynchronous online training modules were developed and made available online at https://agsafetyhealth.training-source.org/ . These modules feature multimedia content and contain pre- and post-training evaluation tests. <ul style="list-style-type: none"> Anthony TR, Nonnenmann M, Nonnenmann M, Morrison L, Rohlman DS, Mohling K: [2021] <i>Transportation Hazards in Agriculture</i> [online module].
Educational aids or curricula	Agricultural Safety and Health: Core Course. The GPCAH was adapted for Dalhousie University in Fall 2021. Attended by 14 undergraduate students. Instruction provided by multiple GPCAH faculty and regional advisors, and they also utilized our online modules (available online at https://agsafetyhealth.training-source.org/).

Audio or video	Rohlman DS, Parker E, Janssen B, Lehmler H: [2020] Rural Health Podcast Conclusion Recording. University of Iowa Prevention Research Center. Feb 4, 2021.
Audio or video	<p><i>From the Field</i> is a series of podcast episodes developed specifically for Agricultural Safety and Health: the Core Course. Four episodes were recorded in 2021.</p> <ul style="list-style-type: none"> • Rohlman, D: [2021] From the Field: Conversation with Rural EMS, Emergency Response on the Farm (No. 1, Guest: Brad Kruse) [Audio podcast episode]. • Rohlman, D: [2021] From the Field: Conversations with Ag Producers, A Typical Day on the Dairy Farm - Challenges and Successes (No. 2, Guest: Rick Naerebout) [Audio podcast episode]. • Nonnenmann, M: [2021] From the Field: Conversations with Ag Producers, Global Agriculture, Challenges and Successes Faced by Ag Employers, Immigrant Workers and Safety (No. 3, Guest: Olga Brouwer) [Audio podcast episode]. • Rohlman, D: [2021] From the Field: Conversations with Ag Producers, Rural Mental Health: Farmer's Perspective (No. 4, Guest: Ted Matthews) [Audio podcast episode].
Other	<p><i>Safety Watch</i> is a monthly agricultural safety and health column published in Iowa Farmer Today, Illinois Farmer today, Midwest Marketer, and other Lee Agrimedia print publications, as well as their online site: agnupdate.com. They are archived at https://gpcah.public-health.uiowa.edu/safety-watch-2-2/.</p> <ul style="list-style-type: none"> • Janssen B: <i>Agencies work together to add respirator test options</i>. Iowa Farmer Today, Oct 2020. • Leonard S: <i>Keep your guard – and mask - up</i>. Iowa Farmer Today, Nov 2020. • Janssen B: <i>Stocked, visible first aid kit vital to farm safety</i>. Iowa Farmer Today, Dec 2020. • Leonard S: <i>Shot in the arm: Vaccine rollout doesn't end need for care</i>. Iowa Farmer Today, Jan 2021. • Janssen B: <i>Develop plans to save livestock and livelihood</i>. Iowa Farmer Today, Feb 2021. • Leonard S: <i>With vaccines come new ways to stay safe</i>. Iowa Farmer Today, Mar 2021. • Janssen B: <i>Flowers are blooming, ticks are crawling</i>. Iowa Farmer Today, Apr 2021. • Leonard S: <i>Farm leaders share COVID-19 vaccination experiences</i>. Iowa Farmer Today, May 2021. • Janssen B: <i>Be aware of equipment blind spots to keep bystanders safe</i>. Iowa Farmer Today, Jun 2021. • Leonard S: <i>'Protecting others' tops motivations to get vaccine</i>. Iowa Farmer Today, Jul 2021. • Janssen B: <i>Keep safety in mind when mowing ditches</i>. Iowa Farmer Today, Aug 2021. • Leonard S: <i>Rural doctor's goal 'Prevent people from getting sick'</i>. Iowa Farmer Today, Sept 2021.
Other	<i>Farm Families Alive and Well</i> Newsletter is published quarterly in collaboration with the I-CASH. While both Centers contribute to all newsletters, the Dec 2020 and Mar 2021 issues were more focused on GPCAH activities.
Other	Rohlman DS: [2020] OEH 6720 Advanced Toxicology: Organophosphate Neurotoxicity. Guest Lecturer. Oct 21, 2020.
Other	Soupene, V: [2021] Pesticide Safety Behaviors and Resources Utilized among Midwest College Students. MS Thesis, May 2021.

Other	Rohlman DS: [2021] Occupational Safety and Health in Agriculture Introduction to Hierarchy of Controls in UMKC 7223 Rural Health & Agrimedecine course. University of Missouri – Kansas City. Guest Lecturer. Attended by graduate students.
Other	Rohlman DS: [2021] Pesticide and Transportation in UMKC 7223 Rural Health & Agrimedecine course. University of Missouri – Kansas City. Guest Lecturer. Attended by graduate students.
Other	Rohlman DS: [Spring 2021] OEH:6110 Rural Health and Agricultural Medicine. Full semester course attended by graduate students at University of Iowa.
Other	Rohlman DS: [Spring 2021] OEH:6120 Topics in Agriculture and Rural Health: Spies, Dr. Seuss, Tobacco, and Genetics. Full semester course attended by graduate students at the University of Iowa.
Other	Janssen B: [Fall 2020] Course in OEH: 6120 Topics in Agriculture and Rural Health: Agricultural Communications. University of Iowa. Full-semester course attended by graduate students.
Other	Rohlman DS: [2020] OEH 6720 Advanced Toxicology: Organophosphate Neurotoxicity. Guest Lecturer. Oct 21, 2020.
Other	Rural Health and Agricultural Medicine OEH:6110/Ag Safety and Health: The Core Course. University of Iowa. Attended by graduate students and professionals. This course is offered both for graduate school credit at the University of Iowa and for continuing education for healthcare providers, EMS, public health professionals, veterinarians, and other health and safety occupations. Summer 2021
Other	Cheyney M: [2021] Youth Worker Rights and Hazard Identification (educational display), Gear Up for Safety (in collaboration with Ag Health and Safety Alliance), Kirkwood Community College, Cedar Rapids, IA. Sept 7, 2021.
Other	Cheyney, M: [2021] Hearing Conservation – What do I have to lose? (Demo and activities for NIOSH HLSim Hearing loss simulator + hearing loss prevention resources), 2021 ASHCA Safety Summit (“Tools of the Trade” exhibit) Virtual, Mar 22-24, 2021.
Other	Rohlman DS: [2020] Occupational Pesticide Exposure: Exposure, Biomarkers, and Health Outcomes in EHS:668 Interprofessional Perspectives in Occupational Health and Safety course. University of Michigan. Guest Lecturer. Attended by graduate students.
Other	Rohlman DS: [2020] Agricultural Safety and Health in OEH: 4240 Global Environmental Health course. University of Iowa. Guest Lecturer. Attended by graduate students.
Other	Rohlman, DS: [2020] Epi Seminar: Occupational Pesticide Exposure: Exposure, Biomarkers, and Health Outcomes. University of Iowa. Guest Lecturer. Attended by graduate students.
Other	Quinn R: [2021] Machinery Link: Farms Have Several Positives but Also Hazards for Youth. Progressive Farmer (interview with DS Rohlman). Mar 22, 2021.
Other	Temple KM: [2020] One Health: Bringing Health to Humans, Animals, and the Environment. Interview with Diane Rohlman. RHIhub, The Rural Monitor. Oct 14, 2020.
2022	
Educational aids or curricula	Outreach staff developed a hands-on needs assessment tool called <i>Shopping for Safety</i> , which asks participants to identify the types of resources they need (along with the topics and time they can allot for each) to better serve their agricultural population. This tool was piloted at the 2022 ISASH conference and feedback was solicited.
Educational aids or	Outreach staff developed falls prevention resources, including posters, A/V stories that outline hazardous situations and what can be done to prevent injuries in those

curricula	situations, and handouts describing general falls prevention and ladder safety tips. These resources were piloted at Minnesota Farmfest, Redwood Falls, MN, Aug 1-3, 2022.
Other	Janssen B: [Fall 2021] Course in OEH: 6120 Topics in Agriculture and Rural Health: The Culture of Agriculture. University of Iowa. Attended by graduate students.
Other	Janssen B: [Fall 2021] Course in CPH: 4200 Agriculture, Food Systems & Sustainability. University of Iowa. Attended by undergraduate students.
Other	Rural Health and Agricultural Medicine OEH:6110/Ag Safety and Health: The Core Course. University of Iowa. Attended by graduate students and professionals. This course is offered both for graduate school credit at the University of Iowa and for continuing education for healthcare providers, EMS, public health professionals, veterinarians, and other health and safety occupations. Summer 2022.
Other	Cheyney M, Bentley M: [2021] Young worker rights and hazard identification games (educational display), National FFA Convention & Expo, Indianapolis, IN. Oct 27-29.
Other	<p><i>Safety Watch</i> is a monthly agricultural safety and health column published in Iowa Farmer Today, Illinois Farmer today, Midwest Marketer, and other Lee Agrimedia print publications, as well as their online site: agnesupdate.com. They are archived at https://gpcah.public-health.uiowa.edu/safety-watch-2-2/.</p> <ul style="list-style-type: none"> Lozano L: <i>Farmer, doctor share story of serious injury</i>. Iowa Farmer Today, Oct 2021. Leonard S: <i>H2S hazard lethal and unpredictable</i>. Iowa Farmer Today, Nov 2021. Janssen B: <i>Gloves protect from more than cold</i>. Iowa Farmer Today, Dec 2021. Leonard S: <i>Next wave – New COVID-19 variant requires all the tools we have</i>. Iowa Farmer Today, Jan 2022. Janssen B: <i>ROPS a proven strategy to keep old tractors safely running</i>. Iowa Farmer Today, Feb 2022. Leonard S: <i>National Weather Service offers training to spot risk</i>. Mar 2022. Janssen B: <i>Consider safety in grain bins of all ages and sizes</i>. Iowa Farmer Today, Apr 2022. Leonard S: <i>Survivor shares vivid memories of '92 twister that took her home</i>. Iowa Farmer Today, May 2022. Janssen B: <i>Retiree awarded for career keeping lowans safe</i>. Iowa Farmer Today, Jun 2022. Leonard S: <i>Noxious plants get under your skin</i>. Iowa Farmer Today, Jul 2022. Janssen B: <i>Even a small needle can cause big problems</i>. Iowa Farmer Today, Aug 2022. Leonard S: <i>Columnist shares story of a loose Toyota truck</i>. Iowa Farmer Today, Sept 2022.
Other	<i>Farm Families Alive and Well</i> Newsletter is published quarterly in collaboration with the I-CASH. While both Centers contribute to all newsletters, the Dec 2021 and Mar 2022 issues were more focused on GPCAH activities.
Other	<p>Outreach staff presented educational resources on Whole Body Vibration, Hearing Loss Prevention and Ladder Safety at farm shows in the GPCAH region</p> <ul style="list-style-type: none"> Minnesota Farmfest (Redwood Falls, MN) Farm Progress Show (Boone, IA) Agricultural Safety and Health Council of America Safety Summit (Las Vegas, NV)

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D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

This information is provided only in the OVERALL component, in concurrence with guidance from our Program Officer.

D.2 Personnel updates - None

- a. Level of Effort:
- b. New Senior/Key Personnel:
- c. Changes in Other Support:
- d. New Other Significant Contributors:

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

Nothing to report

E.2 - What is the impact on physical, institutional, or information resources that form infrastructure?

Not applicable

F. CHANGES

F.1 - Changes in approach and reasons for change, including changes that have a significant impact on expenditures

Not applicable

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

We are finalizing four online modules: Off-Road Vehicle Safety, Musculoskeletal Disorders, Hazards Associated with Animal Caretaking, and Pesticides.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

Not applicable

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements

Nothing to report

G.2 Responsible Conduct of Research

Nothing to report

G.3 Mentor's Research Report or Sponsor Comments

Nothing to report

G.4 Human Subjects

G.4.a Does the project involve human subjects?

No

G.4.b Inclusion Enrollment Data

N/A

G.4.c ClinicalTrials.gov

N/A

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?

N/A

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?

Not applicable

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?

No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?

No

G.8 Project/Performance Sites

The University of Iowa, 105 Jessup Hall, Iowa City, IA 52242-1316
 Congressional District IA-002
 UEI: Z1H9VJS8NG16

Ag Health and Safety Alliance, 4560 230th Ave, Greenville, IA 51343
 Congressional District: IA-02
 UEI: PW5GJ6179MC3

G.9 Foreign Component

No foreign component

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

G.11 Program Income

Is program income anticipated during the next budget period?

Not applicable

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?

Not applicable

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

To maximize adoption of health and safety behaviors, the Outreach Core in the Great Plains Center for Agricultural Health (GPCAH) has used a multi-tiered approach to disseminate information to agricultural workers, employers, and other intermediaries. Our goal was to build evidence-based agricultural safety and health (ASH) knowledge and skills among farmers and other members of the agricultural sector at-large through education and the translation and dissemination of research. The Social Ecological Model (SEM) was applied to influence the knowledge, attitudes, and practices of agricultural workers and stakeholders at individual, interpersonal, community, organizational, and policy levels. This was done through the following Specific Aims: Increase impact of our national training program in agricultural safety and health through

improved access to collaboratively developed content, educational materials, and curriculum (Aim 1), Translate scientific findings and experiential narratives into culturally appropriate messages to prevent injury and illness and to protect agricultural workers (Aim 2), and Improve awareness of agricultural injury and illness as a preventable public health burden through a multi-modal communication and dissemination strategy (Aim 3). These aims addressed the 2008 NORA AFF Agenda Goal 3: to move proven health and safety strategies into workplaces through the development of partnerships and collaborative efforts. The Outreach Core interacts with all components of the GPCAH to translate research into practice and to disseminate evidence-based practices and resources through multiple communication channels. We have engaged in outreach activities which have led to the following outputs and impacts.

A primary activity of the Outreach Core is to design, develop, and disseminate ASH curriculum. During this project period, we expanded national and international delivery of ASH education. The University of Iowa has been delivering ASH education since 1974 (i.e., the Agricultural Safety and Health: Core Course, formally known as the Agromedicine Course). In 2006, NIOSH began to support the delivery of this Core course at other sites, through the GPCAH. Since 2006, the course has been delivered 76 times in 10 US states, and Australia, Turkey, and Canada. The GPCAH has supported ASH education at 14 sites, including three new sites during the current cycle (University of Missouri, Kansas City; Dordt University in Iowa; Dalhousie University, Nova Scotia). It has been adopted into graduate and professional training (public health, pharmacy, medicine) and provided continuing education credits for physicians, nurses, emergency medical services, and veterinarians. The development of an asynchronous digital learning platform expanded the reach and impact of the Core Course through a series of online training modules. In addition to the GPCAH, four other sites have integrated the online modules into their curriculum. These modules are included in the SAY National Clearinghouse, aligned with the Agricultural, Food & Natural Resources (AFNR) Career Content Standards used by agricultural educators. Participants who completed our training indicate the material was relevant, demonstrated increased knowledge, and would recommend the curriculum. Follow-up surveys found participants reported implementing a health or safety program, incorporating changes into their practice, sharing materials, or using them in classroom settings, and increasing discussions with stakeholders. They also continue to engage with the GPCAH (e.g., request materials, invite an instructor to present at events, submit a pilot proposal, adapt curriculum into their programs, providing media interviews).

Scientific findings and experiential narratives (storytelling) were combined into multi-media products for a range of audiences (e.g., children and adult farmers, healthcare providers, and intermediary organizations that serve rural communities). Topics were determined by regional needs assessments, emerging issues, NIOSH priorities, and included the translation of evidence-based findings from GPCAH research and pilot projects. The Telling the Story Project is a collaborative project with the Central States Center for Agricultural Safety and Health (CS-CASH), the Upper Midwest Agricultural Safety and Health Center (UMASH), and the National Farm Medicine Center used to convey the story of agricultural safety. Prevention messaging incorporated elements of traditional injury investigation with stories provided by individuals (farmers, agricultural workers, and family and community) directly affected by farm injuries, near-miss incidents, and fatalities. Articles, vignettes, and videos include prevention resources. These materials have been incorporated into the Core Course and other curricula; classroom discussion guides are available. In addition, print materials, outreach displays, online resources, podcasts and videos, and media stories are used to promote agricultural safety and health. A regular *Safety Watch* column co-hosted by the GPCAH and Iowa's Center for Agricultural Health is disseminated through Lee Agri-Media channels (circulation >341,000). Most recently, given the depth of materials available from the GPCAH, we have developed Outreach Toolkits to provide support to those who providing safety and health outreach at farm shows and events. The Toolkits (Rural Roadway Safety, Gas Monitor Use, Hearing Protection, COVID resources, and Falls Protection in 2022) include pamphlets and handouts, visual displays, and a mini curriculum to help partners talk about safety and health topics and appropriately respond to questions.

The Outreach Core uses a comprehensive communication strategy that directly engages farmers at agricultural events to improve their health and safety knowledge and wide dissemination of information through web-based, direct mail, and media outlets to expand our reach and impact. We are able to use our long-standing partnerships with intermediary organizations to disseminate our research findings directly to farmers/producers and agricultural workers. For example, partnering with other sites, the GPCAH *Core Course* has served as an international resource for training agricultural safety and health professionals for decades. Expanding the course format beyond traditional on-site delivery, including hybrid and distance learning models, has increased learning opportunities and enabled more trainees to participate.

Our long-term goal is to reduce injury and illness among agricultural workers. Through our ongoing *educational activities* (including supporting national and international partners), translation of research findings into *multimedia outreach and educational products*, and *partnerships* with intermediary organizations, the GPCAH has raised awareness of agricultural hazards and built capacity to reduce exposures to the hazards facing workers in our region. The *impact* of our outreach program is demonstrated by the extent to which our educational efforts are integrated into programs and policies at workplaces, educational programs, and in clinical practices and adopted by workers and professionals that support the agricultural industry.