# GREAT PLAINS CENTER FOR AGRICULTURAL HEALTH

# ANNUAL REPORT: 09/30/2011 - 09/29/2012

# 5-U54-OH007548

**Principal Investigator: Fred Gerr, MD**

**Center Coordinator: Ellen Heywood**

**Department of Occupational and Environmental Health**
**College of Public Health**
**105 River Street**
**University of Iowa**
**Iowa City, IA 52240**

fred-gerr@uiowa.edu
ellen-heywood@uiowa.edu

**January 31, 2013**

GREAT PLAINS
Center for Agricultural Health

# SECTION I

## CENTER SUMMARY

The Great Plains Center for Agricultural Health at The University of Iowa is a nationally recognized resource with an established record of developing and implementing programs of research, intervention, translation, education, and outreach to prevent occupational injury and illness among agricultural workers and their families. The Center addresses the health and safety needs of agricultural workers in the Midwestern states of Iowa, Missouri, Kansas, Nebraska, Illinois, Wisconsin, Minnesota, South Dakota, and North Dakota. These states constitute America's most agriculturally intensive region.

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

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

## RELEVANCE

Agricultural workers experience high rates of occupational injury (including fatal injury) and illness when compared to other employed groups. The US upper Midwest is the nation's most agriculturally intensive region. As the region's most well-established agricultural health and safety resource, Center activities are highly relevant to agricultural workers, health department officials, community organizations, public health scientists, physicians, and researchers committed to protecting the health and safety of all persons engaged in agricultural work. Relevance is described by project, below.

***Prevention Intervention Core: Intervention to Reduce Aerosol Exposures in CAFOs (R Anthony)***

The focus of this project is to improve the air quality of swine CAFOs using standard mechanical ventilation design methods, typical of industries other than agriculture. An estimated 200,000 to 500,000 US workers in concentrated animal feeding operations (CAFOs) are at substantial risk of adverse respiratory outcomes from poor air quality. This project presents a structured method to assess the relative effectiveness of ventilation and contaminant control devices to reduce these exposures and, ultimately, the development of these adverse outcomes. To have the largest impact on the protection of human health, the project focuses on the production cycle associated with the highest exposure (winter in the Midwest) in areas where workers have the highest exposure risks due to full-shift building occupation (farrowing barns). There are three major aims for this work: 1) identify optimal clean air delivery to the building through computational fluid dynamics modeling; 2) select and bench test appropriate air pollution controls based on efficiency of contaminant removal and costs; and 3) field test the complete system in a CAFO farrowing facility in winter months.

***Research Core: Farm Equipment Crash Study (M Ramirez)***

Crashes involving farm equipment are a persistent risk in the Midwestern U.S. Prevention efforts require an understanding of the patterns of these crashes and the development of effective interventions to reduce crash risks. One intervention approach - traffic legislation that requires lighting and marking of farm equipment – has not been rigorously evaluated. The goals of this project are to i) determine if farm equipment/vehicle crash rates vary across nine Midwest states and if rates are higher among states with the least strict marking and lighting policies, ii) identify individual, crash and environmental risk factors for farm equipment/vehicle crashes and subsequent injuries, iii) determine if operators of farm equipment/vehicles with citations for marking and lighting have increased risk for crashes and crash-related injuries, and iv) using Geographic Information Systems, identify high frequency locations for these crashes and which roadway factors are associated with crashes.

***Research Core: Musculoskeletal Symptoms among Agricultural Workers (N Fethke)***

Musculoskeletal symptoms and disorders are common and potentially disabling conditions among agricultural workers. This prospective epidemiological study will (1) provide new information about associations between physical risk factors (e.g., forceful muscular exertions, awkward postures, repetitive activities, and whole-body vibration) and musculoskeletal symptoms among a large cohort of agricultural workers, and (2) characterize the fundamental biomechanical aspects of exposure to physical risk factors during common agricultural activities. Our approach uses a combination of repeated questionnaires among the full cohort and, among a subsample of participants, on-farm measurements of exposures to physical risk factors. The eventual results of this research will contribute important knowledge for future intervention efforts.

***Research Core: Keokuk County Rural Health Study (J Merchant)***

The Keokuk County Rural Health Study (KCRHS) is an eighteen year prospective epidemiological study (1994-2012) of 1000 families living in this highly agricultural and entirely rural county in Southeastern Iowa. The KCRHS has consistently addressed NIOSH high priority research areas and National Occupational Research Agenda strategic goals. The primary foci of the study are respiratory disease, injury, and agricultural/environmental exposures, but other areas related to farming and rural living are also included--noise-induced hearing loss, mental health outcomes and stress, allergic diseases and farm safety. The study has contributed much to a better understanding of health and safety risks from farming and their associated health effects among rural men, but importantly also among understudied women, children and the elderly.

***Education/Translation Core: Advancing Research to Practice through Community Partners (K Donham)***

This project's goal is to reduce occupational injuries and illnesses in production agriculture within the GPCAH nine-state Region of the Midwest by facilitating research-to-practice (i.e., *translation*) activities in collaboration with the Center's community partners. Bureau of Labor Statistics Census of Fatal Occupational Injuries data from 2003 to 2010 show an average of 185 production agriculture deaths annually in the region and preliminary data for 2011 report 157 fatalities, representing 37% of the US total of 423 deaths for production agriculture. Best available data (NIOSH-NASS OISPAS, 2002 and 2004) show the Region's 27.5% of US adult production agriculture workers experienced 20,180 injuries, 27.9% of the comparable US total.

***Evaluation Program (E Parker)***

Effective and appropriate evaluation serves as an important guide to all public health activities. Evaluation provides an indication of the effectiveness of activities and resource allocation. The

inclusion of surveillance activities augments evaluation by providing estimates of the actual morbidity and mortality experience of agricultural workers. The ultimate goal of the center is to prevent agricultural injury and illness. Surveillance of these outcomes provides the most direct assessment of the impact of Center activities.

***Surveillance Program (C Peek-Asa)***

The surveillance activities of the University of Iowa Great Plains Center for Agricultural Health aim to keep our partners and collaborators informed of trends in and characteristics of agriculturally-related deaths. The surveillance core partners with GPCAH collaborators to identify, analyze, and make available relevant data, and to examine surveillance strategies.

***Pilot Feasibility/Emerging Issues Program (F Gerr)***

The Pilot/Feasibility Projects and Emerging Issues (P/F&EI) Program is an incubator for new research, prevention, intervention, outreach, education, evaluation, and translation activities. In order to assure separate and "level playing fields" for community-based applications, we aimed to fund two $15,000 proposals in each area. Ten proposals were submitted in the first round of applications in Spring 2012. We funded three proposals, two academic and one community-based. An off-cycle round in September resulted in another ten proposals, with funding awarded to one academic proposal.

## KEY PERSONNEL

| Name | eRA Commons User Name | Organization | Role on Project |
|---|---|---|---|
| Gerr, Fredric | fredgerr | University of Iowa | Center Director |
| Anthony, Renee | RAnthony | University of Iowa | Project Leader |
| Donham, Kelley | DONHAMKJ | University of Iowa | Project Leader |
| Fethke, Nathan | fethke | University of Iowa | Project Leader |
| Kelly, Kevin | KELLYKM | University of Iowa | Co-investigator |
| Merchant, James | JMerchant | University of Iowa | Project Leader |
| Parker, Edith | edithp | University of Iowa | Project Leader |
| Peek-Asa, Corinne | cpeekasa | University of Iowa | Co-investigator |
| Ramirez, Marizen | MARAMIREZ | University of Iowa | Project Leader |

## CENTER WEB LINK

http://CPH.uiowa.edu/GPCAH/

# SECTION II

## PROGRAM HIGHLIGHTS OF HIGH IMPACT

A complete list of program outputs is provided in Appendix A (Page 10).

***Prevention Intervention Core: Intervention to Reduce Aerosol Exposures in CAFOs (R Anthony)***
High impact accomplishments for Year 1 include performing baseline monitoring of our intervention facility (Mansfield Swine Education Center's large farrowing room at Kirkwood Community College, Cedar Rapids, IA) and finalizing the mathematical model to support Aim 2. In winter 2012, field assessments of concentrations in our test barn were conducted, measuring dust, ammonia ($NH_3$), hydrogen sulfide ($H_2S$), carbon monoxide (CO), and carbon dioxide ($CO_2$). In addition to quantifying room concentrations, mobile monitoring and fixed location monitoring were conducted simultaneously to recommend future sampling strategy during the intervention phase. While mobile monitoring provided information on a larger area of the barn, spatial variability was limited and recommendations for deploying a matrix of 5 fixed area monitors was determined. Findings were presented at the 2011 American Industrial Hygiene Conference and Exposition (Reeve, Anthony; poster), and a manuscript has been submitted to the *Journal of Occupational and Environmental Hygiene* (awaiting review). More importantly to agricultural workers, a poster was generated and presented to the Community College's Swine Center to educate students and faculty about the concentrations measured, and informational pamphlets were provided to educate students, as future agricultural producers, about the hazards and health effects associated with indoor air quality within this work space.

The second main highlight focuses on modeling to optimize and evaluate the effectiveness and cost of engineering controls to improve air quality. The time-dependent mass- and thermal-energy balance model, incorporating equipment and heating costs, has been developed using Simulink (MathWorks, Inc., Natick, MA). Sensitivity tests have been completed, examining how changes in inputs affect the model outputs, and comparison to the winter 2012 concentrations to validate the model. *Preliminary findings:* Contaminant concentration estimates for dust and CO varied over 8-hr shift, with the morning (7am-3pm) nearly 16% higher dust concentrations compared to the evening because of morning feeding, but evening CO exceeding morning by 47% from prolonged nighttime heating. Estimates of $CO_2$ increased by 1% from morning to evening but increased by 22% from 100% fresh air to 100% recirculated air. Ammonia did not vary over shifts. Operation of the system with particle filtration and 0% fresh air introduced an incremental cost of 53% above current heating costs for a moderately cold season, with a 36% reduction of dust compared to no system. Sensitivity tests identified limited influence on insulation factor assumptions (0.2 to 0.4 $W/m^2$ K) and exchange ratios between the pit and room air (ratios from 0.01 to 0.2). Cost estimates, mainly associated with heater operation, varied 20% from the baseline when mean temperatures changed $5^o$ C over the season. Engineering decisions based on optimizing ventilation design (shape and position of inlet and outlet ducts) are currently still being modeled to support Aim 1, but preliminary data have been disseminated on the GPCAH web site (at http://www.public-health.uiowa.edu/GPCAH/research/center%2Dfunded/cafo/ ) which includes video loops highlighting the effects of contaminant transport by velocity exhaust configuration.

***Research Core: Farm Equipment Crash Study (M Ramirez)***
Department of Transportation Data involving crashes with farm equipment from 2005-2010 were collected from eight Midwest states (IA, IL, MN, NE, ND, SD, MO, WI). Data on crashes in Kansas have been collected for 2005 through 2008. Geographical Information Systems was used to determine the zip code where the farm crash occurred and to link to available census-based data. For example, Rural Urban Commuting Areas (RUCAs) were linked to each crash location by zip code to classify crash locations as *urban*, *large rural*, *small*

*rural* or *isolated rural*. In addition, policies on lighting and marking have been collected from all nine states, and an analysis of the content of these policies have been conducted to assess how state policies align with recommendations provided by the American Society of Agricultural and Biological Engineers Standards (ASABE). A compliance score was calculated to measure extent to which state codes follow ASABE standards.

Results here are focused on the eight states with data from 2005 through 2010. Over five years, 6692 crashes in the eight state region involved farm equipment; 6529 (97.6%) were geocoded for the rurality of the crash zip code. Approximately, 70% of crashes occurred in rural and 29% in urban areas. Of the crashes occurring in rural zip codes, 34% occurred in isolated rural communities, 18% in small and 19% in large rural towns. Farm equipment being "rear-ended" accounted for 23.5% of all crashes. Following a seasonal trend, crashes in rural communities increased from March through June, corresponding to planting season, and then peaked in the fall months during harvest season. Crashes in urban communities stayed relatively steady over time.

All states had policies related to lighting and marking of farm equipment, however, compliance of these policies with ASABE standards was variable (mean =20.7, range=5-30). Illinois had the highest compliance score of 30 while Missouri had the lowest score of 5. Compliance with ASABE standards (compliance score) was associated with a significant reduction in farm equipment crash rates ($\beta$=-0.16, 95%CI=-0.30, -0.02).

Research findings were presented at the 2012 Midwest Rural Agricultural Safety and Health Conference as well as to collaborators from the Iowa Departments of Transportation and Public Safety.

***Research Core: Musculoskeletal Symptoms among Agricultural Workers (N Fethke)***

The project successfully met timeline benchmarks in its first year of funding and is on schedule. Basic descriptive information from baseline questionnaires has been compiled for 489 of 518 currently enrolled participants. Of the participants, 94% are male, the average age is 59.7 years (SD = 11.7 years), the average body mass index is 29.1 kg/m$^2$ (SD = 4.9 kg/m$^2$), 80% are the farm owner/operator, 82% reported performing the majority of the work on the farm, 36% reported having earned a college degree, and 54% reported gross agricultural sales of $100,000 or more in 2011. The tabulation of farm types (row crop, cattle, hogs, and other) and sizes is in process.

The prevalence of musculoskeletal symptoms (of any severity) ranged from 23% to 48%, depending on anatomical area (low back, neck/shoulder, or elbow/wrist/hand) and recall period (August-October 2011, November 2011-January 2012, February-April 2012, May-July 2012, or the previous two weeks). Importantly, the baseline prevalence estimates substantially exceed the prevalence (15%) used in the power calculations to estimate the proposed sample size. The greatest prevalence (48%) was observed for low back symptoms during the recall period between August and October of 2011. The compilation of additional questionnaire responses, including alternative outcome variables (e.g., the number of days symptoms interfered with ability to work) and the Job Content Questionnaire (used to assess occupational psychosocial stress) is in process. On-farm measurement of exposure to physical risk factors is underway.

***Research Core: Keokuk County Rural Health Study (J Merchant)***

- Humann MJ, Sanderson WT, Gerr F, Kelly KM, and Merchant JA. Effects of Common Agricultural Tasks on Measures of Hearing Loss. American Journal of Industrial Medicine. 55:904-916, 2012.

  Audiometry and lifetime exposure to 11 agricultural tasks were analyzed among 1,568 adult participants in Round 2 of the KCRHS. Among men, significant associations were observed between

hearing loss and hunting or target shooting, all-terrain vehicle (ATV) or motorcycle riding, chain saw use, electric or pneumatic tool use, living on a farm, and all agricultural tasks combined. When all significant exposure metrics were included in a single model, associations remained for hunting/target shooting, electric/pneumatic tool use and living on a farm. No consistent association between defined exposures and hearing loss were observed among women.

- Yang J, O'Gara E, Cheng G, Kelly K, Ramirez M, Burmeister L, and Merchant J. At What Age Should Children Engage in Agricultural Tasks? The Journal of Rural Health. doi: 10.1111/j.1748-0361.2012.00412.x

  Round 2 data from the KCRHS was collected and analyzed from parents of children age 17 and under. Parents were interviewed separately regarding the age of their children's involvement in 14 agricultural tasks and their opinions about appropriate age of involvement. Of the 264 families included, 86.5% with a son and 69.8% with a daughter reported having their oldest child involved in at least 1 of 14 agricultural tasks. The average actual-performance ages of children involved in any of the tasks were younger than those that parents perceived to be appropriate. Furthermore, for six of the nine North American Guidelines for Children's Agricultural Tasks (NAGCAT) that we assessed, parents' perceived-as-appropriate ages were younger than minimum ages recommended by the NAGCAT. Driving an all-terrain vehicle (ATV) was the most common task with actual performance age younger than the NAGCAT recommended age—53% of boys and 36% of girls. Boys and girls who live on a farm, or whose parents have been or are farmers, were significantly more likely to perform agricultural tasks at earlier ages. It is concluded that farm parents, and all other rural stakeholders, need to be better educated and that multilevel interventions are needed to protect farm children from age-inappropriate farming exposures.

***Education/Translation Core: Advancing Research to Practice through Community Partners (K Donham)***
We have recruited a 16-member Regional Advisory Committee (RAC) of representatives from organizations which work directly with the farming community across the region (e.g. extension, non-profits such as Farm Safety for Just Kids and the AgriSafe Network). Significantly, the neighboring NIOSH Agriculture Centers (CS-CASH and UMASH) which also serve states in the Midwest have agreed to actively participate in Center outreach and have provided a representative to serve on the RAC. The RAC has met quarterly to review research results, exchange information, set priorities, and guide this project, especially in developing best practice guidance to facilitate community-based intervention activities. Draft guides are in development for use of respiratory and hearing personal protective equipment in agriculture and for farm equipment road transport safety. In addition, half the pilot/feasibility project budget request for this fiscal year was made available to encourage and support desired community partnering project activities.

On November 16-17, 2011, The Education/Translation Core co-sponsored the Midwest Region Agricultural and Safety and Health (MRASH) Forum in Johnston, IA. This effort included collaboration with Iowa's Center for Agricultural Safety and Health and was attended by people from ten US states and Sweden. Topics included behavioral health issues, youth safety, pesticide and herbicide safety, ATV safety, and personal protective equipment.

The 2013 MRASH conference was planned during the Annual Report project period. The Conference was held in Cedar Rapids, IA, in November 2012. During planning, GPCAH faculty and staff conferred extensively with representatives from the NIOSH-funded Agricultural Health Center at the University of Nebraska; the Illinois NIOSH-funded Education and Research Center at the Universities of Iowa, as well as agricultural health and safety specialists from the University of Illinois, Purdue University, Ohio State

University, and Pennsylvania State University. In addition, members of the Grain Handling Safety Coalition (a broad public-private consortium) participated in planning. We were very pleased that the MRASH planning committee agreed to focus on grain bin safety and handling as an area of special emphasis this past year. The MRASH planning committee also committed to drafting a white paper to enhance the development of policy in guiding and strengthening injury prevention among grain handling workers.

***Evaluation Program (E Parker)***

Effective and appropriate evaluation serves as an important guide to all public health activities. Evaluation provides an indication of the effectiveness of activities and resource allocation. The inclusion of surveillance activities augments evaluation by providing estimates of the actual morbidity and mortality experience of agricultural workers. The ultimate goal of the Center is to prevent agricultural injury and illness. Surveillance of these outcomes provides the most direct assessment of the impact of Center activities.

In order to best fill the goal of the Evaluation Program, the evaluation team developed three data collection forms:

- Investigator Form: A data collection form and protocol for process and impact evaluation measures to document and monitor Center investigators' research, outreach, and training activities. Following pilot testing and validation of the process indicators developed with Center staff/investigators, the form is distributed at monthly GPCAH meetings for the investigators to complete.
- Center Form: A data collection form that includes quantitative measures and indicators of progress and success for overall Center activities. This form is used to document the progress and impact of the Center activities in the areas of research, outreach, and training.
- Focus Group Guide and Data Collection Form: A semi-structured interview guide protocol that includes open-ended questions to collect data on the center's strengths, weaknesses, threats and opportunities. The qualitative data are to be collected using a focus group format among members of the Internal Advisory Committee. In addition, focus group(s) will be undertaken using modified Focus Group Guide with members of External Advisory Committee every other year.

The evaluation team is working with the outreach team to assist them with the development of evaluation indicators and methods to document whether and how the Center's outreach goals are met.

Following the departure of Dr. Ginger Yang in July, 2012, we opened a search for an Evaluation Coordinator. While that position has not yet been filled, we continue to collect monthly investigator data and have administered the first annual Center Evaluation Form. Results of the first year of evaluation will be presented to GPCAH investigators and staff in February.

***Surveillance Program (C Peek-Asa)***

Surveillance core activities can be categorized according to the severity of the agricultural injury outcome – fatal or non-fatal. For several years, the GPCAH has supported a newspaper clipping service to identify agriculturally-related deaths. This effort had not been evaluated previously and in the past year we conducted an evaluation to determine the completeness reporting by the newspaper clipping service and to evaluate the most appropriate contributions from clippings. Through this analysis, we compared the prevalence of newspaper clippings in our nine-state region to those reported through the Census of Fatal Occupational Injuries (CFOI) and found very high variation between these sources across the states. Given this high variability, we concluded that the newspaper clipping service is not a good source for research-based analyses. However, the clippings provide public information about events, which can be very

interesting and informative. We have developed an interactive map of events based on these clippings, and this map will soon be posted to the Center website. In order to conduct research-based analyses, we have submitted and had approved a request for CFOI data for the Midwest region.

The Surveillance Core conducted a thorough inventory of potential sources for non-fatal agricultural injuries. Regional surveillance would be very difficult because the sources are so broad, so we have focused our efforts on Iowa. Iowa has a statewide Trauma System that includes an Iowa Trauma Registry. We have finalized a Memorandum of Understanding with the Iowa Department of Public Health, home of the data, to use it for agricultural trauma. Analyses of these data have begun.

***Pilot Feasibility/Emerging Issues Program (F Gerr)***
**FUNDED PILOT PROJECTS**

| Investigators | Organization | Proposal |
|---|---|---|
| Adkisson,J<br>Aherin, R<br>Rhomba, P | IL Grain & Feed Assn.<br>University of Illinois<br>Illinois Farm Bureau | *Using technology to enhance the flexibility, adaptability of training tools for community based training in grain handling safety* |
| Jennissen, C<br>Denning, G | University of Iowa<br>University of Iowa | *Determining the mechanisms and outcomes of ATV crashes among high-risk groups in the Great Plains Region* |
| LeVan, T<br>Merchant, J | Univ Nebraska MC<br>University of Iowa | Genetic variation in endotoxin receptors and their association with COPD phenotypes |
| Koc, AB<br>Downs, W | University Missouri<br>University Missouri | A tractor rollover detection and emergency system based on mobile electronic devises |

See Appendix B for abstracts of these pilot projects and for four pilots funded in the previous year and implemented during 2012.

# APPENDIX A
## Great Plains Center for Agricultural Health Program Outputs
### October 2011 - September 2012

**Agricultural Safety and Health Manuscripts Accepted for Publication**

Douphrate DI, Fethke NB, Nonnenmann MW, Rosecrance JC, Reynolds SJ: (2012) Full shift arm inclinometry among dairy parlor workers: a feasibility study in a challenging work environment. Applied Ergonomics, 43(3):604-613. (PMID: 22019358)

Hoppin JA, Long S, Umbach DM, Lubin JH, Starks S, Gerr F et al: (2012) Lifetime organophosphorous insecticide use among private pesticide applicators in the Agricultural Health Study. J Expo Sci Environ Epidemiol,
22(6): 584-92.

Humann M, Gerr F, Sanderson WT, Kelley K, Merchant JA: (2012) Effects of common agricultural tasks on measures of hearing loss. Am J Ind Med, 55(10): 904-16.

Leedom Larson KR, Wagstrom EA, Donham K, Harper A, Hanson BM, Male M, Smith TC: (2012) MRSA in pork production shower facilities: an intervention to reduce occupational exposure. J Agric Saf Health, 18(1): 5-9.

O'Shaughnessy PT, Peters T, Donham K, Taylor C, Altmaier R, Kelly K: (2012) Assessment of swine worker exposures to dust and endotoxin during hog load-out and power washing. Ann Occup Hyg, 56(7): 843-51.

Pavalonis B. (May 2012) Evaluation of EPA Dispersion Modeling Using Passive Monitors. B Pavalonis, OEH PhD Dissertation.

Pavalonis B. (May 2012) Relative exposure to swine confined animal feeding operations and childhood asthma prevalence in an agricultural cohort. OEH PhD Dissertation.

Peters TM, Anthony TR, Taylor C, Altmaier R, Anderson K, O'Shaughnessy PT: (2012) Distribution of particle and gas concentrations in swine gestation confined animal feeding operations. Ann Occup Hyg, 56(9), 1080-1090.

Starks SE, Hoppin JA, Kamel F, Lynch CF, Jones MP, Alavanja MC, Sandler DP, Gerr F. (2012): Peripheral nervous system function and organophosphate pesticide use among licensed pesticide applicators in the Agricultural Health Study. Environ Health Perspect, 120(4):515-20.

Yang J, O'Gara E, Cheng G, Kelly KM, Ramirez M, Burmeister LF, Merchant JA: (2012) At what age should children engage in agricultural tasks? J Rural Health. 28(4):372-9.

**Abstracts/Presentations at Scientific Meetings**

Donham K. (2011): Building capacity in agricultural medicine training. Midwest Rural Agricultural Safety & Health Conference. November 16-17, 2011, Johnston, IA.

Donham K. (2012): Agricultural medicine education, the AgriSafe Network, and the Certified Safe Farm: A U.S. model providing structure and service for occupational health in agriculture.

Badtke L, Kelly KM, Wang K, Merchant J, and Ludewig G. (2012): Influence of paraoxonase 1 Q192R and lifestyle factors on PON1 activity over time in an agricultural population. Society of Toxicology Meeting, March 2012, San Francisco, CA.

Burgus S. (2011): Working Farm Youth Education. Midwest Rural Agricultural Safety & Health Conference. November 16-17, 2011, Johnston, IA.

Denning G. (2011): Location, Location, Location: How Data Based on ATV Crash Site Informs Rural Health Policy for Injury Prevention. Midwest Rural Agricultural Safety & Health Conference. November 16-17, 2011, Johnston, IA.

Gerr F. (2012): Neurobehavioral effects of solvent exposure among agricultural works. International Society Agricultural Safety and Health 2012 Annual Meeting. June 24-28, 2012, Burlington, VT.

Jennissen C. (2011): Safety Tips for ATV Riders: Increasing ATV Safety Knowledge through an In-Classroom Educational Intervention. Midwest Rural Agricultural Safety & Health Conference. November 16-17, 2011, Johnston, IA.

Jennissen C. (2011): Utilizing Social Media to Better Understand the Crash Mechanisms of Actual All-terrain Vehicle (ATV) Crash Victims. Midwest Rural Agricultural Safety & Health Conference. November 16-17, 2011, Johnston, IA.

Kline A. (2012): Building Capacity of Agricultural Medicine – The Academy of Instructors. Midwest Rural Agricultural Safety & Health Conference. November 16-17, 2011, Johnston, IA.

Manz N, Silver K, Fethke N, Hoffman K, Loury S, Florence J. (2012): Building a consensus for tomato grower ergonomics: a community-based expert panel study. American Public Health Association 104th Annual Meeting and Exposition. October 27-31, 2012, San Francisco, CA.

Ramirez M, Gerr F. (2012): Agriculture injury surveillance: collaborations between academia and government. Council of Territorial and State Epidemiologists National Meeting. June 3, 2012, Omaha, NE.

Ramirez M. (2012): Agriculture injury surveillance: collaborations between academia and government. Midwest Rural Agricultural Safety & Health Conference. November 13-15, 2012, Cedar Rapids, IA.

Reeve KA, Anthony TR. (2012): Wintertime factors affecting contaminant concentration in farrowing barns. Student poster presented at American Industrial Hygiene Conference and Exposition. June 20, 2012, Indianapolis, IN.

Sawvell R, Anthony TR. (2012): Improving indoor air quality in swine CAFOs using enhanced ventilation and engineering controls. Midwest Rural Agricultural Safety & Health Conference. November 13-15, 2012, Cedar Rapids, IA.

Sullivan R, Ramirez, M, Kraemer J, Peek-Asa, C, Gergelt R. (2012): Toxicology testing in fatally injured workers. National Occupational Injury Research Symposium (NOIRS). October 18-20, 2011, Morgantown, WV.

**Lectures or Seminars Delivered at the University of Iowa**

Anthony TR. (2012): Lectures: delivered to graduate OEH students for 175:230 (2).

Donham K. (2011-12) Seminar: "Current topics in agricultural safety" delivered to students in 175:210 and 175:210EXW (8 class periods).

Donham K. (2011-12) Seminar: Agricultural Safety: Theories & Practice" delivered to students in 175:176 and 175:196EXW (4 class periods).

Donham K. (2011-12): Seminar: "Preceptorship in Occupational & Environmental Health" for 175:203 (3 class periods).

Donham K. (2011-12): Seminar: "Research in Occupational and Environmental Health" for 175:201 (1 seminar).

Donham K. (2011-12): Seminar: "Rural Health and Agricultural Medicine" 175:209 (42 class periods).

Donham K. (2011-12): Seminar: "Independent Study in OEH" 175:172 (3 class periods).

Donham K. (2011-12): "Thesis/Dissertation" 175:300 (2 class periods).

Donham K. (2012): Seminar: "Veterinary Public Health: The Profession" 175:211 (13 class periods).

Fethke N. (2012) Lecture: "Case study of ergonomics in the tomato harvesting industry" delivered to students
in a course lecture (1 lecture).

Gerr F. (2012) Paper review: 'Musculoskeletal disorders among agricultural workers' delivered in Course 175:185 (1 lecture).

Gerr F. (2012) Lecture: "Neurological effects of pesticide exposure" delivered to 25 Public Health MPH and PhD students (1 lecture).

Gerr F. (2012) Paper Review: 'Asthma and pesticides' by Hoppin et al." delivered in Course 175:185 (1 review).

Merchant J. (2012) Seminar: "Impacts of industrial livestock production" delivered to OEH students and faculty (1 seminar).

Merchant J. (2012) Seminar: "The children of Keokuk County" delivered to OEH students and faculty (1 seminar).

Merchant J. (2012) Distinguished Faculty Lecture: "Advocating for rural health—Community-based research and policy (1 lecture).

Ramirez M. (2012) Seminar: "Use of KCRHS for data analysis" delivered to MS/PhD students (10 class periods).

*Sessions below presented by students in class:*

Getchman B, Ramirez M (2012) Occupational Injury Seminar: "Alcohol Abuse and the EFFECTS OF Job Demand on a Population of Rural Women."

Aamodt J, Ramirez M (2012) Occupational Injury Seminar: "Safety training among youth from Keokuk County Rural Health Study who engage in hazardous agricultural tasks."

Smithart K, Ramirez M (2012) Occupational Injury Seminar: "The relationship between intimate partner violence and pregnancy in a rural setting: cross-sectional results from the KCRHS (1994-1998)."

Schwab Reese L, Ramirez M (2012) Occupational Injury Seminar: "PV directionality and risk factors in a rural community."

Wentworth L, Ramirez M (2012) Occupational Injury Seminar: "Self-reported depression and suicide ideation: The Keokuk County Rural Health Study."

Frederick M, Ramirez M (2012) Occupational Injury Seminar: "Intimate partner violence, self-efficacy, and depressive symptoms among adolescents in a rural setting in Iowa."

Afolayan O, Ramirez M (2012) Occupational Injury Seminar: "Injury as a risk factor for depression in a rural community."

Ramirez M. (2012) Lecture: "Farm equipment roadway crashes" delivered to NADS investigators and investigators from Marshfield, Queens University, and University of Alabama (1 lecture).

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

Donham K. (2012) Lecture: "Farm Safety Day" Rural Health Clinic of Greater Johnson CO. Delivered to farm families from Johnson, Iowa, Keokuk, and Washington Counties, Iowa City, IA.

Donham K. (2011) Webinar: Agricultural Musculoskeletal Diseases.

Donham K. (2011) Webinar: Agricultural Hearing Loss and Other Physical Factors.

Donham K. (2011) Webinar: Human Health Hazard of Veterinary Pharmaceuticals.

Donham K. (2011) Webinar: Agricultural Respiratory Conditions.

Donham K. (2012) Webinar: Certified Safe Farm Translation to Practice.

Donham K. (2011) Workshop: Building Capacity. Agricultural Medicine: the Core Course. Marshfield Farm Medicine Center, Marshfield, WI.

Donham K. (2011) Workshop: Agricultural Medicine: the Core Course, Vermont Farm Health Task Force, Burlington VT.

Donham K. (2011) Workshop: Agricultural Medicine: the Core Course, Lakes Technical College and ND Office of Rural Health, Devils Lake, ND.

Donham K. (2012) Workshop: Agricultural Medicine: the Core Course, Marshfield Farm Medicine Center, Marshfield, WI.

Donham K. (2012) Workshop: Agricultural Medicine: the Core Course, North Carolina Agromedicine Institute, East Carolina University, Greenville, NC.

Donham K. (2012): Lecture: Personal protective equipment demonstration and use, Farm Progress Show, Boone, IA.

Donham K. (2012) Workshop: Agricultural Medicine: the Core Course Central States Center for Agricultural Safety and Health, Omaha, NE.

Merchant J (2012) Rapporteur: UNC and UI CAFO Research Workshop, Chapel Hill, NC.

Merchant J (2012) Commissioner and discussant: National Commission on Industrial Farm Animal Production Workshop—Update and Review. Center for a Livable Future, Johns Hopkins Bloomberg School of Public Health, September 30 - October 2, Baltimore, MD.

Ramirez M. (2012) Lecture: "Fatality Assessment and Case Evaluation: Toxicology Testing in Fatally Injured Workers" delivered at the Iowa State Medical Examiners Meeting, Des Moines, IA.

**Consultation or Information Exchange with Community Partners**

Anthony TR. (2011-12) Consultation: "Barn Air/Ventilation" walk through and discussion (3 producer sites).

Anthony TR. (2012) Information Exchange: Study Results (poster and brochures) provided to intervention site.

Donham K. (2012) Information Exchange: "Library information services, hot line calls, research compendium, research to practice discussion" discussed in a conference call with the RAC of the GPCAH.

**Consultation or Information Exchange with Non-Community Partners**

Donham K. (2012) Information Exchange: "Designing and developing programming that is relevant to the farm population of the 4 country region of Johnson, Iowa, Washington, and Keokuk Counties" to the Rural Health and Safety Clinic of Greater Johnson County.

Fethke N. (2012) Consultation: Ongoing consultation on project within the Colorado State Agricultural Center.

**Data and Scientific Evidence Provided to Policy Makers by GPCAH Personnel**

Donham K. (2012) Child Labor Law information provided to Senator Harkin's Staff.

Gerr F. (2012): Impact of the Great Plains Center for Agricultural Health provided to the AFF Review Panel of the National Academy of Sciences, May 31.

**Press Releases and Media Stories**

Anthony TR. (2012): "Safety Tips for Agricultural Workers: Lessons Learned through Fatality Investigations," *Farm Families Alive and Well* newsletter (18):2.

Donham K. (2011): "Facilitating research to practice with community partners," *Farm Families Alive and Well* newsletter (18):1.

Donham K. (2012): "Highlighting the Certified Safe Farm program," *Farm Families Alive and Well* newsletter (18):2.

Donham K. (2012): "Building capacity is back," *Farm Families Alive and Well* newsletter (18):3.

Donham K. (2012): "Facilitating research to practice at MRASH," *Farm Families Alive and Well* newsletter (18):4.

Donham K. (2012): "The application or translation of the Certified Safe Farm Program to selected farms across the country," *Successful Farming Magazine*.

Donham K. (2012): "Rural Roadway Safety," *Successful Farming Radio*.

Gerr F. (2012): "Two new agricultural health centers in the Midwest and a looming funding crisis," *Farm Families Alive and Well* newsletter (18):2.

Gerr F. (2012): "Funding Threatened," Trade periodical, *Iowa Farmer Today* magazine.

Gerr F. (2012): "Roadway safety continues to be major concern to agricultural producers," *Farm Families Alive and Well* newsletter (18):4.

Masad J. (2012) "Healthier pigs, less $: Decreasing air pollution while increasing heating efficiency," *Graduate Education at Iowa* newsletter.

Ramirez M. (2011): "Iowa FACE program warns of grain entrapment risk," University of Iowa news release, October 19.

Ramirez M. (2012): "Iowa FACE program warns farmers of tractor run-over risk," University of Iowa news release, October 30.

Ramirez M. (October 2011): "Prevent fatalities from grain entrapment," Iowa FACE Hazard Alert.

Ramirez M. (October 2012): "2 Iowans killed when run over by tractors that were started while standing beside tractor," Iowa FACE Hazard Alert.

Rosmann K, Madsen M. (2012): "Behavioral health services for farmers withering in drought too," *Farm Families Alive and Well* newsletter (18):4.

Unknown (2012): "Using the web to reach farmers," *Farm Families Alive and Well* newsletter (18):3.

Unknown (2012): "Moving research in agricultural safety and health to practice," *Farm Families Alive and Well* newsletter (18):1.

Donham K (2012): "Agricultural Safety, Health Conference Announces Call for Abstracts," University of Iowa news release, June 11.

**Research Grant Proposals Submitted and/or Funded**

Anthony TR. Design, Evaluation, and Validation of a Next-generation Inhalable Aerosol Sampler. (Funded 2012).

Gerr F. Submitted and Funded: Great Plains Center for Agricultural Health Administrative Supplement. (Funded 2012).

Gerr F. Submitted and Funded: Great Plains Center for Agricultural Health Non-Competitive Renewal. (Funded 2012).

**Co-authored Grant Proposals Submitted and/or Funded**

Becklinger N, Anthony R, Fethke N. Submitted to GPCAH Pilot Funding Program. Design and test of a self-report system for non-fatal accidents and near misses among agricultural workers. (Not Funded 2012).

Merchant J, LeVan TD, Kelly K. Genetic Variation in Endotoxin Receptors and Their Association with COPD Phenotypes. (Funded 2012).

Ramirez M. Motivating Farm Owners to Create Safe Play Areas: A Randomized Controlled Trial. (Funded 2012).

Ramirez M. Evaluation of PrepKids; A Program for Enhancing Resiliency among Rural Children with Disabilities. (Funded 2012).

Merchant J, LeVan, TD, Kelly, K. Genetic Variation in Endotoxin Receptors and Their Association with COPD Phenotypes. (Funded 2012).

.

## APPENDIX B

### 1. Pilot Projects Funded for 2012-13

**Project Title:** **Using technology to enhance the flexibility, adaptability of training tools for community based training in grain handling safety**
PI: J Adkisson, BS, Grain and Feed Association of Illinois
Co-Investigators: R Aherin, PhD, University of Illinois; P Rhomba, MS, Illinois Farm Bureau

Summary of Project:
Under a prior GPCAH Community Partners Small Grant Program, the Grain Handling Safety Coalition developed a curriculum module Overview of Safe Handling and Storage of Grain, including a Train the Trainer component. We will continue to offer both Tier 1 and Tier 2 training of the Overview Curriculum to both the production and commercial sectors. We will be enhancing the current evaluation mechanism of this module to include a pre- and post-learning assessment. The post learning evaluation instrument will also include questions targeting participants' likes/dislikes of the presentation format. An advanced analysis will be performed to determine areas of technical effectiveness; identify areas in which technical content requires improvement; and identify areas of unfavorable presentation format. The results of this analysis will drive enhancements and improvements to the curriculum utilizing electronic media applications. The goal is to produce a curriculum which can be more interactive, flexible, and adaptable according to audience/instructor needs. A Level Two evaluation instrument will be utilized to assess the effectiveness of the improvements and enhancements, as well as content, for learning acquisition and reaction. Lastly, we will explore the feasibility and cost of other electronic media applications, such as phone apps or virtual training.

Project title: **Determining the mechanisms and outcomes of ATV crashes among high-risk groups in the Great Plains Region**
PI: C Jennissen, MD, University of Iowa, Department of Emergency Medicine
Co-investigators: G Denning, PhD, K Harland, PhD, University of Iowa, Department of Emergency Medicine

Summary of Project
All-terrain vehicle (ATV) crashes are a serious public health and safety concern in and near rural communities. To date, studies of ATV-related deaths and injuries have focused on the larger ATV user population which rides ATVs primarily for recreational purposes. In contrast, little or nothing is known about ATV crashes and injuries among agricultural families, particularly those resulting from occupational use. In addition, there is no published data regarding injuries and deaths due to crashes with utility vehicles (UTV) or side-by sides, a type of off-highway vehicle that has gained more recent popularity. The objective of our pilot study is to determine the epidemiology and mechanisms of injury for occupational ATV crashes, and especially those that involve UTVs. For these studies, we will use several data sources, including records from the Iowa Department of Transportation (IDOT) and state trauma registry (2002-2009) and press clippings for the 9-state Great Plains region (2009-2011). We will also analyze data from the Keokuk County Rural Health study, the only population-based study of rural families. Finally, in collaboration with Dr. Marizen Ramirez, we will include occupational ATV and UTV crashes as part of a larger study on farm vehicle crashes, using DOT data from several states. Our studies will provide important insights into the factors that contribute to occupational ATV and UTV injuries and will be valuable for developing targeted ATV/UTV injury prevention programs for farm families.

**Project Title:** **Genetic variation in endotoxin receptors and their association with COPD phenotypes**
PI: Tricia LeVan, PhD, University of Nebraska Medical Center
Co-Investigators: James Merchant, MD, PhD, University of Iowa; Kevin Kelly, PhD, University of Iowa, Department of Occupational and Environmental Health

Summary of Project
Chronic obstructive pulmonary disease (COPD) is a complex disease of major public health concern, and is the 3rd leading cause of mortality worldwide. The American Thoracic Society concluded that the fraction of COPD due to occupational exposures was as much as 15%, independent of smoking. Farming is among occupations associated with COPD with a COPD prevalence of COPD of 30% in smokers and as much as 17% in never smokers. Human genetic studies provide support for genetic factors involved in occupationally-related COPD manifestations. Yet there is a fundamental gap in our understanding how agricultural exposures contribute to COPD. We hypothesize that unique genes may contribute to COPD in agricultural workers. A major strength of our application is the use of the Keokuk prospective cohort and the existing collaboration between the University of Nebraska and the University of Iowa. Goals of this study are: 1) to perform a case/control candidate gene association study in Keokuk subjects with and without COPD, chronic bronchitis, FEV1 and FEV1/FVC as the primary outcome phenotypes; 2) to use a single SNP, gene-centric and pathway approach for association analyses; and 3) to perform gene-environment interaction analyses using genes associated with COPD phenotypes. We expect to identify novel genes and consequent pathological mechanisms of COPD in agricultural workers.

Project Title: **A tractor rollover detection and emergency reporting system**
PI: AB Koc, PhD, University of Missouri
Co-Investigator: W Downs, PhD, University of Missouri

Summary of Project
The overall goal of this proposal is to develop a multifunctional vehicle stability monitoring and emergency reporting system for motorized vehicles using the data from the inbuilt sensors of mobile electronic devices (tablet computers and smart phones). An iPhone application, vehicle rollover/accident prevention, education, training and emergency reporting system has already been developed by the PI's group. We perceive that it will be suitable for several motorized vehicles. With this project we aim to conduct tractor rollover tests to evaluate the accuracy and the limitations of the system.
The specific aims of the proposal are:

1) To modify a 2WD agricultural tractor for laboratory and field experiments;
2) To conduct field upset tests to evaluate the reliability and accuracy of the functions of the system; and
3) To demonstrate the use of the system for educating the public on tractor rollover.

## 2. Pilot Projects Funded for 2011-12

Project Title: **Web-based interaction encouraging safe and healthy rural-related behavior**
PI: S Burgus, Med, Farm Safety 4 Just Kids
Co-Investigator: K Funkenbusch, PhD, University of Missouri

Summary of Project:
The number of farms has remained relatively unchanged during the past two decades, an increase of small part-time and large farm operations continues while traditional mid-sized family farms become fewer. Only 45% of principal operators listed farming as their primary occupation in 2007.

This project will identify effective ways to electronically communicate safety and health messages to farm family members, especially among non-traditional farm families. Surveys will identify preferred electronic communications systems and modes used to convey safety and health topics to the intended audience. Web-based social networking will encourage farm families to interact about ways to prevent injuries due to the rural agricultural working environment.

Project Title: **Using community based partnerships for grain safety awareness and prevention training across the grain handling spectrum**
PI: J Adkisson, BS, Grain and Feed Association of Illinois
Co-Investigators: R Aherin, PhD, University of Illinois; P Rhomba, MS, Illinois Farm Bureau

Summary of Project:
The Grain Handling Safety Coalition (GSHC) will focus on a combined program of increased awareness and prevention education for the commercial and production grain industries. The program's specific aims include:

1) Raise awareness of the dangers, hazards and risks across the grain handling spectrum through the dissemination of information and public services announcement by utilizing the established network of the GHSC;
2) Develop a network of community based education programs to teach preventive safety measures by facilitating the collaboration of commercial, production, rescue, manufacturing, education, inspection, regulation, and health care personnel' and
3) Deliver a consistent message of safety and prevention as a first priority through the development of curriculum and materials, including train-the-trainer curriculum, in a variety of formats and made readily accessible through the GHSC network.

Project Title: **Prevention of injury, illness, and fatality due to grain entrapment and exposure**
PI: D Neenan, EMT, PS, National Education Center for Agricultural Safety

Summary of Project:
The National Education Center for Agricultural Safety (NECAS) will develop and implement an interactive educational program for farmers and ranchers and their families in the Great Plains Center for Agricultural Health region. Proposed sites are in rural South Dakota, Iowa, Missouri, and Minnesota. The primary focus will be on grain safety and entrapment issues. Machinery safety, personal protective equipment, and chronic health issues will be a part of the presented program. Optional educational opportunities will include first aid and CPR classes. The equipment to be used will include the portable grain bin simulator,

general farm equipment, and personal protective equipment. Collaborating partners will include local agribusinesses, Cooperative Extension, area educators and volunteer emergency service and fire fighters. In addition to community education, a five hour rescue training program will be available for area rescue personnel. Grant funding will be used to support staff time, travel, equipment support and training materials.