

Centers for Agriculture Safety and Health

2016-2021 Projects and Contact Information

January 3, 2018



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California

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CDC/NIOSH Cooperative Agreement 2 U54 OH007550-16

Planning and Evaluation Core

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The Planning and Evaluation Core provides infrastructure to support strategic planning, overall administration, coordination, and communication among the cores, programs and projects. This Core ensures that both the internal Steering Committee and External Advisory Board meet regularly to evaluate WCAHS goals and progress. In addition, the Planning and Evaluation Core works to implement the project work into educational material or outreach activities. The Administration unit and Emerging Issues Program are housed at the Center for Health and the Environment on the UC Davis campus, while Program Evaluation is at the Clinical and Translational Sciences Center (CTSC) on the UC Davis Health Systems campus in Sacramento. The aims of the Planning and Evaluation Core are to: 1) Provide leadership, vision, and direction for all Center cores, affiliates and stakeholders through Center Administration; 2) Evaluate the impact of the Center, its programs, and its research projects on improving health and safety in western agriculture through research, education, and outreach; and 3) Identify and address new or emerging problems in western agricultural health and safety through an Emerging Issues Program.

Outreach Core

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The overarching mission of the WCAHS Outreach Core is to disseminate evidence-based best practices to key stakeholders, including underrepresented and vulnerable subpopulations. Thus, WCAHS works with farmers, labor contractors, farmworkers, policymakers, local and regional government representatives and agencies, agribusinesses, nonprofit organizations, unions, and others that have a stake in improving the health and safety of farmers and farmworkers. Materials and programs are developed to be culturally, linguistically and educationally tailored to each group. Communication and partnerships between WCAHS and key stakeholders in the agricultural community are promoted via meetings, social and traditional media. The dissemination of research findings and policy recommendations are provided through professional publications and presentations, worker trainings, educational publications and videos, and WCAHS media. WCAHS investigators and colleagues at other agricultural health and safety centers actively collaborate to share findings.

Pilot/Feasibility Program

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Western agriculture is continually evolving in technology, environment, and labor force, resulting in an ever changing health and safety landscape. New investigators and approaches are required to adapt to these changes. The Western Center for Agricultural Health and Safety will employ a Pilot/Feasibility Program to promote research in agricultural health and safety through the provision of research funding, access to Center resources, and intellectual support. The Pilot/Feasibility Program will encourage the generation of new resources by enabling investigators to explore new research directions, collect preliminary data, or test new methods and technologies. The Program will enhance the mission of the Center by bringing together faculty, postdoctoral fellows, and students across numerous disciplines through a shared focus on agricultural health and safety research. The *overarching goal* of the WCAHS Pilot/Feasibility Program is to encourage the development of creative research projects while nurturing researchers — particularly beginning researchers — interested in improving agricultural health and safety.

Research Core

1. *Differential characterization of air pollutant emissions and associated toxicity from common agricultural practices in the San Joaquin Valley*

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There is a vast epidemiological and toxicological literature demonstrating strong associations and causal relationships between exposure to particulate matter (PM) and various metrics of adverse pulmonary, cardiovascular and neurological health effects. San Joaquin Valley farmworkers represent an especially susceptible population given a confluence of exposure to multiple known co-stressors, including heat, poor working conditions and adverse socioeconomic circumstances. This project assesses agricultural practices that pose the greatest risks in terms of exposure to PM emissions, how these emissions are toxic and which populations are most susceptible. Therefore, it is of great importance to understand the toxicity of agricultural related emissions in order to protect and improve farmworker health through education, translation and outreach. PM will be collected at different sites and with different crops. The PM will be characterized and evaluated for toxicity. Based on the results, appropriate worker safety recommendations will be developed and disseminated to farmworker communities, industry, regulatory agencies, and advocacy groups.

2. *Reducing toxin exposure for workers in Western agriculture: development of sustainable alternatives to soil fumigation*

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This project addresses the need to reduce farm worker exposure risk associated with applying toxic soil fumigants, which is widely performed in Western United States agriculture. The absence of a versatile, effective, and straightforward technology to displace fumigation constitutes an important problem because conventional soil fumigants, such as methyl bromide and chloropicrin, have been identified by federal and state regulatory agencies as carcinogens and a cause of both acute and cumulative toxicity. This project tests the use of a novel soil pest-inactivation technology, biosolarization, as a safe fumigation alternative that uses passive soil heating and fermentation to inactivate pests. This research will test biosolarization under practical conditions relevant to growers by considering major pests, currently available materials and practices, and the effect on subsequently planted crops. The outcomes of this research will significantly advance the field of biosolarization and

provide the validation required to accelerate its adoption by growers to decrease soil fumigation and associated health risks. Results will provide stakeholders with actionable data for growers to adopt biosolarization in lieu of soil fumigation with toxic compounds.

3. *Ergonomics of mechanical, robotic and personal strawberry harvest-aids*

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California is the nation's leading producer of strawberries. Strawberry harvesting is a very labor-intensive task, which results in many workers suffering from musculoskeletal disorders (MSD), especially low back disorders (LBDs). Various strawberry harvest-aids have been developed recently but no formal ergonomic and biomechanical studies have been conducted. The main objectives of this project are to attain a better understanding of the balance between the productivity and ergonomics of labor-aid machines, and to evaluate machine-specific interventions for their safe deployment. The combined effects of operating speed and time breaks on productivity, biomechanical response, fatigue and MSD symptoms will be investigated for multi-row harvest aid machines as well as a prototype single-person harvest-aid robot. The study results will be disseminated through outreach efforts and various industry-specific publications. The expected outcomes of the research are guidelines for the speed settings of large harvest-aid machines and rest breaks for their crews, and algorithms that implement ergonomically sound operation for single-person programmable machines. These guidelines will minimize workers' LBD risk, while maintaining acceptable productivity levels.

4. *Heat illness prevention in farm workers: Translation of economic, socio-cultural and physiological factors into effective interventions*

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Despite major campaigns to reduce Heat Related Illness (HRI) in agricultural workers, deaths and illnesses still occur at a significantly higher rate compared to other workers exposed to hot environments. The causative factors are more complex than just environment, work intensity and physiology and include cultural and socio-economic factors unique to the largely immigrant pool of farm workers. This project will translate existing quantitative and qualitative data from our original study on behavioral and physiological factors in California farm workers into multi-faceted risk-reduction strategies that are culturally relevant and more effective than current preventive efforts. The hypotheses to be tested are: 1) an economic study of California farms will indicate previously discounted effects of HRI on human and production costs and thereby increase industry support of HRI programs, and 2)

electronic mobile phone applications can be devised to reduce the risk of HRI by assisting primary prevention, and secondly by incorporating sensors, prevent workers exhibiting early signs of HRI from becoming overly ill. This project adds a dimension previously lacking: incorporating worker and employer buy-in to develop solutions and tailor education, training and outreach to encompass their needs. Developing alerts and delivering real time information to the fields via mobile phone applications to the supervisors will bring HRI prevention into daily rather than occasional awareness.

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The success of the High Plains Intermountain Center for Agricultural Health and Safety (HICAHS) is grounded in engaging and listening to stakeholders, and responding to their needs with sound, relevant programs and partnerships. Building on a substantial record of accomplishments in research, intervention, education and outreach, HICAHS is an innovative transdisciplinary Center that leverages expertise and resources among partners to promote a healthy agricultural and forestry/logging population in PHS Region VIII and beyond. Our innovative approach to the dairy industry, including establishment of a regional

HICAHS Dairy Network, and an International Dairy Research Consortium (IDRC) has been a highly successful model for advancing Research to Practice (r2p). Building on Regional needs assessment, this renewed HICAHS center continues to emphasize dairy, while also more broadly addressing emerging regional needs with cross-cutting, research, intervention, and outreach-translation. The Administrative, Planning, and Evaluation Core is organized to facilitate the success of the Center and utilizes an innovative approach to foster synergy among the multiple constituent projects and partners. The **Goal** of the Core is to provide overall vision, leadership, administration, and management of the Center. The specific aims/functions are to:

- Provide vision, leadership, strategic planning, and management.
- Ensure transdisciplinary coordination and synergy.
- Coordinate and facilitate innovative, high impact-programs in Outreach and Research.
- Enhance the HICAHS Dairy HS Network and the HICAHS International Dairy Consortium.
- Provide leadership and resources for Projects addressing high priority Emerging Issues.
- Use a novel logic model to evaluate the quality, effectiveness, and impact of the HICAHS.
- Collect evaluation data from research participants, advisory board members, and constituents to 1) Provide feedback and assess regional needs, 2) Provide feedback and guidance to each HICAHS project and program, based upon evaluation and 3) Evaluate and document Center-wide collaborations with multiple entities.

Outreach Core

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The outreach efforts proposed build on a foundation of twenty-five years of outreach activities to agricultural stakeholders and end-users and on our previous community-initiated projects at the HICAHS. A core function of the outreach program is to lead communications on behalf of the High Plains Intermountain Center for Agricultural Health and Safety. This work includes responsibility for contributing to, creating, and managing implementation of a multi-faceted communications plan for promoting HICAHS trainings, events, and safety and health messages. HICAHS proposes to focus on opportunities to strengthen the effectiveness of our outreach activities and of the community-initiated activities among our community partners involved in agricultural and forestry (AgF) safety and health. The goal of the community-initiated program is to continue to enhance the translation, dissemination, and evaluation of the AgF safety and health activities of

community organizations in the HICAHS region. Key facets include financial support to organizations involved in occupational safety activities through community-initiated small grants and methodological assistance to grant recipients in the conduct and evaluation of their translation and dissemination efforts. Knowledge generated from community initiated small grants will be translated into user-specific media and disseminated to the targeted AgF communities. HICAHS investigators will utilize a participatory approach through which university personnel and AgF stakeholders are engaged in a process focusing on the needs of their respective constituents. The HICAHS personnel will work directly with key agricultural partners (change agents and end-users) such as Extension specialists and agents, forestry, logging, and agricultural associations, insurance companies, and migrant health services, all of whom have direct access to end-users.

Pilot/Feasibility Program

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The High Plains Intermountain Center for Agricultural Health and Safety (HICAHS) serves Public Health Service (PHS) Region VIII (Utah, Wyoming, Montana, Colorado, and the Dakotas), an area largely defined by its unique western climate and geography. Central to the HICAHS mission is the development of new information and tools with which to improve human health and safety in agriculture and forestry. Therefore, the primary goal of the Pilots/Feasibility Projects Program is to support agriculture and forestry related health and safety needs specific to the National Occupational Research Agenda (NORA) and to Region VIII. The HICAHS Pilot/Feasibility Projects Program has been highly successful in the past, leading to the generation of leveraged grants and larger-scale federally-funded grants, the development of new educational materials and intervention techniques, the training of student and junior investigators, and the publication of peer reviewed journal articles and conference presentations. For example, previous pilot projects led to the successful development of 10 leveraged or subsequent larger-scale grants as well as 19 peer-reviewed manuscripts and over 32 conference presentations. The HICAHS Pilot/Feasibility Projects Program has three aims:

- Aim 1: Develop new and creative research (basic, applied, translational) related to human health and safety in agriculture and forestry within Federal Region VIII.
- Aim 2: Build research capacity related to human health and safety in agriculture and forestry in Federal Region VIII.
- Aim 3: Foster new, collaborative partnerships among the HICAHS researchers, private industry, and regional and federal government agencies with stakeholder interests in human health and safety in agriculture and forestry.

Research Core

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1. *Development of Engineering Controls to Reduce Foldable ROPS Overturn Fatalities (Years 1-3)*

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Research priorities identified by the National Occupation Research Agenda (NORA), Section 4 and this PAR identify tractor rollover fatalities as a research priority (NORA, 2008). The specific goal of this project is to develop a retrofit mechanical lift assists for foldable ROPS that can be operated from the tractor seat and meets ergonomic standards, and generate guidelines for implementing these engineering controls on various size tractors/ROPS combinations. This is needed to decrease the number of tractor rollover fatalities occurring when a foldable ROPS is left folded down. The activities include 1) develop and test a sensor to measure the actuation forces and angles for foldable ROPS, 2) determine the actuation forces and angles on foldable ROPS of various sizes and compare to theoretical values to define both the theoretical and frictional forces, 3) based on the actuation forces and location of the foldable ROPS with respect to the seat reference point, design and develop a retrofit mechanical lift assist mechanism operable from the tractor seat for various size ROPS, 4) evaluate the mechanical lift assist to determine the forces and movement required by the operator to meet appropriate ergonomic standards, and 5) generate guidelines that can be used to aid the development of mechanical lift assists for foldable ROPS.

The guidelines will ease the manufacture and implementation of the lift assist mechanism for foldable ROPS and increase the use of properly positioned ROPS. It is imperative the lift assist mechanism does not alter the mechanical strength of the foldable ROPS and nullify the ROPS certification.

2. *Occupational Safety Management and Leadership on Large-Herd Dairy Farms*

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The U.S. dairy industry has shifted towards a large-herd, mass-production model due to economies of scale. This shift has led to a higher risk of fatalities, injuries and work-related musculoskeletal disorders (MSDs) due to task specialization, increased work demands and hazards. Additionally, dairy owners are increasingly dependent on front-line supervisors to effectively manage a larger workforce comprised primarily of low literacy, non-English speaking workers with minimal to no experience of working on large-herd farms. Owners are increasingly seeking supervisors who demonstrate effective management and leadership skills, especially in relation to worker health and safety. Much research effort has been put into developing safety management systems for large enterprises, whereas there is a lack of development, implementation and evaluation of safety management systems for small enterprises, especially dairy farming operations. Despite increasing herd sizes with increasing numbers of hired workers, over 95% of dairy farms in the U.S. remain private, family-owned operations. This study builds on extensive HICAHS dairy research and outreach over the past 14 years, and responds to these findings with the development of an integrated safety management strategy that will be operationalized on modern, large-herd U.S. dairy farms. The long-term goal of the project is to reduce or eliminate injuries and fatalities among a vulnerable workforce on dairy farms. Two primary aims will be addressed: 1) Develop and implement an integrated safety leadership and management training intervention for large-herd dairy front-line supervisors, and 2) Evaluate the effects of the safety leadership and management training intervention on dairy supervisor daily leadership and management practices, as well as worker group safety climate and behavior. This project will adopt a salutogenic approach to worker safety on dairy farms where we will focus on proactive, leading indicators and practices, instead of reactive lagging indicators which focus on the occurrence of safety outcomes. This approach reflects a dairy industry movement towards a more proactive approach to safety leadership and management. We will employ novel and innovative longitudinal data collection and analysis methods which have not been utilized in occupational safety research in agricultural settings. Additionally, we will develop a Safety Leadership and Management Practice (SLAMP) index to be used to measure and monitor supervisor safety leadership and management daily practices.

3. *Agricultural Safety Education Initiative*

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The long-term goal of this five year project is to understand how an agricultural machinery safety education program may provide a lasting impact on intermediate behavioral and environmental health outcomes for youth working in agriculture in the high plains and intermountain region. These intermediate health outcomes include reduced machinery entanglements, tractor run-overs, tractor roll-overs, ATV collisions, ATV turn-overs, falls from dismounting equipment, and vehicle collisions on rural roadways. The objective of the proposed work here is to determine how local chapters of the National FFA organization can be leveraged to reduce injuries to youth who work with agricultural machinery. With the large number of students engaging in work-based experiential learning, it is imperative to improve supervision strategies and safety training provided by agricultural education teachers. The specific aims are to: i. Determine the effectiveness of utilizing an evidence based agricultural machinery safety curriculum to provide “Train the Teacher” programming to secondary agricultural teachers, ii. Assess performance of safety procedures related to agricultural machinery using teacher-led supervised agricultural experiences (SAE), iii. Measure local community adoption of agricultural machinery safety procedures and develop a model for translation using an FFA Award structure (SAE Proficiency Awards) to diffuse student safety education gains.

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The Administration Program maintains the necessary infrastructure to assure coordination among the multiple projects, investigators, and institutions within the SEC-CAgSH, and support the SEC-CAgSH advisory boards and committees. To optimize the research infrastructure and assure quality in study design and data analysis across all Center projects, a consultative biostatistics unit is included within the Administration Program.

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The Evaluation Program collects relevant monitoring and evaluation data from the SEC-CAGSH as a whole, its cores, and individual research projects. The evaluation team analyzes and interprets data to establish the quality and effectiveness of the center, reports and shares evaluation findings and recommendations with key stakeholders, and maintains an open line of communication and engagement with the Evaluation Programs of other Ag Centers across the country.

Emerging Issues Program

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The Emerging Issues Program will identify new and existing agricultural, forestry, and fishery industry safety and health issues throughout the southeast region; identify appropriate stakeholders involved with these issues; prioritize emerging issues; and address prioritized emerging issues through direct Center investment and/or referral to appropriate resources.

Outreach Core

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The goal of the Outreach Core is to develop, disseminate, and evaluate evidence based and culturally effective communication and education tools and practices, in order to help agricultural producers, growers, and workers proactively address health and safety issues. The Outreach Core is comprehensive in nature, providing knowledge transfer support for the research projects, integration with all proposed educational activities, and effective and culturally competent communication and information dissemination to stakeholders across the six state region. Outreach Core activities align with the National Occupational Research Agenda (NORA Ag FF) outreach plan, and consist of disseminating relevant research findings and promoting adoption of best health and safety practices in the agricultural and fishery workplaces. The outreach approach and strategy utilizes two-way participatory and social marketing strategies. This includes working with a Community/Stakeholder Advisory Board (CSAB). The CSAB is a significant research-to-practice mechanism designed to engage stakeholders, communicate research findings and review outreach materials.

Pilot/Feasibility Program

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The Pilot Projects Program provides seed funds to stimulate original projects in worker safety and health in the areas of agriculture, forestry, and fishing (AgFF). Projects may include basic/etiologic research, translational research, intervention studies, and/or surveillance. Our primary goal is to provide early pilot/feasibility support to projects that ask innovative/important questions, and which lay the groundwork for subsequent research grant submissions, either to NIOSH or other federal or state funding agencies.

Research Core

1. *Occupational Health and Safety Surveillance of Gulf Seafood Workers*

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Workplace-related illnesses, injuries and deaths are not uncommon for commercial seafood workers, and many of these adverse outcomes are avoidable in this mostly self-employed, uninsured, hardworking workforce that feeds our nation. This surveillance research project will assess the current status of commercial fishery worker safety in the southeastern US, focusing on the coastal Gulf of Mexico workforce in Florida and Alabama. In collaboration with community partners we will develop, validate and implement an in-person questionnaire to discern fishery subsector-specific hazards and adverse outcomes associated with occupational injuries, illnesses and mortalities in the region. Surveillance efforts will support development of culturally-relevant outreach and hazard interventions for Gulf coastal communities to provide meaningful acquisition of safety knowledge and skills, and approaches for self-oversight to reduce occupational injuries, illnesses, and deaths. Project aims include: (1) surveillance to discern occupational hazards and risk factors, history of injuries, and knowledge of co-worker deaths for workers engaged in multiple fishery subsectors along the Gulf coast of Florida and Alabama, and (2) development and assessment of potential intervention(s) to address risk factors associated with specific hazards and negative health outcomes in the different fishery subsectors in the project study region.

2. *Extent of Agricultural Pesticide Applications in Florida Using Best Practices (Years 1 & 2)*

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Although agriculture represents a key industry in Florida, little, recent information is available on the potential exposure for workers from various herbicides and pesticides that are needed to grow commercial food crops. We will develop estimates of the potential site-specific environmental exposures that should be expected, based on geographic extents of specific crops, daily local temperature and precipitation regimes when 'best practices' are applied to the use of important pesticides and herbicides. We will use historical data on state-wide pesticide applications for initial comparisons with the model that uses weather patterns during the growing seasons. Historical distributions of selected crops and temperature

regimes will be derived from high and moderate resolution remotely sensed (RS) imagery and classification algorithms to identify the locations and extents of various crops. Time series analyses of the RS imagery will be used to establish the relationship between modeled phenology and spatial texture and patterns in croplands. We will also use University of Florida agricultural research sites located throughout the state to confirm calibration both of the crop type signatures and the timing and impacts of herbicide/pesticide applications on resulting remotely sensed imagery. In year 2, we will extend the analysis to the present time and incorporate additional crops and pesticides.

3. *PISCA: Pesticide and Heat Stress Education for Latino Farmworkers that is Culturally Appropriate*

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Chronic low-dose exposure to pesticides and extreme heat and humidity are major sources of poor health outcomes among farmworkers, most of whom are immigrants from Mexico. Recent revisions to the EPA's Worker Protection Standard (WPS-r) and growing concern over heat-related illness (HRI) necessitate creation of education curricula that minimize pesticide exposure and the deleterious effects of exposure to heat and humidity. The goal of our project is to reduce pesticide- and heat-related illness among Latino farmworkers. We will achieve this goal through a community-

advocate-university partnership that will: (1) Create reproducible, culturally- and contextually-appropriate curricula for Latino farmworkers targeting pesticide exposure (suitable for meeting employer requirements under WPS-r) and HRI, (2) Determine the effectiveness of the developed pesticide and HRI curricula implemented by professional educators in promoting advocated safety behaviors, and (3) Identify the comparative effectiveness of a *promotora*-based implementation of developed curricula relative to the use of professional educators. Our 5-year project will be undertaken in three phases. Phase one is an intervention with farmworkers (n=125) to determine the effectiveness of WPS-r and HRI curricula that will be developed from existing materials. Phase two uses a randomized attention control placebo design (n=325) to determine if our WPS-r curricula performs better than the EPA's curricula. Phase 3 deploys the curricula to a farmworkers (n=400) exclusively through *promotoras*, and compares behavioral changes to those obtained from professional educators in Phase two.

Iowa

Great Plains Center for Agricultural Health (GPCAH)

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Planning and Evaluation Core

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The Planning and Evaluation Core provides personnel and infrastructure necessary to a) plan, coordinate and monitor Center activities, b) integrate Center expertise across disciplines, c) manage and oversee resources, d) optimize Center advisory personnel, e)

meet required recordkeeping, and f) prepare information needed to meet reporting obligations. Regular interaction (weekly, monthly, quarterly meetings) between the Core, research, and outreach personnel facilitate information sharing, problem identification, and opportunities to leverage resources and expertise to meet the overall mission of the Center. The P&E Core are responsible for maintaining systems of communication with our agricultural stakeholders, including establishing and running conference call meetings, managing updates to the Center web site, coordinating news releases on Center findings and activities, and coordinating investigator-developed media stories pertinent to project findings and persistent hazards faced by the region's agricultural workers. The Core includes a formal Evaluation program, with monthly reporting, assessment of annual benchmarks, and to evaluate progress toward center-wide goals. Center evaluation includes a component on leadership, where all project investigators/staff and regional advisors evaluate the center organization and leadership to recommend opportunities that help the Center achieve its mission. As new and important health and safety hazards emerge over the funding period, the P&E Core will determine the expenditure of funds from an "Emerging Issues" program, using input on hazards and events throughout the region, provided by investigators, advisors and affiliates throughout the Center.

Outreach Core

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The Outreach Core provides coordinated education, translation and communication activities throughout the agricultural sector in the GPCAH region. We aim to provide outreach that focuses on disease, injury, and exposure prevention; serve as a national resource for agricultural health knowledge and expertise for health and safety professionals; and promote agricultural health and safety. The long-term goal of the Outreach Core is to reduce injury and illness among agricultural workers throughout the region by providing a multi-tiered approach to disseminating health and safety information in a way that maximizes adoption by agricultural workers. The short-term goals are to build evidence-based agricultural safety and health competence among farmers and other members of the agricultural sector at large by expanding our educational programming and translating and disseminating research into effective prevention messages and behaviors. We aim to a) increase impact of our national training program in agricultural safety and health through improved access to collaboratively developed content, and curriculum, b) translate scientific findings and experiential narratives into culturally appropriate messages to protect agricultural workers, and c) improve awareness of agricultural injury and illness as a preventable public health burden through a multi-modal communication strategy. The

achievement of these aims will work toward a clear and widely-held understanding that agricultural injuries and fatalities are preventable public health burdens.

Research Core

1. *Instrumented Farm Vehicle Roadway Study*

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Transportation is a leading mechanism for agricultural fatality and injury. Farm equipment crashes, which often involve a vehicle rear-ending or passing the farm equipment, are frequent causes of injury. This project involves two phases in which we will first use novel technology to objectively observe vehicles as they approach farm equipment, and in the second phase will use this information to develop a community-level safety campaign to improve driver behavior when sharing the road with farm equipment. In the first phase we will use SafeTrek, an innovative GPS/video integrated data system developed by our research team to record farm equipment roadway exposure and behavior of vehicle drivers approaching the farm equipment from behind. The aims are to a) measure farm equipment exposure to the roadway (miles travelled, location) and the frequency with which cars approach the farm equipment; and b) 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. In the second phase, we will develop, implement, and evaluate a community-level intervention to increase driver awareness and reduce driving errors in order to protect farm equipment operators. The aims in this phase are to a) 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; and b) measure effectiveness of a community campaign to improve driver behavior when approaching farm equipment on the roadway, using objective data from SafeTrek. The community intervention will use a 2-community design with one intervention and one control community. The intervention will deliver tailored messages through local newspapers, radio stations, businesses, and farm operators. This will be the first study to use vehicle and roadway GPS and video technology for a community-level intervention.

2. *Air Quality Improvements in Livestock Production Buildings*

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Voluntary respirator use among swine industry workers is the state-of-the-art for exposure control from inhalation hazards in commercial swine production. However, rates of voluntary respirator use among swine production workers are low. Few studies are available in the peer-reviewed literature evaluating engineering controls to reduce worker inhalation exposures to aerosols and hazardous gases. Bioaerosols in swine production contribute to exposure burden and disease transmission among both animals and workers. Our preliminary data demonstrate that two engineering technologies can improve the air quality in a small-scale swine farrowing rooms: a recirculating ventilation system with air filtration technology and a gas-fired heating system that vents to the outside. Modifications using proven disinfection technologies (e.g., ultraviolet light [UVC]) within the ductwork of this system may be effective to reduce the burden of disease in both pigs and workers. Our long-term goal is to develop engineering guidelines for the swine industry that will be adopted by builders and swine producers to reduce occupational exposures, thereby reducing lung disease and infection in this working population. We will evaluate engineering system effectiveness to improve air quality in commercial operations, and then optimize bioaerosol control for commercial swine production using filtration and UVC light. Finally, we will evaluate the bioaerosol treatment system on reducing airborne concentrations of bioaerosol in a commercial swine farrowing building. We expect that this work will result in novel engineering solutions to decrease dust, carbon dioxide and bioaerosol concentrations and subsequently agricultural worker exposure in swine production. This contribution is significant because successful demonstration and adoption of an engineering control would demonstrate a paradigm shift from the current approach to control inhalation hazards.

3. *Surveillance of Injuries and Risk Factors in Using Workers' Compensation Data*

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Although it is well-established that agriculture is among the most dangerous industries and occupations worldwide, surveillance of agricultural injuries and their risk factors - a key strategy for prevention - is poorly conducted and wrought with methodologic challenges. The goal of this research is to improve the science of agricultural injury surveillance through a partnership with Nationwide Insurance. This project will analyze agricultural injuries captured in two overlapping datasets: Iowa's Statewide Trauma System and Nationwide's Iowa-based Worker's Compensation program during a ten-year study period (2005-2015). The aims are to a) estimate the incidence of agricultural injury in Iowa reported through two sources: the Iowa Trauma Registry, and Nationwide Insurance's Worker's Compensation program; and b) compare agricultural injuries by severity, type, mechanism and demographics reported by farm operations in the Nationwide database with those reported in the Trauma registry. We will calculate injury incidence in both datasets and compare characteristics of these injuries and the demographics of the injured workers. In addition, we will evaluate a new agricultural hazard surveillance tool to be developed by Nationwide Insurance over the next year. The tool is scheduled to be

implemented longitudinally with a cohort of U.S. farm operations. The specific aim is to evaluate the effectiveness of the Agricultural Hazard Surveillance tool in predicting agricultural injuries reported to Nationwide's program. This project represents a unique academic-industry partnership, and has promise to improve surveillance of both agricultural injuries and risk factors. This study will lead to improved surveillance of agricultural injuries and risk factors.

Kentucky

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Planning and Evaluation Core

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The Planning and Evaluation Core supports the overall functions of the Southeast Center for Agricultural Health and Injury Prevention, which is dedicated to innovative and transdisciplinary approaches to improving agricultural occupational safety and health throughout our 10-state service region: Kentucky, Tennessee, Georgia, Alabama, Virginia, West Virginia, North Carolina, South Carolina, Mississippi, and Florida. The primary aims of the Planning and Evaluation core are to “anchor” the Center’s research and outreach activities in a single harmonious entity. The Evaluation program works with the Planning Core to assess and measure how well the Center is progressing towards its goals, which fully align with NIOSH Agriculture, Forestry, and Fishing (AgFF) priorities for engaging stakeholders; building surveillance capacity; addressing the needs of vulnerable workers/populations at risk. This solid foundation of Planning and Evaluation ensures both the maximization of results (impact) and their fullest possible dissemination. The specific aims of the Planning and Evaluation core are to 1) provide highly visible leadership across diverse Center projects; 2) ensure skilled support for all Center projects; 3) facilitate Center

cohesiveness, effectiveness and reach through an established infrastructure for communication; 4) ensure good stewardship of sponsor awards and other fiscal resources; 5) document, monitor and evaluate the overall effectiveness and impact of the Center in reducing occupational disease and injuries among agricultural workers and their families through its research and outreach cores across the agriculture/forestry and fishing industries and throughout the region; 6) collaborate with other NIOSH-funded Agricultural Centers toward development of a uniform, scientifically rigorous evaluation framework across the Agriculture, Forestry and Fishing Initiative. The core is built upon the expertise and strengths of Center Director David Mannino, MD, Deputy Director Wayne Sanderson, PhD, Evaluation Director, Richard Ingram, DrPH, and a 10-member External Advisory Board of diverse stakeholders and researchers across the AgFF discipline and region. This combination of backgrounds and expertise will ensure good stewardship, accountability and effectiveness.

Outreach Core

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Outreach is the systematic process by which the Southeast Center (SCAHIP) works to maximize communication and collaboration between its faculty and staff and stakeholders in agriculture, forestry, and commercial fishing. Successful Southeast Center outreach has earned the reciprocal interest and trust of stakeholders; that is, their frequent contact of the Center for information, advice, and/or practical tools for enhancing worker safety. This ongoing exchange of information and ideas fosters the timely dissemination of knowledge and the translation of practice to research, research to practice. Stakeholders include farm owners and operators, hired workers, commodity and labor representatives, insurers, equipment dealers, rural health care providers, and fellow researchers in agricultural occupational safety and health. The Specific Aims for Outreach are to : 1.

Develop/enhance a direct outreach network to reach end users via local media outlets (newspapers and radio) and national specialty media (i.e., trade magazines in rural communities across Southeastern United States); 2. Develop and manage the SCAHIP Outreach Network of Partner Organizations by working cooperatively with partner organizations such as the Cooperative Extension Service, trade groups, professional associations, and businesses serving the agricultural workforce to reach end users; 3. Support development of the Next Generation National Ag Safety Database, continue to provide both financial and informational resources to Conceptual Arts, Inc., the technical

provider and web host for NASD; and 4. Develop, administer, and evaluate a “Mini Grant” outreach program to partner with stakeholders to allow them to promote safety among their members and customers. The Outreach Core will be led by Dr. Mark Swanson, Associate Professor and Interim Chair in the Department of Health Behavior at the University of Kentucky’s College of Public Health. He will be assisted by Deputy Outreach Director Dr. Stacy Vincent, who will work with the Cooperative Extension Service and will be the lead contact with Conceptual Arts, Inc., the web producers for the National Ag Safety Database.

Research Core

1. *Preventing Farm Injury and Fatalities to At-Risk Youth in Rural Communities in the Southeast: A CROPS Intervention for Behavioral Change*

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The purpose of this intervention research is to reduce the exposure to tractor overturn hazard in nine southeastern states in the Appalachian and Mississippi Delta regions by expanding regional and national access to a previously piloted CROPS Tractor Overturn Hazard Reduction and Injury Prevention Program in high school agricultural education classes. The intervention will strategically target Agricultural Education programs in areas of the Southeast & Delta regions to expand the cadre of agricultural education teachers and students trained in the use of an integrated safety curriculum that includes CROPS installation procedures. Over a five-year period, 75 agriculture mechanics teachers, from these states, will engage in professional development that will prepare them to involve students in a modernized and interactive curriculum that immerses students in farm safety practices, community development, empowerment, and experiential learning. As a result of this process, approximately 1,500 students will engage in the two-week classroom curriculum followed by a two-week hands-on laboratory exercise of constructing and installing a CROPS on the tractors of farmers in their home communities. Each school selected will be located in the Appalachian or Delta regions of the United States notable for high poverty, dangerous topography and smaller family farming operations. Regardless of size these types of operations continue to account for a high number of tractor overturns and farm injuries and fatalities. The CROPS Curriculum intervention will continue and expand the impact of learned behavior and offset the Apprenticeship of Observation theory in four key ways: (1) expand the cadre of trained pre-career professionals to include Agricultural Education programs throughout the Southeast, (2) engage youth in a community inclusive experiential learning piece, (3) construction and installation of ROPS that follow a NIOSH

approved plan to code, and (4) a social media campaign that determines the overall impact at the youth and adult level.

2. *Training Program for Occupational Safety and Health in Agriculture across the Southeast Region: A Multi-University and State Agency Collaboration*

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Despite increased efforts over the past 25 years, the Agriculture, Forestry, and Fishing (AFF) industry remains the most hazardous industry sector in the U.S. with a higher rate of injuries and fatalities than any other sector. A number of interventions have been attempted, with relatively limited success. It has been shown that healthcare professionals and professionals in other agricultural disciplines are able to influence the work practices of farmers and agricultural workers, however few people in these professions have been trained in agricultural health and safety. Efforts to build capacity in increasing the number of trained professionals in agriculture health and safety and shown significant success, particularly in the Midwest. The long range goal of this education/translation project through the Southeast Center for Agricultural Health and Injury Prevention (SCAHIP) is to provide the essential education required to address the critical shortage of agricultural occupational health and safety professionals, particularly in the Southeast. The aim is not only to produce well informed practitioners, but leaders and researchers for the next generation of agricultural safety and health (ASH) specialists.

We propose three Specific Aims to build this capacity:

1. Provide in-class training in short, one-week (40 contact hour) courses provided in partnership with colleges and universities in the Southeastern part of the U.S. We will provide this training at institutions with training programs for healthcare providers, public health professionals, or agriculture production.
2. Develop on-line distance delivery of our in-class training program to ensure broader dissemination of our training program. While our focus is the Southeast region, this course can be provided in collaboration with other Ag Centers across the U.S.
3. Using the topic materials developed for the in-class and on-line courses provide continuing education training in a modular format on specific health and safety topics. These topic modules may be delivered via in-class or on-line format.

3. *Timber Safe - Reduction of West Virginia Logging Hazards through the Implementation of a Logging Operations Safety and Health Management System*

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This project proposes to address uncontrolled hazards on logging sites through a company-wide organizational intervention approach that will include training, implementation, assessments, regular audits, feedback reports for identifying hazards, as well as accountability and assistance measures for correcting uncontrolled hazards. We propose to implement a logging safety management program based on the Fall-Safe program, an evidence-based construction safety management program that will enhance current safety and health management systems in logging and improve the data collection and monitoring capabilities of logging companies, which will help increase the safety of their operations and reduce injuries. Specifically, we will develop, implement and evaluate a program to improve the safety and health management systems in logging operations in West Virginia. The program will be implemented with 30 small, mostly family-owned logging companies in the state. The control group will receive all elements of the program required to implement on their own and the intervention group will receive all aspects of the program as well as an intense intervention including the support of an independent third party university to provide training and assistance with implementation and verification of implementation in the field through regular audits, feedback, corrective actions and ongoing support. The intense intervention will include a training component through which we will educate owners, operators and employees on safety and health management best practices and the importance of implementing all aspects of a safety and health management system. We will equip the intense intervention group to implement the program in the workplace. This program will also include the development and implementation of an innovative mobile phone application for use by the participating companies and the field researchers for the collection of work site hazard and safety management implementation data. The use of the mobile application ensures accountability of participating companies, provides consistent data collection and builds a foundation to expand the program to other states and regions through the use of technology.

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Planning and Evaluation Core

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The Upper Midwest Agricultural Safety and Health Center (UMASH) Planning and Evaluation Core coordinates the diverse research, education and outreach components of the center such that the activities of experts working in their own areas benefit the work of all. Each project within the center has its own specific aims and objectives. The role of the Planning and Evaluation Core is to facilitate and evaluate the combined center functions to create the greatest possible impact. The evaluation program has the added advantage of being a feedback loop for a continuous strategic planning process. The overall goal of the Planning Program is to coordinate the activities of UMASH center to most effectively use the resources available to the center.

The Aims of the Planning Program are as follows:

- Facilitate communication and collaboration between the UMASH partners and external stakeholders,
- Implement UMASH Strategic Plan through the Outreach, Emerging Issues, and Evaluation programs.
- Enhance collaboration with other NIOSH funded centers.

- Ensure appropriate management of center resources, activities, budgets, records, and reports.

The overall goal of the Evaluation Program is to provide the evidence necessary to determine achievement of program outputs and desired short-, intermediate, and long-term outcomes and impactful contributions to the center goals. The Aims of the Evaluation Program are as follows:

- To collaborate with Center Administration and relevant Center staff to plan, design, coordinate, implement, and evaluate key Centerwide work and related outcomes.
- To collaborate, contribute, and interact with other Agriculture Centers and NIOSH to develop and share evaluation best practices and to define and operationalize common, standardized process and outcome evaluation metrics that effectively and efficiently demonstrate the impact of the NIOSH Agricultural Center program.

Outreach Core

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The Outreach Program of the Upper Midwest Agricultural Safety and Health Center (UMASH) is designed to improve the health and well-being of agricultural worker populations in the upper Midwest by translating best practices research and interventions to workers through communication channels that are relevant and resonate with workers, managers, and producers.

The overarching goal of the Outreach Program is to **increase the awareness of occupational safety and health among agriculture workers and their families, and becoming widely known as a resource for promoting safety and health in agriculture occupations.** To reach that goal, UMASH faculty and staff will **leverage our local, regional and national partnerships and collaborations**, widely **share expert knowledge, assist educational systems and programs with research to practice content** for curriculum and professional development, **leverage current UMASH communications channels to increase the reach and access by stakeholders** of UMASH science and resources and **augment science-based prevention messages with first-person narrative to be disseminated via appropriate channels directly to farmers and farm workers, as well as to our media partners** based on local and regional agricultural injury and illness data through a working group of members from the three co-located Centers of Excellence that will be sculpted for media utilization and made available through social media.

The program is innovative because it provides flexible, online, and timely education and outreach materials to employers and managers within the agriculture community and

industry. All outreach and educational materials will be freely available on the UMASH website and will be disseminated through stakeholder event participation and networking, a regularly published newsletter, strategic emails, social media and print materials ensuring that the UMASH Outreach Core Program has a regional, national, and global reach.

Research Core

1. *Optimizing Assessment of Virus-Containing Particles in Animal Agriculture*

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Those working in animal agriculture are at risk of airborne exposure to infectious viruses, such as zoonotic influenza viruses. Conventional wisdom suggests that most transmission of infectious viruses occurs by droplet transmission. However, recent research indicates that at least some viruses can be transmitted by the airborne route. To assess exposures to viral aerosols and manage them effectively, we must know the concentrations and sizes of particles with which infectious airborne viruses are associated. Remarkably, only a few studies have investigated airborne levels of viral RNA as a function of particle diameter, and almost no measurements exist of the sizes of particles that contain infectious viruses. Our prior research indicates that large volumes of air must be sampled for sufficient live virus to be recovered in workplaces for detection and quantification, and that sampling methods (filters, impingers, impactors, cyclones, electrostatic precipitators) have different strengths and weaknesses. Therefore, the objectives of the proposed research are to develop a high-volume, field-portable, size-differentiating viral aerosol sampler and to use it to measure worker exposures to live airborne influenza viruses in animal agriculture facilities.

The first step to accomplishing these objectives is to comprehensively evaluate existing sampling approaches. We will test an array of samplers side-by-side to determine the optimal combination of sampler properties for airborne viruses in animal agriculture. Using the results from these comparisons, we will design and build an improved sampler for measuring concentrations, sizes, and infectivity of virus-containing particles. We will utilize computational fluid dynamics to design the sampler. Size-dependent particle sampling efficiency will be established in laboratory tests. We will compare the newly-fabricated improved sampler to existing samplers to verify that the improved sampler recovers live virus more effectively than the others. Finally, we will demonstrate the utility of the new sampler by measuring virus-containing particle concentrations, sizes, and infectivity in animal agriculture facilities. These tests will demonstrate how data from the new sampler will be used to assess and manage risks of airborne virus transmission in animal agriculture workplaces.

2. *Rural Firefighters Delivering Agricultural Safety and Health (RF-DASH)*

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The overall goal of this line of intervention research is to improve the access of farms to capable health and safety consultation in order to reduce farm hazards and improve farm safety. The Rural Firefighters Delivering Agricultural Safety and Health (RFDASH) project will leverage the esteemed and influential position held by rural fire departments and test the benefit of expanding their repertoire to farm-specific first aid and farm safety advice and consultation. We will explore the feasibility and efficacy of equipping rural emergency responders with farm-specific first aid curriculum, safety consultation capabilities, and farm hazard mapping strategies to assist in emergency responses to farms. We will also provide rural fire departments with digital tools to help train and guide them in the conduct of farm safety consultations. This project will test the RFDASH model to fill a gap in service by cross training rural fire departments in agricultural health and safety. We will enlist local academic institutions and insurance companies in the development and support of programs to sustain this cross trained workforce.

The following specific aims will be achieved over a five-year period:

- Modify existing curricula to instruct rural emergency responders to effectively disseminate agricultural health and safety knowledge. The proposed curricula will enable firefighters to: 1) Instruct farmers, farm families, and farm workers in Farm First Aid in order to raise injury awareness and disseminate prevention strategies, 2) Perform agricultural safety consultations for farmers with the assistance of the Farm/Agriculture/Rural Management – Hazard Analysis Tool (FARM-Hazard Analysis Tool) in order to increase the number of competent agricultural safety consultants and 3) Utilize Farm Mapping to Assist, Protect and Prepare Emergency Responders (Farm-MAPPER) in order to prevent injuries to firefighters during farm emergencies and expedite response times.
- Utilize social network analysis and anthropologic data to describe and efficiently navigate the existing network of agricultural health and safety experts, fire training institutions, firefighters, insurance companies, and farmers.
- Develop guidelines and technical assistance resources in order to promote sustainability, update curricula, and enable replication of the RFDASH model in new regions.

3. *Longitudinal Study of Infectious Disease Risks at the Human-Swine Interface*

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The importance of the human-animal interface as a source of emerging infectious diseases is universally recognized. People having regular animal contact are at the front line for exposure to known and emerging pathogens, and veterinarians provide a unique window into occupational risks for emerging zoonotic diseases. A 5-year longitudinal cohort study of US swine veterinarians will be conducted to understand the exposure and health risks attributable to pig exposure for three important emerging zoonotic pathogens that are endemic in the US swine industry: 1) Livestock associated *S. aureus* (including MRSA and multidrug resistant *S. aureus*); 2) Influenza A viruses; 3) Hepatitis E virus. A control group of companion animal veterinarians without contact with swine will be included for comparison of exposure and health risks, and to enable calculation of risks attributable to swine exposure. The specific aims are 1) Determine the relative risk of MRSA and multiple drug-resistant *S. aureus* (MDRSA) exposure, and associated health events, in swine veterinarians and companion animal veterinarians; 2) Determine relative risks for influenza A virus (IAV) exposure and disease in swine veterinarians and a control population, and estimate the relative likelihoods of bidirectional transmission events; 3) Estimate the risk of Hepatitis E (HEV) exposure and seroconversion in swine veterinarians. The study includes routine quarterly sampling to assess exposure, and opportunistic sampling associated with n relevant health events occurring during the study. The *S. aureus* component focuses on health risks in the subset of subjects that become permanently colonized with swine-origin *S. aureus*, and includes assessment of trends in antibiotic resistance following regulatory changes in antibiotic use in the swine industry. The IAV component is directed at furthering understanding the relative importance of human-to-pig and pig-to-human transmission to the overall epidemiology of influenza at the pig-human interface. The HEV study is directed at assessing short-term and longer term trends in occupational risk of HEV exposure and infection in swine industry workers.

4. *Surveillance of Zoonotic Diseases in Agricultural Workers in Minnesota*

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Previous work by the Minnesota Department of Health (MDH), through UMASH, has demonstrated that occupational zoonotic infections associated with animal agriculture comprise a much larger disease burden than previously estimated. The objective of the proposed work is to reduce the occurrence of zoonotic diseases related to occupational exposures among agricultural workers, their families, and others exposed to animal agriculture settings. Specific aims are to: 1) continue to prospectively collect systematic, detailed data on animal agricultural exposures in people with zoonotic diseases statewide - this will provide more robust data to

characterize affected populations, estimate the burden of disease, and conduct trend analyses; 2) use prospective data to conduct case-case comparison analytic studies to identify specific risk factors for the acquisition of the most important zoonotic pathogens (i.e., *Campylobacter*, *Salmonella*, *Cryptosporidium parvum*, and Shiga toxin-producing *E. coli*), and preventive measures to minimize risk for infection; 3) collaborate with neighboring states (e.g., North Dakota, South Dakota, Wisconsin, Iowa, and Nebraska) to estimate the burden of zoonotic diseases in agricultural workers regionally, which would represent a large proportion of animal agriculture in the U.S.; 4) collaborate with Dr. Peter Davies at the University of Minnesota to determine whether *S. aureus* strains known to colonize pigs are causing clinical infections in humans, which is currently unknown in the United States; and, 5) continue to detect, respond to, and characterize emerging zoonoses related to animal agriculture through enhanced surveillance for unexplained critical illnesses and deaths of infectious etiology, enhanced testing of enteric disease outbreaks of undetermined etiology, and other mechanisms to detect and respond to emerging disease issues. MDH will continue to rely on and grow relationships with partners in animal agriculture industries, the Minnesota Board of Animal Health, the Minnesota Department of Agriculture, and academia. These relationships are the key to a coordinated, effective response to emerging issues involving both animal health and human health, as well as to the development, implementation, and success of prevention programs aimed at minimizing risk.

Nebraska

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Planning and Evaluation Core

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The Central States Center for Agricultural Safety and Health (CS-CASH) Planning and Evaluation Core has three independent programs with separate leaders and budgets: Administration and Planning Program, Evaluation Program, and Emerging Issues Program. The Administration and Planning Program (APP), described here, provides planning, oversight, leadership, and management, as well as centralized services to all Cores, projects, programs, and investigators in the Center. APP engages the External Advisory Committee in the strategic planning of the Center's research and outreach. APP leads the Center's public relations, communication with stakeholders, scientific meetings, and engagement of the agricultural community in the Center's region. APP provides the administrative structure for day-to-day management, planning, budgeting, IRB compliance, and other essential functions.

Evaluation is a critical function to ensure that the Center a) has effective leadership, b) achieves identified goals, c) becomes a valuable resource to the regional agricultural community, and d) reduces the burden of agricultural injury and illness in the region. The Evaluation Program will make a contribution to the national NIOSH Agricultural Centers evaluation efforts and will disseminate findings in scholarly venues including publication and national presentations.

Outreach Core

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The Central States Center for Agricultural Safety and Health (CS-CASH) aims to promote evidence-based interventions that can be effectively adopted and sustained in agriculture across the region and the nation, thereby contributing to long-term improvements in agricultural worker health. To accomplish this goal, the Center will implement a coordinated outreach strategy directed at two primary audiences a) agricultural producers, with a focus on women and military veteran farmers and b) agricultural, health, and safety professionals. The Program will be strengthened and broadened by working in partnership with members of the AgriSafe Network, USDA Extension, National Agricultural Safety Database, Farm Bureau, Brownfield Broadcasting, Women in Agriculture Organizations, Veteran Farmer Organizations, CHS, agri-insurance agencies, news organizations and other NIOSH funded Agricultural Centers. All Center projects are developed to contribute to the outreach effort by producing and disseminating new information relevant to their specific fields of study.

Research Core

1. *Pilot/Feasibility Program*

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The long-term goal of this program is to support pilot and feasibility projects that lead to independent research projects concerning agricultural safety and health, with particular attention to critical issues. The objective of this program is to support a series of well-constructed pilot and/or feasibility studies concerned with important issues in agricultural safety and health. The aims of this program proposal are to: 1) Select and fund at least three 18-month pilot/feasibility projects each year; 2) Evaluate the results of each pilot/feasibility project; and 3) Monitor the effectiveness of converting pilot/feasibility projects into funded grants.

2. *Agricultural Dust-Induced Airway Injury and Repair: An IL-10 Centered Approach*

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This project will help identify mechanisms, biomarkers, human genetic polymorphisms, and potential therapeutic targets important in the repair and recovery response to agriculture organic dust mediated lung injury that can be later translated

to agriculture-exposed human cohorts to ultimately reduce disease burden. In Aim 1, we will characterize the role of IL-10 in governing the post-inflammatory homeostasis repair and recovery response in an animal model of agriculture organic dust-induced airway injury. In Aim 2, we will identify the mechanisms of scavenger receptor A (CD204) in regulating the IL-10 response to agricultural dust using in vitro cell models and in vivo animal models. In Aim 3, we will determine the relationships between systemic IL-10 levels, IL-10 pathway genetic polymorphisms, and pro-inflammatory cytokine hyper-responsiveness in persons with prior agricultural exposure.

3. *Enhancing the Health and Safety of Range Bison Herd Workers*

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We aim to reduce bison herd worker injury incident rates and hazard scores by one-third in participating tribal herds. Results from this work will assist bison producers, both tribal and non-tribal, in implementing best management practices and employing effective training to enhance bison worker safety. The main goal of this project is to improve the health and safety of range bison herd workers. Building on our preliminary work, we propose to investigate injuries, working conditions, and animal handling practices, comparing the situation in tribal and non-tribal operations. Based on the findings, we will develop and implement a multi-faceted intervention including guidance on best practices in bison handling, safety assessment of bison handling facilities, and training of bison herd workers. Using evaluation findings, we aim to disseminate the updated intervention broadly to tribal communities with bison herds. Our overall hypothesis is that the risk of injury in bison handling on tribal property can be mitigated by employing best practices, facility improvements, and training.

4. *Health and Safety Risks Among Immigrant Cattle Feedlot Workers in the Central States Region*

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This project addresses several areas of central importance to agricultural safety and health including surveillance; vulnerable workers; outreach, communications, and partnerships; and agricultural health (NORA AFF Goals: 1, 2, 3, and 5). Specifically, this project seeks to address Latino immigrant cattle feedlot workers within the rural Midwest making it uniquely relevant to the continued viability and economic stability of the agricultural workforce. This project seeks to better understand Latino immigrant cattle feedlot worker health and safety in two top cattle producing states, Nebraska and Kansas, through interviewing 256 workers. We propose a new Ecological Stress-based Model of Immigrant Health and Safety and will test the

model's properties with the information that is collected from the workers. Finally, we plan to develop, evaluate, and disseminate culturally and linguistically, industry-specific health and safety information for cattle feedlot workers.

5. *Surveillance of Agricultural Injury and Illness in the Central States Region*

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This project will enhance our ongoing model for injury surveillance and extend it to include alternative surveillance methods. Our approach fills gaps in existing surveillance and contributes to reaching the NORA Strategic Goal 1: to “Improve surveillance within the Agriculture, Forestry, and Fishing (AgFF) Sector to describe: the nature, extent, and economic burden of occupational illnesses, injuries, and fatalities; occupational health hazards; and worker populations at risk for adverse health outcomes”. The Specific Aims of this project are to: Aim 1: Conduct annual surveys of agricultural injuries in the Central States region, linked with existing data on farm production and operator characteristics from the Census of Agriculture. We aim to augment current mail surveys with calls to non-respondents to improve data quality and to reduce biases; Aim 2: Explore alternative surveillance methods for injuries and illnesses, including analyses of ‘big data’ from existing administrative databases, automated online surveys, and media tracking services, thus expanding the evidence base for prevention.

New York

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The Northeast Center for Occupational Health and Safety in Agriculture, Forestry, and Fishing (NEC) will address two overarching goals in the next five-year Center funding cycle: 1) continue to reduce agriculture, forestry, and fishing (AFF) work-related injuries and illnesses and improve AFF worker conditions; and 2) further advance the field of occupational safety and (OSH) research through novel approaches to mobilizing partners,

communicating with workers, incorporating user-friendly technologies, promoting worker adoption, and catalyzing community change agents. To ensure that program investments effectively address worker health outcomes (Impact), the NEC has systematically identified the most prominent sources of injury and fatality (Burden) and determined research and dissemination gaps that are precluding progress (Need).

Outreach Core

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The NEC Outreach Program has been designed to maximize the translation of NEC and AFF OSH research and programs into the workplace, so that evidence-based OSH solutions have a substantive impact on worker health and safety. To facilitate this process, a number of activities have been proposed. One of these Outreach activities includes the development of a Northeast Agricultural Safety Trainers Coalition. These trainers will meet annually, to discuss new and innovative training methods, participate in training demonstrations and identify / practice improved methods of worker safety training delivery. In addition to improving training approaches, the Outreach Program will focus on providing face-to-face, hands-on AFF worker training opportunities and will incorporate training best practices identified by Northeast trainers. The NEC will also expand programs that have proven to be popular and effective with AFF communities. These trainings will include: 'Safety at Sea', 'Game of Logging' and farm safety trainings on a number of priority health and safety topics for Northeast farmers. An NEC marketing plan has also been developed and will include a mix of marketing efforts to increase the reach and repetition of NEC and AFF OSH messaging. These will include paid advertising; stakeholder outreach; tailored materials; outreach events; print, radio and TV journalism and branding. Key performance indicators will also be used to assess the success of outreach and promotional efforts. These will include Center program recognition, the # of NEC contacts/ inquiries and worker participation in training and events. Surveys will also be used to measure the costs/benefits of various promotions activities.

Pilot/Feasibility Program

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The goals of the NEC Pilot/Feasibility Program will be to: 1) expand NEC research networks and 2) advance the field of injury R2P by exploring innovative ways of addressing AFF priorities. The NEC will inform these efforts by identifying barriers to progress, expanding researcher networks, gathering and identifying promising proposals, tracking progress and documenting outcomes.

Research Core

1. *Improving Methods for Traumatic Injury Surveillance in Agriculture, Forestry and Fishing*

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This study seeks to establish low-cost injury surveillance methods for the agricultural, forestry and commercial fishing industries in the Northeast. This will enhance understanding of the causes of traumatic injuries, identify high risk groups, and allow for ongoing program evaluation. If successful, similar methods can be employed to capture data in other areas of the country. To achieve the overarching aims of this proposal, researchers will optimize narrative keyword searches, investigate state and regional trauma databanks, and explore the utility of ICD10 E-Codes for AgFF surveillance. Lastly, the study will collect injury data using a survey designed by the Central States Center for Agricultural Safety and Health (CS-CASH), which will permit regional comparisons of injury data.

2. *Assessing Overall Health and Improving Injury Surveillance of Maine Logging Workers*

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This research project will address a number of priorities that are outlined in the NIOSH National Occupational Research Agenda. These include improvements in injury surveillance within the forestry sector and the reduction of logging-related

deaths, traumatic injuries, and exposures through the collection and analysis of injury data and evidence-based safety improvements. In addition, data gathered on health conditions and musculoskeletal disorders in the Northeast logging worker community will be important for identifying factors leading to chronic disease and premature disability.

3. *Participatory Ergonomics for the Lobster Industry*

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The lobstering industry is a large segment of the fishing industry in the Northeast United States. Lobstermen have been documented with rates of injuries higher than the general industry average and high percentages of crew suffering musculoskeletal disorders. Ergonomic exposures that contribute to these outcomes have also been identified, as well as sporadic instances of individual crews taking action to reduce the risk of such outcomes. However, preventive measures have not been systematic, broad-based, or organized. There is no regulatory oversight, nor any infrastructure dedicated to examining how to reduce ergonomic exposures for this occupational group. A participatory action research model will be utilized in this project to train lobstermen in ergonomics. Lobstermen will also be trained to systematically recognize, evaluate, and control ergonomic risks that are both present on their boat, but also likely to be present in many other boats. As these ideas are systematically implemented and evaluated, a network for intervention will be formed and support for industry development and risk reduction demonstrated.

4. *Using Influence Strategies to Increase the Efficacy of the NY PTO Shielding Intervention*

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The goal of this study is to gain a better understanding for how agricultural workers and business owners may be persuaded to adopt best-practices that they have been previously resistant to put into practice. Previous studies indicate farmers are aware of entanglement dangers, but lack the appropriate motivation to replace missing or broken shields. The objective of this application is to build on previous intervention development efforts to facilitate a 20% increase in NY PTO shield sales by the end of the study. This will be accomplished by implementing influence strategies in six distinct agricultural communities. These influence strategies will be evaluated by measuring changes in opinion (as outlined in Kelman's 'Processes of Opinion Change') and changes in PTO sales. Changes in PTO shield sales will also be

monitored via shield sales conducted through the Northeast Center and NY equipment dealers.

5. *Acceptance and Use of Mobile Apps for Commercial Fishing Safety (Years 1-3)*

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The proposed project will field test a novel intervention using smartphone technology to improve safety in the commercial fishing industry, one of the most dangerous industries in the United States. Vessel disasters and falls overboard are the largest hazards in commercial fishing. Preventing vessel instability and having a crew trained in how to respond during emergencies are essential to maintaining safety at sea. Two mobile apps have been developed to address these concerns. The Small Craft Motion Program (SCraMP) app provides real-time vessel motion monitoring data, giving the captain early warning of vessel instability and allowing corrective actions to be taken before capsizing occurs. The Fishing Vessel Drills (FVdrills) app is designed to facilitate conducting safety drills by providing drill checklists, dynamic drill scenarios, electronic logs, and reminders. While these apps hold enormous potential, they will only improve safety if they are accepted and used by fishing vessel operators. Trials assessing app usage and value in the field under typical commercial fishing operations are needed. The purpose of this project is to field test the SCraMP and FVdrills apps to determine their acceptability and utility among commercial fishing vessel operators, and to determine the impact of these apps on monitoring vessel stability and conducting safety drills. If these apps are accepted and used by commercial fishing vessel operators and are found to improve safety practices, there is potential to substantially reduce injuries related to vessel disasters and falls overboard. The knowledge generated by this study will guide further refinement of the apps to increase their acceptability and utility among commercial fishing vessel operators, if necessary, or allow targeting of the apps to the operators most likely to benefit from using them. The long-term goal of this work is to ensure that affordable, innovative, evidence-based safety interventions are available to address the major causes of vessel disasters and fatalities in the commercial fishing industry.

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CDC/NIOSH Cooperative Agreement 2 U54 OH007541-16

Planning and Evaluation Core

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The long term goal of the Planning and Evaluation (P&E) Core is to support the Center's ability to attain workplace improvements in agricultural, forestry and fishing (AFF) safety and health in U.S. Public Health Region 6. In order to attain this goal, the objectives of the P&E Core are to: provide Center-wide administration, planning, coordination and oversight; identify and respond to emerging issues; and implement an evaluation program. The P&E Core objectives are supported by two decades of experience, continuity of leadership and dedicated Internal and External Advisory Committees. The SW Ag Center's management team has adopted the theme: **Building strategic partnerships to improve the health and safety of diverse AFF populations** because it reflects the essence of historical success and reinforces an approach that can improve the safety and health of the regional agricultural workforce. Coordination and integration of Center research and outreach will facilitate the translation of research findings into prevention practices and products that are ready for implementation within AFF industries.

The P&E Core specific aims are to (1) support the ability of the Center cores and projects to function and achieve their objectives; (2) identify, characterize and prioritize the emerging AFF issues in the region; and (3) determine the efficacy of the SW Ag Center in achieving its goals, utilizing stakeholder input, addressing emerging issues, conducting research, and integrating outreach activities. These aims will be accomplished through regular interaction of staff, advisors and PIs to facilitate integration of work in order to recognize and respond to opportunities. The proposed strategies for the P&E Core reinforce the Center's ability to not only plan, conduct, and evaluate Center activities, but also integrate research and

outreach efforts. The Internal Advisory Committee (IAC) and External Advisory Committee (EAC) assist the Director in achieving the Center's goals.

Outreach Core

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A critical need exists for occupational safety and health resources and outreach programs that are culturally, linguistically, educationally and socially acceptable for AFF workers. In addition, those resources require evidence-based strategies for dissemination and workplace intervention. In order to address this critical need, the Outreach Core within the SW Ag Center will engage partners and their respective networks to design, develop and disseminate outputs that positively impact AFF workers.

The specific aims of the Outreach Core are to (1) expand the network of strategic partners; (2) create and disseminate communication products and education/training materials; and (3) conduct prevention activities to promote safe and healthy work behaviors. The network will be expanded through conference participation, meetings, and exhibits. Communication products will include a quarterly newsletter and monthly safety articles. Education/training materials and prevention activities will target areas of regional relevance including: heat related illness, bites and stings, pesticides, tractors and machinery, livestock, and agricultural medicine. However, the outreach plan will remain flexible enough to respond to emerging issues identified through the Planning and Evaluation Core. Google Alerts will be collected and a needs assessment will be performed within the Outreach Core to further inform emerging and persistent issues. Capacity building will be woven into outreach, specifically through agricultural safety and health internships and mini grants. Staff will work closely with PIs to help foster productive and collaborative relationships with target audiences and translate research findings into outreach products. The Center's outreach program will continue to collaborate with other NIOSH funded ag centers through multiple working groups that leverage resources and promote efficiencies.

Pilot/Feasibility Program

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The long-term goals of the Pilot/Feasibility Studies (PFS) Program are to foster critical research inquiry among scholars to characterize and estimate injuries and exposures to address workplace improvements and safety outcomes in AFF in Public Health Region 6. The objectives of the PFS Program are to provide administrative oversight of research and mentoring efforts, coordinate marketing and recruiting for the program, and to identify opportunities for collaboration among interested stakeholders and scholars. The Center is positioned to respond to high priority and emerging issues of regional importance. Through its Planning and Evaluation Core and Internal/External Advisory Committees (IAC/EAC), the Center has the expertise and strategic partners to contribute to the demographic characterization of the dynamic AFF workforce and articulate changes in each industry of the AFF sector.

The PFS Program aims to (1) identify researchers to conduct small-scale, short-term innovative research (translational, etiologic, intervention or surveillance) projects in AFF occupational safety and health that address National Occupational Research Agenda goals and SW Ag Center Strategic Goals; (2) support innovative, small-scale, short-term research projects in AFF occupational safety and health that have the likelihood of garnering additional funding through the submission of longer-term comprehensive projects; (3) establish and foster mentoring relationships between early stage investigators and established scientists to build capacity of AFF occupational safety and health researchers; and (4) employ innovative surveillance techniques to identify trends, emerging issues, and potential partners for the SW Ag Center to engage in investigative projects.

Research Core

1. *Physical Exposures and Musculoskeletal Symptoms Among Logging Machine Operators*

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Logging machines may expose workers to risk factors associated with the development of work-related musculoskeletal disorders (MSDs), which include whole-body vibration (WBV), static and awkward postures, and repetitive hand and feet movements. Literature regarding ergonomic investigations of WBV, postures, and repetitive movements among logging machine operators (LMOs) is limited, as no studies have measured these exposures simultaneously using direct instrumentation. A more comprehensive understanding of the interactions between these physical risk factors will help guide the development of intervention strategies to decrease the incidence of work-related MSDs among LMOs.

The primary objective of this project is to provide new information about associations between exposure to physical risk factors and musculoskeletal symptoms (MSS) among LMOs. In prospective fashion, we will assess musculoskeletal symptom status more frequently than in previous studies. In addition, we will use direct measurement methods to estimate exposure during logging machine operation. We will address the following specific aims: (1) characterize low back, neck/shoulder,

and distal upper extremity MSS among LMOs; (2) characterize exposure to physical risk factors for low back, neck/shoulder, and distal upper extremity MSS among LMOs; and (3) estimate associations between physical risk factors and low back, neck/shoulder, and upper extremity MSS among LMOs.

Combining prospective observation with directly measured physical exposures will enable a more precise estimation of the associations between physical risk factors and MSS than are currently available. To our knowledge, no other study has simultaneously measured multiple physical exposures using direct measurement technologies among LMOs.

2. *Poultry Dust Exposure and Lung Inflammation*

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Exposure to concentrated animal feeding operations (CAFO) dust is a risk factor for respiratory symptoms and lung diseases. Poultry workers experience a higher incidence and severity of respiratory symptoms and lung diseases compared to other agricultural workers. Despite the rapid growth of the poultry industry and its impact on worker health in the United States, there is insufficient information on the effects of poultry dust exposure on the pathogenesis of lung diseases. Chronic exposure to organic dusts is associated with bronchitis, hypersensitivity pneumonitis, occupational asthma, and others. Lung inflammation is an essential component of these diseases, and lung epithelium is a key player in the modulation of inflammatory responses. Thus, a better understanding of molecular mechanisms underlying lung inflammatory responses is essential to develop new strategies for the treatment of lung diseases in agricultural workers.

Our studies have revealed that protease activities in poultry dust and increased intracellular oxidant production control induction of lung inflammatory gene expression. On the basis of our studies, we hypothesize that poultry dust modulates protease activated receptors and intracellular oxidant generation to activate protein kinase signaling pathways and AP-1, NFκB and Stat3 transcription factors to induce lung inflammation. We will use Beas2B bronchial epithelial cells and knockout mouse models to investigate control of poultry dust induced lung inflammation.

The project's specific aims are to (1) determine mechanisms by which protease activities in poultry dust and protease activated receptors (PARs)-1 and -2 induce lung inflammation; (2) determine if STAT3 activation mediates poultry dust induction of inflammatory gene expression and lung inflammation; (3a) determine the role of oxidants in poultry dust induction of inflammatory gene expression and lung inflammation; and (3b) determine the role of mitochondrial impairment in lung inflammation. The project is expected to provide new information on the involvement of cellular signaling pathways and intracellular oxidants in the control of poultry dust induced lung inflammation that could be useful for the development of new treatments for occupational lung diseases in agricultural workers.

3. *Occupational Exposures of Tree Planters in the Forestry Services Sector (Years 1 & 2)*

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Forestry and logging, as occupations, have an unacceptably high rate of fatalities and non-fatal injuries. The forestry and logging sector represents a significant contribution to the economies of Texas, Louisiana and Arkansas and a number of other states throughout the southern U.S. Developing sound solutions to occupational safety and health issues requires an accurate characterization and estimate of injuries and exposures in the AFF sector throughout the region.

The primary objective of this project is to provide an evidence base for a research program that focuses on the occupational health and safety outcomes of tree planters in the forestry services sector. Using a participatory approach, this project will commence with an assessment of work place risks and exposures, using both direct measures and self-report with both manual and machine tree planters.

Through in-depth interviews, an industrial hygiene exposure assessment and an ergonomics risk assessment, we will address three specific aims: (1) delineate health and safety risk factors associated with tree planting; (2) develop a draft of an exposure assessment instrument for use with tree planters; and (3) establish the feasibility of collecting quantitative data from forestry services workers on their occupational health risk factors, health outcomes and mobile device usage.

4. *Reducing Pesticide Exposure Among Latino Adolescents through Promotora-Based Interventions*

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Adolescent Latino farmworkers come into contact with agricultural pesticides through occupational exposure. In recent data collected by our team, our adolescents had elevated concentrations of 3PBA, roughly in the 90th percentile for 12-19 year olds in the nation. Prior work has clearly illustrated the value of La Familia Sana, a promotora-based intervention in improving knowledge and understanding of how to reduce paraoccupational exposure in the home. However, it remains unclear whether this evidence-based intervention is capable of producing changes in safety behaviors among adolescent Latino farmworkers.

The overall goal of this study is to determine the effectiveness of a promotora-based intervention in protecting adolescents from exposure to pesticides. This project implements and evaluates a promotora-based intervention targeted at adolescent farm workers. The intervention will be delivered to three different treatment groups: 1) adolescent only, adolescents receive the adapted adolescent version of La Familia Sana program, 2) mother only, adolescent's mother receives the La Familia Sana program, and 3) family enhanced, adolescent and mother both receive the La

Familia Sana program. The specific aims for this project will (1) determine if a promotora-based intervention targeting pesticide safety in the workplace is effective in increasing knowledge about safety behaviors among 225 Latino adolescents (aged 12 to 18) engaged in farm work; (2) delineate variation by treatment group among adolescents' knowledge about safety behaviors; and (3) delineate variation in adolescents' pesticide safety behaviors and neurological outcomes after intervention between all three treatment groups. Aims 1 and 2 will be accomplished by the administration of a pretest and posttest survey to all three treatment groups that will assess knowledge of pesticide safety behaviors. Aim 3 will be accomplished by administering a pretest and posttest survey assessing hand washing and clothes changing behaviors in addition to using a finger tapper exercise to examine potential neurological outcomes.

5. *Contributing Factors to Slips, Trips and Falls Among Texas Shrimp Fishermen (Years 4 & 5)*

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Commercial fishing is known to be one of the most dangerous occupations in the United States; however, little is known about actual contributing factors to slip, trip, and fall hazards among shrimp fishermen. Moreover, although proven measures are available to improve safety in the work environment, the acceptance of safety interventions, both in terms of content and manner of delivery, is not widely embraced among Vietnamese shrimp fisherman (Galveston area) and even less is known about Hispanic shrimp fishermen (the southern Gulf area).

Our multidisciplinary approach of industrial hygiene and safety, sociology, occupational medicine, and epidemiology will provide detailed information on cultural and non-cultural work-related behaviors, attitudes, and practices, which influence slip, trip, and fall hazards and risks and the acceptance of safety interventions among Texas shrimp fishermen. This is the first study to investigate the obstacles to safety interventions to non-fatal slip, trip, and fall injuries and identify effective safety intervention methods using community-based participatory approaches.

The specific aims of this project are to (1) identify potential occupational and environmental hazards and other contributing factors for slips, trips, and falls among fishermen by conducting workplace observations and questionnaires; (2) estimate the frequency of slips, trips, and falls, and other related non-fatal injuries among fishermen using questionnaires; and (3) identify cultural and non-cultural factors associated with the acceptance of traditional safety interventions (such as the use of safety boots) using community-based participatory research techniques.

6. *The Impact of Thermal Load on PFD use Among Shrimp Fishermen*

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The long-term goal of the project is to increase the routine use of Personal Floatation Devices (PFDs) among Vietnamese commercial shrimp fisherman in the Gulf of Mexico, thereby reducing Falls Over Board (FOB) fatalities in commercial fisheries. This is relevant because FOBs are the second most frequent cause of death in the U.S. commercial fishing industry and are the most prominent cause of death in southeastern shrimp fisheries, accounting for 61% of worker deaths. Findings from the current study, *Marketing Safety among Commercial Shrimp Fishermen*, reveal increased thermal load while working as a major barrier to wearing PFDs.

The objective of this translation project is to test the physiological impact of heat on PFD use and to design and test a multimodal and culturally appropriate social marketing campaign to increase adoption of OSHA/NIOSH recommendations for heat stress reduction to increase comfort, access and acceptability of PFDs. The central hypothesis is that by reducing the impact of heat stress while working, the acceptability of wearing PFDs will increase and this will lead to a significant increase in fisherman readiness to use PFDs in the treatment group, as compared to the control group.

The specific aims are to (1) understand, quantify and compare physiological responses to the thermal environment, heat stress symptoms, and physiological measures, with and without PFD and cooling devices among Vietnamese shrimp fishermen during the physically demanding work of harvesting shrimp in the Gulf of Mexico region; (2) identify commercially available personal cooling equipment designs that have demonstrated comfort and workability. These will be identified by conducting a trial with two types of personal cooling equipment designs with Vietnamese shrimp fishermen; and (3) design, launch and evaluate the effectiveness of a multimodal and culturally appropriate social marketing campaign to increase OSHA/NIOSH recommendations for heat stress reduction and PFD use.

7. *Leveraging Motor Vehicle Crash Data for Injury Surveillance and Research in AFF (Years 1-3)*

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In the U.S., the number one cause of fatal occupational injuries is highway transportation crashes (CDC, 2011 in MMWR). AFF workers experience substantially higher transportation-related injury rates compared to other workers. Additionally, all five states (AR, LA, NM, OK, TX) in the SW Ag Center region were among those with the highest or second highest rates (CDC, 2011). National or regional estimates of nonfatal injury rates are not widely available and the most recent national study of fatal injury is over 20 years old. In 2009, a USDA report emphasized that, "Many

details of public road crashes involving agricultural machinery and motor vehicles are unknown or lack sufficient detail to aid prevention efforts” (CASHRE/USDA, 2009). This assertion is still relevant. To our knowledge and of additional concern, none of the available studies of fatal or nonfatal injury focus on the SW Ag Center region. This lack of data substantially hinders the development of regionally specific outreach or interventions, which are important given the diversity of AFF operations across the U.S. This creates an urgent need for exploring how existing data sources, such as state crash records, can transform traditional surveillance systems and support research, especially for the SW Ag Center region. At the same time, crash records contain narrative, free-text fields that are can be a rich source of data for informing the identification of AFF-related crashes for surveillance purposes along with illuminating causal factors.

To address surveillance and research needs, this project includes two aims: (1) to construct a model system to support surveillance and research of nonfatal and fatal crashes involving AFF equipment and vehicles in the SW Ag Center region and (2) to develop and evaluate a process for identifying and extracting variables from crash narratives that aids in the identification and characterization of crashes involving AFF equipment, vehicles and workers. These aims will be addressed by merging crash records from AR, LA, NM, OK, and TX while also analyzing data from FARS, CFOI, and other sources. Our overall objective is to inform the development of surveillance systems while also filling gaps in our understanding of transportation-related injuries in AFF populations in the SW Ag Center region.

Washington

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PNASH Center programs and activities are conducted across federal region X: Washington, Idaho, Oregon, and Alaska. We will work in partnership with regional public and private organizations to fulfill its mission as a multi-state, multi-institutional, and multi-disciplinary research, prevention and education center. The Planning and Evaluation Core provides the administrative infrastructure for the entire Center and assists in the implementation of individual project and program objectives. Core programs ensure that project activities are well coordinated and integrated within the center, of high scientific quality, meet their objectives and work in coordination with community partners to move results into practice.

The Planning and Evaluation Core's specific aims and programs include:

1. Management, Operations, Facilities and Communications

2. Internal and Scientific Advisory Committees
3. Data and Statistical Service
4. NIOSH and NIOSH Agricultural Center Collaboration
5. Pilot/Feasibility Project Program and Emerging Issues Fund
6. Evaluation Program

Outreach Core

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The Agricultural Community Engagement, Education and Outreach Core referred to as the “Outreach Core,” is the Center’s foundation for building relationships and sharing information with our agricultural community. The Outreach Core links the Center to its stakeholders by forging partnerships that are essential to the success of all our activities. Our stakeholders include:

- Agricultural workers – farmworkers, farm supervisors, fishermen, forestry workers, and loggers
- Agricultural employers – farm producers and managers, skippers, forest land managers, and contract logging and service firms
- Health Care Providers/Safety Professionals – physicians, physician assistants, nurses, health educators, community health workers, and safety professionals
- Government Agency Staff – departments of Labor & Industries (state OSHA), Health, Agriculture, Environmental Protection Agency, US Coast Guard, Forest Service, NIOSH, OSHA, and state extension specialists
- Academics – researchers, educators, and students.

The Outreach Core is the mechanism by which we gather the agricultural community’s health and safety concerns to inform and provide context for the Center’s research, intervention, and educational activities. The Outreach Core is also the vehicle that puts the products of our research, tested interventions, and educational strategies back into the hands of the agricultural community. Our stakeholders are central beneficiaries of that information.

The Outreach Core’s specific aims are to:

1. Collaborate with our stakeholders to identify the key issues and problems in agriculture that our Center can address by further research, intervention, or educational activities;

2. Develop a research-to-practice plan for each of the Center's projects to ensure that the benefits of our research, interventions, and education are put back into the hands of agricultural workers and producers, health and safety professionals, health care providers, public agencies, and academic institutions;
3. Implement outreach strategies that are specific to the needs and communication preferences of each stakeholder group; and
4. Provide regular communications between the Center and the agricultural community and serve as a forum for our stakeholders to discuss issues and resolve emerging problems.

Pilot/Feasibility Program

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The PNASH Center will administer a Pilot/Feasibility Project Program (P/FP) to support new initiatives in research, intervention, and translation. The P/FP Program will fund up to 2 projects in Years 3 and 4 through a competitive process for a maximum total annual direct cost allocation of \$30,000 and a project duration of 12 to 18 months.

The program will follow the mechanism previously developed and implemented by the PNASH Center. This is a formal process that includes: 1) release of a request for proposals for Northwest investigators; 2) internal and external review and scoring of proposals; 3) notification of award or request for revision and resubmission; and 4) a record of program process and project results.

This program provides both early stage and experienced investigators with opportunities to:

- Develop preliminary data or expertise to support new proposals;
- Adapt or evaluate proven tools or techniques for new populations, workplaces or delivery methods;
- Evaluate the merit of a new ideas, or new approaches to existing methodologies or datasets;
- Explore new directions in research, prevention/intervention and education/translation; and
- Apply their expertise to the field agricultural safety and health.

In addition, the P/FP, places a special emphasis on supporting meritorious projects that widen PNASH's work in the industries of fishing and forestry, and those projects that support early stage investigators.

Research Core

1. *Prevention of Occupational Exposure to Pesticide Drift*

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The overall objectives of this project are to understand the mechanisms of pesticide drift exposure among agricultural workers and prevent such exposures in the future. Pesticide-related illness among agricultural workers remains a significant public health concern in the Pacific Northwest.

First, we will determine the probability of drift events due to environmental conditions during spraying by:

- 1a. Estimating drift-related weather conditions at the time and location of all documented drift events in Washington State between 2000 and 2015;
- 1b. Conducting a case-crossover study of weather conditions on drift event days vs. non-drift event days to build a 'drift determinants' model.

Second, we will conduct validation studies of our Drift Determinants model:

- 2a. Comparing field meteorological measurements to AgWeatherNet-based estimates at representative sites in the Yakima Valley;
- 2b. Testing the validity of model predictions through field sampling for pesticide drift under variable weather conditions.

Third, we will translate study findings into exposure prevention tools for agricultural producers and workers by providing new training modules for regional "Drift Management Best Practices" courses, creating a user-friendly method for epidemiologic investigators to integrate weather conditions into drift event documentation, and developing a system to alert pesticide applicators about drift event-prone weather conditions. This work will result in the novel integration of environmental and health data systems, and holds potential to demonstrably reduce occupational illness due to pesticide drift.

2. *The Healthy Dairy Worker Study*

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While workers on dairy farms have multiple occupational exposures including microbes, dust, and endotoxin, some studies have reported low rates of asthma,

atopy, and symptomatic diarrhea among people living and working on farms. The “hygiene hypothesis” or “farm effect” posits that exposures to microbes and allergens on farms may actually have immune benefits, and could be a critical determinant of whether farmworkers remain healthy or develop occupational disease including infection and airway inflammation. Better understanding of the role of particular exposures and host factors in the dairy work environment could lead to more effective interventions including early detection of persons at risk of developing problems. This study will explore this hypothesis by recruiting new hires on dairy farm as well as existing worker and community controls and observing changes in gut and nasal microbiome communities, as well as subject health status, over a two-year period.

This study will help identify priorities for preventive interventions and healthy host adaptation to the dairy environment including infection control practices and understanding vulnerable worker populations in a research to practice (R2P) fashion.

The study will test the following hypotheses:

Hypothesis 1: Occupational exposure to dairy environments and microbes in these environments causes changes in the gut and nasal microbiome that persist over time.

Hypothesis 2: Baseline and subsequent microbiome status in dairy workers may be associated with the health and occupational status of these workers.

These hypotheses will be explored through accomplishment of the following specific aims:

1. Compare reported health status, gut and nasal microbiome, and respiratory function in a cohort of newly hired dairy workers, as well as comparison groups of community controls and experienced workers;
2. Over a two-year follow-up period, compare gut and nasal microbiome change between new workers and controls; and
3. Determine whether microbiome components are associated with health status or early work cessation.

3. *A Multi-Level Approach to Heat Related Illness Prevention in Agricultural Workers*

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This project proposes to develop and evaluate a multi-level approach to heat-related illness (HRI) prevention in agricultural workers. Outdoor agricultural workers are at high risk for occupational HRI, and previous studies suggest that HRI risk factors exist at individual, workplace, and community levels, including in hot housing conditions. The proposed study will build upon the PI's previous HRI work with Washington (WA) tree fruit growers and farmworkers, who are largely foreign-born, Spanish-speaking workers, to:

1. Develop, with input from stakeholders, an HRI prevention intervention approach that addresses HRI risk factors at multiple levels;
2. Evaluate the intervention on occupational heat strain and HRI symptoms in a parallel, comparison, group intervention study in WA tree fruit workers during the summer season; and
3. Assess whether hot evening farmworker housing conditions worsen health effects of workplace heat stress in these workers using a longitudinal observational study design.

To accomplish project aims, advisory groups that include workers, farm managers, and other stakeholders will be established to guide the development, testing, and dissemination of the intervention. The intervention will build upon the PI's preliminary work on: 1) participatory worker HRI education that will address risk factors at individual, workplace, and community levels; and 2) a heat awareness system using Washington State University's AgWeatherNet weather station network to provide tailored recommendations to growers on how to reduce HRI risk on hot workdays. Heat health effects will be measured using wireless core body temperature sensors to assess worker heat strain and novel mobile text messaging methods for tracking specific heat strain/HRI symptoms. To address NIOSH's r2p mission, a final consensus lay document with recommendations for multi-level HRI risk factor assessment and intervention development will be crafted, with input from advisory groups, and disseminated to workers, growers, housing and healthcare stakeholders, scientists, and public health practitioners. The ultimate goal of this work is to reduce occupational HRI rates in agricultural workers.

4. Injury and Illness Prevention in the Pacific Northwest for the Dairy Industry

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The purpose of this intervention project is to minimize acute worker injuries in Washington state dairies and develop a surveillance program to track acute and chronic injuries. The objectives are to 1) identify specific injuries typical to dairy workers using historic Worker Compensation (WC) claims data in Washington State; 2) develop and evaluate novel training and safety measures targeting these predominant injuries; 3) disseminate best practices to the Washington State Dairy Industry; and 4) develop an ongoing surveillance system for dairy injury and illness with the primary goal of identifying trends and emerging issues and secondary goal of evaluating the effectiveness of implemented interventions over time. This project is designed to include ongoing participation of a wide variety of industry representatives through both a Technical Advisory Group (TAG) and an Expert Working Group (EWG) comprised of the on-the ground dairy managers and workers involved in day to day activities of milk production and animal handling.

Specific Aims:

1. Identify common tasks and circumstances associated with acute injury risk in Washington Dairies;
2. Survey current safety training and animal handling practices in Washington Dairies;
3. Establish an EWG comprised of managers and workers involved in day-to-day activities on the dairy;
4. Implement and evaluate selected training interventions with study population;
5. Develop methodology for and conduct a dairy injury surveillance program; and
6. Translate results in a Best Practice Guide for minimizing injuries in Washington Dairies.

5. Safety Surveillance for Pacific Northwest Fisheries

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Although commercial fishing is a dangerous industry, documentation of injury risk and risk factors remains far from complete. This project based at Oregon State University will develop and test a safety surveillance system for commercial fishing that can be used to evaluate and inform safety initiatives to prevent injuries.

Voluntary and mandated prevention efforts to reduce both vessel and fishermen casualties have improved the safety of fleets and fishermen throughout the United States since the 1980s. Additional prevention efforts could further reduce the hazards in this industry. For these efforts to be properly targeted and evaluated, they must be informed by the most comprehensive injury ascertainment practicable.

The National Institute for Occupational Safety and Health's (NIOSH) Commercial Fishing Incident Database tracks fishermen fatalities and vessel disaster information in the commercial fishing industry. This study will make use of this available data for Pacific Northwest commercial fishing industry and will supplement this data with non-fatal injury data and vessel casualty data using United States Coast Guard reports. Additionally, this project will include other sources of vessel and fishermen casualty and safety data from marine insurance claims as well as through state-based Trauma Registries. Combined, these data will form the foundation for ongoing, scalable, adaptable surveillance system for hazard assessment and for evaluating programs or particular interventions in the commercial fishing industry. The surveillance system can be adapted and expanded after this project to provide a flexible yet consistent method for comparing injuries and injury rates in the commercial fishing industry across regions.

6. *Practical Solutions for Pesticide Safety*

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This project will develop new practical solutions that farm and forest services managers and pesticide handlers can implement to minimize pesticide exposures. These resources will expand the model used for our existing bilingual [*Practical Solutions for Pesticide Safety*](#) guide developed for pesticide handlers in the Washington State tree fruit industry. The proposed project will develop new practical solutions for handheld application equipment used in nurseries (greenhouses), grass seed production, and forest services (reforestation) industries. The objectives are to develop and disseminate practical solutions that 1) reduce exposure; 2) are practical (compatible, convenient, adaptable, safe, novel, and meet regulations); and/or 3) support the training needs of the newly revised US EPA Worker Protection Standard.

We will employ three approaches to engage stakeholders. First, the Expert Working Group (EWG), a farm and research participatory model used for the original guide. EWG is a collaboration of the experts, managers and the pesticide handlers that know best the daily operational needs on the farm, and the research team. Second, National Advisory Group with representatives from employer and agricultural and forestry worker organizations; pesticide educators, and federal agencies will support adapting the solutions for a national audience and advise on national dissemination. Third, we will create a practical solutions online community presence using web and social media tools for ongoing discussion and dissemination nationally.

We will identify practical solutions using worksite walkthroughs with checklists, interviews with handlers and managers, and submissions to the online forum. New solutions will be developed based on identified needs. Solutions will be evaluated based on selection criteria and field tested. Some solutions will be used in the development of hands-on training modules for pesticide safety training in support of the WPS.

Other Active NIOSH AFF Awards

1. *Heat Exposure, Injury Risk, and Productivity in Agricultural Workers (July 1, 2014 – June 30, 2017)*
June Spector, MD, MPH
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With this New Investigator award, Dr. June Spector examines the association between heat exposure and traumatic injury risk in agricultural workers. The ultimate

goal is to develop injury prevention solutions. As part of the study, the risk of traumatic injury in farmworkers was estimated using temperature data linked to the geographic location of the injury. Established climate models and WA workers' compensation data from claims from 2000 to 2012 were used to estimate risk. Orchard harvest workers were also evaluated in the field for associations between heat stress, psychomotor performance and productivity. In addition, urine samples were collected from the harvest workers, and the feasibility of using an oxidative stress biomarker to measure heat acclimation will be assessed.

2. *Safety and Health of Latino Immigrant Forestry Services Workers in the Pacific Northwest (September 1, 2014 – August 31, 2017)*

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A partnership project of the UW PNASH Center, Northwest Forest Worker Center and the Berkeley Labor Occupational Health Program. **This project is referred to in the community partnership as Sí Sé: Salud y Seguridad en el Trabajo (Yes, I Know: Health and Safety on the Job).** Workers in the forestry services industry are exposed to high-risk tasks and conditions. Compared to general U.S. workers, job-related injury and illness rates among forest workers are 2-3 times higher and fatality rates 9 times higher, yet the work is essential to our US forest management. This project aims to characterize working conditions and job-related injury and illness experiences among immigrant Latino forest workers in relation to workplace risk factors and outcomes in medical treatment, recovery/return-to-work, and safety mitigation. This community-based, partnership project addresses both an underserved workforce and a uniquely vulnerable population due to their work tasks, social position and the remote nature of the work. This population is immigrant, Spanish-speaking, and young (median age was 30). The project engages workers through an Expert Working Group (EWG) and a Technical Advisory Group (TAG) of leaders in forestry, policy and research. Essential to the project is the community-based approach, led by the Northwest Forest Worker Center and their promotora (lay health educator) program and community training workshops. Research components include employer field visits, 100 worker interviews and 25 in-depth case study analyses. Worker participants must have had an injury with the previous two years severe enough to have lost at least one work day. Case studies will be developed using participatory narrative storytelling to create educational videos that are culturally, linguistically, and educationally appropriate for immigrant Latino forest workers and their employers. Lastly, the project will respond to the training needs identified through the research to produce and field-test safety bilingual training materials for use by forestry worker supervisors.

Wisconsin

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National Farm Medicine Center Social Media Accounts

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Research Core

1. *Filling the Gaps in Child Agricultural Injury Data*

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This project is exploring the most promising, existing public health data systems to determine their utility for adding to the limited data currently available via the NIOSH/NASS surveillance process. Preliminary work by Dr. Marlenga's team has provided insights into potentially valuable agriculture-related data embedded within child death reviews, trauma registries, and emergency medical services data. Recommendations will guide future policies for national data collection.

2. *Enhancing Supervisors' Skills and Employer Policies to Promote and Protect the Health of Youth Agricultural Workers*

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This project will conduct a randomized controlled trial blending elements of Total Worker Health with agricultural safety. Content on substance abuse, fatigue and cell-phone use will augment existing safety resources and policies for employers. Results will inform its impact on both English- and Spanish-speaking supervisors.

Prevention, Intervention and Translation Core

1. *Understanding Beginning Farmers and Ranchers*

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This project strives to understand the attitudes of millennial generation, non-traditional family farmers whose livelihood has been launched by USDA-funded support. As an anthropologist, Dr. Bendixsen will compare and contrast demographics and practices of African Americans, Native Americans, Hispanics and

other unique groups in order to guide future culturally relevant interventions addressing children and farm safety.

2. *Developing a Sustainable Infrastructure for the SAY National Clearinghouse*

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In 2013, responding to the agricultural community's rejection of proposed updates to child labor laws, the USDA awarded funds to establish a clearinghouse for educational resources. The Safety in Agricultural Youth (SAY) clearinghouse is now under construction. This project will evaluate the roll-out of SAY at a regional level, then, based upon results, generate recommendations for SAY's modification, termination or long-term sustainability.

Outreach, Education and Translation Core

1. *Advanced Knowledge Mobilization and E-communication*

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The health communications, marketing, and technology specialists of AKME facilitate messaging, packaging and dissemination of information across all projects. This team collaborates with center-wide and external partners. AKME facilitates timely and culturally-appropriate communication strategies, including social media, virtual meetings, and mobile applications. Considered the centerpiece project of the National Children's Center.

2. *Strengthening Organizational Capacity*

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This project leverages current relationships with organization executives to reach into networks of leaders across domains of youth serving organizations, insurance companies, agricultural media, and agricultural bankers. The project uses marketing approaches and principles of corporate social responsibility to increase the number and spectrum of groups that incorporate a focus on childhood farm safety into their ongoing systems, policies and communications with constituents and members.

3. *Protecting Children While Parents Work*

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This project aims to increase the engagement of agribusiness leaders in facilitating availability of, and access to, off-farm child care services for migrant and immigrant agricultural workers with children younger than 12 years. It is based upon the successful RCMA model in Florida.

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