Improving the Health and Safety of People Working in Agriculture in the West

Annual Report Period: 9/30/17–9/29/18

Grant Number: U54 OH007550

UC DAVIS
Western Center for
Agricultural Health and Safety

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October 2018

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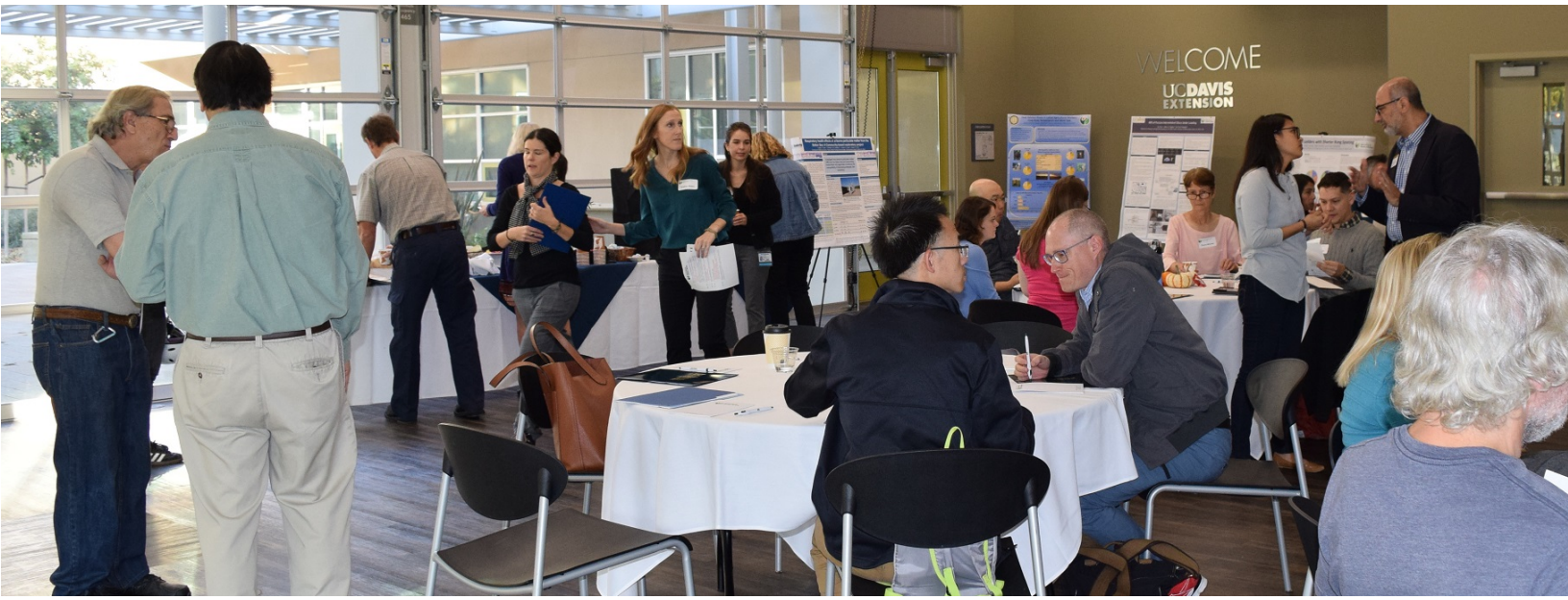
SECTION ONE

Center Summary



Summary

Agriculture in the Western United States represents one of the most intensive and productive operations in the world. California's agricultural industry alone is the largest and most diverse in the nation, producing nearly half of US-grown fruits, nuts, and vegetables. WCAHS' mission is to improve the health and safety of farmers, farmworkers, and their families and communities, with particular consideration of those issues unique to western agriculture in the states of Arizona, California, Hawaii, and Nevada.

WCAHS has a 25-year history of interdisciplinary research accomplishments, including recognition of inorganic dust as a cause of respiratory disease in agriculture, ergonomic changes to reduce injury in grape harvest, new assays for pesticide monitoring, outreach to farmworkers on pesticide and heat-related illness prevention, and addressing the health impacts of migrant status on farmworkers. WCAHS works with regional growers, industry, labor, governmental and non-governmental organizations (NGOs), and community groups to address agricultural safety and health issues through the translation of research results into effective workplace interventions.

WCAHS is located at the University of California, Davis, which is ranked number one in the United States for its agriculture program. The multidisciplinary nature of the Center faculty has facilitated a wide variety of field-oriented research projects, along with diverse trainings and multi-lingual educational programs, and interventional prevention programs.

Relevance

Agriculture is one of the most hazardous occupations and more than 30% of the nation's farmworkers live in the four western states covered by WCAHS: California, Nevada, Arizona, and Hawaii. WCAHS has direct public health importance by increasing the understanding of what causes disease in this population and applying the findings to develop interventions to reduce injury and illness.

WCAHS maximizes the impact of NIOSH Center funding by obtaining extramural funding (e.g., NIH), nurturing existing partnerships (e.g., CalOSHA, CalEPA, and California Department of Pesticide Regulations (DPR)), and building new NGO/private industry partnerships (e.g., the Almond Board of California and Reiter Affiliated Companies, the largest multi-berry producer in the world). Partnerships and campus graduate student support continue to allow us to broaden our impact, enhance outreach and training activities, and nurture the next generation of researchers. Substantial matching funding from UC Davis further allows us to leverage the core Center funding from NIOSH.

WCAHS' outreach and public communication efforts are comprised of diverse media platforms (e.g., website, newsletter, social media) that include a joint NIOSH Ag Center Health & Safety YouTube channel. The successes and outcomes of all Center activities are evaluated within our comprehensive evaluation program on an on-going basis.

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SECTION TWO

Administration, Communications, and Evaluation

Center Administration

The WCAHS administrative team, including the Director, Associate Director, Outreach Director, Research Director, and Center Manager meet at least twice a month to review, prioritize, and advance Center activities. The administrative core provided leadership in convening center faculty and stakeholders in research and advisory meetings, including a WCAHS External Advisory Board meeting, a Fall Symposium, and Steering Committee meetings. The Fall Symposium was the first of its kind for WCAHS and attracted over 60 attendees and featured center research. Breakout and poster sessions by Center investigators and students provided opportunities for networking.

The annual WCAHS Seminar Series began in October 2017 and continued through June 2018. Topics presented included tractor operator safety, migrant farmworker health, cannabis and farmworker health and safety, housing needs for farmworkers, and preventative interventions to reduce dairy worker infection.

WCAHS participated in several UC Davis events, including the annual Research Expo and World Food Center Showcase, to increase the Center's profile and foster collaboration opportunities for new investigators interested in agricultural health and safety.

Center Visibility and Communications

WCAHS continues to disseminate agricultural health and safety information utilizing numerous formats yielding impressive results. In 2017–2018 WCAHS experienced dramatic increases in attendance to our monthly seminar series, website page views and users, and social media followers and engagement. Our monthly electronic newsletter reaches nearly 1,000 stakeholders with WCAHS news, funding opportunities, events, and research highlights. WCAHS launched a bilingual electronic newsletter, *Proximamente*, targeting the agricultural community (e.g., growers, farm supervisors, farmworkers) with safety tips, health fair, and training event opportunities. We continue to survey our stakeholders, both formally and informally, to learn more about their preferred method of receiving health and safety information and Center news.

Evaluation Program

The WCAHS evaluation component assesses the impact of the Center's research and outreach efforts, as well as the Center overall. The evaluation team collects data from program records and study investigators to document outputs and outcomes. WCAHS evaluation findings are shared to develop and disseminate best practices for evaluating NIOSH Agricultural Health and Safety Centers. Evaluation supports Center-wide activities, including systematically tracking all outreach trainings and events, evaluating participant experience of the annual symposium, synthesizing External Advisory Board feedback, and updating the NIOSH Program Performance One Pager.

The WCAHS evaluation team continues to support the interactive collaboration map developed in 2017. The maps display WCAHS activities in its geographic catchment area (California, Nevada, Arizona, and Hawaii) in four areas: outreach, research, and stakeholder engagement. Each map displays information on the number and type of outreach events; location of research sites; as well as the geographic areas represented by advisors and other key stakeholder groups, such as agricultural labor, industry, and government.

Cross-Center Collaboration

For the last year, WCAHS has led the Agriculture, Forestry, and Fishing (AFF) Evaluation, Communication and Outreach (ECO) Group, a cross-center forum that enables all 11 AFF centers to share approaches to evaluation and outreach and collaborate on priorities, challenges, and opportunities. From October 2017 to September 2018, the outreach and evaluation staff participated in ECO conference calls, which featured training sessions on topics including: Promoting Ag Center videos, Altmetrics, and Educational Resources for Ag. WCAHS also participated in center-wide initiatives, such as National Farm Safety and Health Week and the NIOSH/CDC Beat the Heat summer campaign, specifically by contributing to YouTube videos, educational resources, and social media awareness. As a result of these efforts, the U.S. Agricultural Safety and Health Centers YouTube channel has seen an increase in average view duration, subscribers, likes, and shares.

SECTION THREE

Emerging Issues Program

The goal of the Emerging Issues Program is to respond quickly to emerging agricultural health and safety topics. This program has the potential to mobilize academic expertise and achieve breakthroughs in never or understudied areas of agricultural occupational health, and to create relationships between Center members and potential new members, both at UC Davis and at other institutions.

Projects may be research, education, or outreach related. New emerging issues topics are discussed during Steering Committee meetings, the annual symposium, and External Advisory Board meetings.

Cannabis worker health and safety and night work were topics identified by the External Advisory Board as priorities. Two proposals on worker health and safety in the cannabis industry were received, scored well in the external review process, and were funded.

Worker Health and Safety in Cannabis Growing and Processing

Marc Schenker, MD, MPH and Farzaneh Khorsandi, PhD

Problem: There is minimal research on the occupational health and safety risks specific to cannabis cultivation. This project aims to determine the key risks of the industry as a whole, as well as for specialized worker job categories.

Project overview: The size and composition of the cannabis workforce, including characteristics of both the labor and farm types, will be identified through data collected from a review of the scientific literature, field visits, and discussions with owners of the facilities visited.

Progress to date: Project leads visited one distribution facility for cannabis extraction equipment, one extraction facility, two outdoor growing facilities, and two indoor facilities in Northern California. On these visits, they observed the production processes and catalogued the possible worker safety and health issues, including diverse biological hazards, chemical risks, and physical hazards.

Limited research suggests that *Cannabis sativa* exposure through inhalation and/or ingestion can result in an allergic reaction including: respiratory symptoms, sensitization, and anaphylaxis. Skin contact exposure has been linked with allergic reaction including hives, itchy skin, and swollen or puffy eyes. Potential chemical exposures include pesticides, rodenticides, fungicides, and insecticides. Exposure to pesticides can result in mild health effects from nasal congestion; throat irritation; respiratory difficulties; skin, eye, and throat irritation; as well as more severe health effects. Pesticides can remain after spraying and exposure risks increase when the plants are handled extensively during the harvesting and processing activities. Each step in production affects workers' safety and health in specific ways. Hazard types, especially for trimmers, include: rapid handwork; repetitive motions; repetitive and prolonged static posture; awkward postures, such as twisting the wrists and other joints; and inappropriate/inadequate hand tools; among others.

Sexual Harassment in the Agricultural Workplace

Stephen McCurdy, MD, MPH and Kimberly Prado, MPH

Our Year 1 (2016–2017) emerging issues funding focused on better understanding the prevalence of sexual harassment in agriculture. Work in this area continued in Year 2, with an Epidemiology PhD student making it the focus of her research.

Problem: Sexual harassment is a problem in the agricultural industry. Victims can suffer physically, socially, psychologically, and economically.

Project overview: This project investigates attitudes, perspectives, beliefs, and experiences regarding sexual harassment in agricultural workplaces through focus groups and surveys among men and women farmworkers, and employer questionnaires.

Progress to date: Focus groups were held with male and female farmworkers in California. Focus group participants discussed their observation that women are predominantly the targets of workplace sexual harassment, while recognizing that either sex could be target or harasser, and the need for effective training across all employee levels, enhancing reporting protections and infrastructure, and gender differences in what constitutes workplace sexual harassment. In surveys, more women than men reported exposure to at least one form of workplace sexual harassment. These included gender discrimination, unwanted sexual attention, and hostile behavior.

SECTION FOUR

Research: Core Projects, Small Grants, and Graduate Student Funding

Core Center Research

WCAHS has five core research projects which are funded for five years (descriptions below).

Small Grant Program

The WCAHS Small Grant Program (pilot project funding) funds new research projects annually for 12 months. When additional funds become available, WCAHS announces additional funding opportunities resulting in rapid response/short-term funding.

The Small Grant Program received 13 proposals for the 2017–2018 funding cycle. An external review committee scored each proposal using the NIH scoring system and the WCAHS Steering Committee made funding recommendations. Five projects were funded and awardees included junior investigators, a graduate student, and new investigators to the center (Projects 1–5 below). Awards ranged in amounts from $10,000 to $30,000. A second call for proposals was announced for short-term and rapid response projects. Seven projects were funded and completed in Summer 2018 (Projects 6–12).

Graduate Student Research Funding Program

UC Davis provided institutional support to fund graduate students working on research related to agricultural health and safety. Through a competitive application process, WCAHS provided financial support (tuition and stipends) to eight graduate students working with faculty from all five UC Davis schools/colleges and six graduate groups.

PROJECT 1

Differential Characterization of Air Pollutant Emissions and Associated Toxicity from Common Agricultural Practices in the San Joaquin Valley

Kent Pinkerton, PhD, School of Medicine and School of Veterinary Medicine, and Keith Bein, PhD, UC Davis

Problem: This project aims to understand the toxicity of agriculturally related air pollution as a means to protect and improve farmworker health through education, translation, and outreach. Air pollution (particulate matter emissions) from agricultural practices differs in physical and chemical composition, which determines its toxicity and resulting health effects. California farmworkers represent an especially susceptible population given a combination of exposure to multiple known stressors, including heat, physically demanding labor, and adverse socioeconomic conditions.

Project overview: Particulate matter from California's San Joaquin Valley and Imperial Valley is being collected at various farming sites with different labor-intensive crops. The impact of these particles on respiratory health is being studied.

Progress to date: Particle-sampling sites in three agricultural regions of California have been identified in which particulate matter samples have been collected and are undergoing biological testing. These sites include Parlier, CA; Taft, CA; and Calipatria, CA. The project team established a cell culture-screening assay, which has been successfully applied to initial particulate matter samples gathered from Parlier, Taft, Calipatria, and the Caldecott tunnel in California. PIs have established a strong relationship with an advocacy group (*Comite Civico del Valle*) in the Imperial Valley of California with conference calls, on-site visits, and the formation of a community advisory group. Placement of a field station at Calipatria High School for air sampling is complete. The Imperial Valley provides winter crop growth and production for the state and the nation.

PROJECT 2

Reducing Toxin Exposure for Workers in Western Agriculture: Development of Sustainable Alternatives to Soil Fumigation

Chris Simmons, PhD, College of Agricultural and Environmental Science, UC Davis

Problem: Many conventional and widely used soil fumigants have been identified as being toxic and/or carcinogenic. As a result, acute and chronic exposure risks exist for agricultural workers and communities near fumigation sites.

Project overview: Biosolarization is a potential alternative to toxic soil fumigation and is less damaging to health and the environment. Instead of toxic conventional pesticides, biosolarization uses solar heating and bacterial activity to create soil conditions that are lethal to many pests but safe for humans. This project tests whether biosolarization is an effective fumigation substitute in the context of western agriculture, which entails controlling major western agricultural soil pests in western specialty crops.

Progress to date: Experiments were conducted to examine biosolarization in the context of the California almond industry, which accounts for nearly all of the nation's almond production. When almond processing residues, such as hulls and shells, were amended into the soil to trigger bacterial activity, volatile fatty acids accumulated in the biosolarized soils. VFAs are generally less toxic than conventional fumigants which benefits orchard workers, neighboring communities, and the environment. In the interest of translating biosolarization to as many cropping systems as possible, an additional field trial was launched to explore application in California lettuce production, which often employs fumigation to control disease. This trial is currently underway in Davis, CA and will measure changes in fungal pathogens within biosolarized soils and the subsequent effect on lettuce growth. Other promising findings included nematode (or roundworm) control under some conditions and improvement in nitrogen transformation and potassium accumulation. The project investigator presented to over 1,500 growers, researchers, and other stakeholders on the potential of biosolarization to control pests in almond cultivation.

PROJECT 3

Ergonomic and Biomechanical Evaluation of Mechanical and Robotic Strawberry Harvest-Aids

Fadi Fathallah, PhD, College of Engineering and College of Agricultural and Environmental Science, UC Davis

Problem: Workers who harvest strawberries can suffer from musculoskeletal disorders, especially low-back disorders. Interventions to reduce low-back disorders, while maintaining acceptable productivity levels are needed.

Project overview: This project evaluates the ergonomics, biomechanics, and productivity of using mechanical and robotic strawberry harvest-aids to protect workers from low-back disorders while maintaining yields. This project strives to use a series of optimized and controlled interventions to gain a better understanding of the balance between productivity and ergonomics of multi-person and personal labor-aid machines for strawberry harvesting. Machine-specific interventions will be evaluated for safe deployment.

Progress to date: Investigators completed the development and building of a harvest-aid system to simulate various speeds and field configurations. Piloting was conducted to determine optimal workers' biomechanical response. Symptom surveys were also piloted. These activities are ongoing. The study team is continually assessing the best means to deploy the results of this project into useful and practical guidelines that minimize the risk of musculoskeletal disorders among strawberry harvesting workers.

PROJECT 4

Heat Illness Prevention in Farmworkers: Translation of Economic, Socio-Cultural, and Physiological Factors into Effective Interventions

Marc Schenker, MD, MPH, School of Medicine, UC Davis

Problem: Despite major campaigns to reduce heat-related illness in agricultural workers, deaths and illnesses still occur at higher rates than in other industries where workers are exposed to hot environments.

Project overview: This project engages farm organizations and workers in a collaborative effort to better understand and address the complexities of heat-related illness. Our goal is to translate the physiological and behavioral data collected from our earlier research into effective risk reduction strategies.

Progress to date: Investigators are working with employers to determine the economic costs and benefits of reducing heat-related illness in California, and whether such a reduction will be motivation for changes in practices. Preliminary results show that acclimatized workers worked an average of 56 minutes longer than unacclimatized workers. Additionally, piece-rate participants worked on average 84 minutes less per day than hourly workers. Investigators are also developing user-friendly mobile phone applications to assist supervisors in managing the safety of their work crews.

A beta app will be tested by volunteer farm supervisors in the coming months. Based on their feedback, necessary changes will be made before the app is ready to launch in iTunes and the Google Play stores. Lastly, more effective participatory heat-related illness prevention trainings are being created and evaluated, and multi-media materials will be developed into instruction packages for Training of the Trainer outreach throughout California. Three sessions were held this year throughout California, from Brawley in the Imperial Valley through Clovis and Stockton, reaching 53 participants (supervisors of farmworkers). Each participant received a manual on participatory instruction methods and interactive training at the sessions. Evaluation from the participants was positive and the supervisors have gone on to train over 4,000 workers using the 'Heat-related illness toolkit.'

PROJECT 5

Reducing Occupational Exposure to Zoonotic Pathogens in California Dairy Workers

Edward R. Atwill, DVM, MPVM, PhD, School of Veterinary Medicine, UC Davis

Problem: Numerous zoonotic pathogens, diseases or conditions that can be passed from animals to humans, are common in dairy cattle populations and throughout the dairy environment. Zoonotic pathogens can cause illness in both humans and animals. Working within a dairy system increases the risk of exposure to dairy feces that may harbor zoonotic pathogens. However, the amount of exposure required before a worker inadvertently ingests enough zoonotic pathogens to become ill is poorly understood.

Project overview: The project will identify high-risk occupational tasks based on exposure to different concentrations of zoonotic pathogens and then develop recommendations that will reduce the risk of exposure for dairy workers. Fecal samples will be collected and analyzed to quantify five zoonotic pathogens shed by infected dairy cattle. Enrolled dairy workers will be observed performing usual job tasks to help identify occupational tasks and specific personal behaviors that increase a worker's exposure to zoonotic pathogens. Based on project findings, outreach training and materials will be developed and disseminated through outreach training programs.

Progress to date: The project team developed and finalized survey instruments that will be used throughout the 2.5-year collection period. A worker occupational exposure survey was developed to cover standard demographic items, dairy worker job satisfaction and job stress, enteric health survey, and microbial risk exposures. The second survey instrument was developed to characterize dairy cattle management styles which will identify host, management, and environmental factors potentially associated with livestock infection with one or more of the studied zoonotic pathogens. Three working dairies have agreed to participate in the study. The team collected a total of 80 fecal samples from two of the three enrolled dairies.

SMALL GRANTS

Small Grant Project 1: A Water Quality Assessment in a Farmworker Community
Marc Verhougstraete, PhD, University of Arizona

Southeastern Arizona is vital for the national production of livestock, hay, corn, pecans, beans, and cotton throughout the year. Despite this importance, those that are responsible for planting, maintaining, and harvesting these products do not have access to adequate potable water, adequate sewer services, and safe/sanitary housing conditions. This study investigated the presence of microbes and metals in an agricultural community's drinking water and found that all metals and bacteria were below EPA safety thresholds. This project also included a survey of residents' concern of drinking water quality. The majority of respondents did not think their household water was contaminated, but surprisingly, over half reported using bottled water as their primary drinking water source. Additional studies are underway or planned to continue to understand the community's needs, evaluate water quality, and enhance infrastructure.

Small Grant Project 2: Leptospirosis Among California Agricultural Workers—A Silent Epidemic?
Alvaro Medel-Herrero, PhD, UC Davis

Leptospirosis, a bacterial infection that affects humans and animals, is primarily an occupational disease, disproportionally affecting farmers. Leptospirosis is a reemerging infection in California; half of California cattle herds have been estimated to be infected with *Leptospira*, which is a serious threat to farmworkers. Active epidemiological surveillance has been repeatedly recommended, but no studies on *Leptospira* seroprevalence have been conducted in California agricultural workers. The goal of this project is to estimate the prevalence of leptospirosis among agricultural workers in the Central Valley of California and its relation to main exposure factors, including demographic information, sanitary conditions, occupational history, and contact with livestock, stagnant water, and moist soil. Investigators plan to use a questionnaire to collect information on exposure factors. To estimate leptospirosis prevalence, biological samples will be collected. Investigators expect to find a relatively high prevalence and close relationships between leptospirosis and occupation, environment, and poverty. Work on this project is ongoing.

Small Grant Project 3: Farm Incubator Agricultural Safety Training
Nathan Harkleroad, Agriculture and Land-Based Training Association (ALBA)

ALBA is a non-profit organization based in the heart of the Salinas Valley, the 'salad bowl of America.' ALBA provides education and farm development opportunities to aspiring farmers—primarily immigrant farm laborers—on its 100 acres of certified organic farmland. WCAHS funding allowed ALBA to conduct ten worker safety

workshops on topics including pesticide safety, tractor safety, heat illness prevention, and CPR. An estimated 80 participants comprised of aspiring farmers and ALBA staff participated in trainings. ALBA had 14 new farmers enter its Organic Farm Incubator in 2018. They received several workshops and tailgate trainings that included: pesticide safety, labor law, tractor safety, and CPR. All of them demonstrated the safe use of tractors and installed appropriate sanitations services for themselves and their families. A bilingual worker safety resource section for the ALBA's website is underway and expected to be finalized in the coming months.

Small Grant Project 4: The Correlation of Metal-Specific Dusts to Lung Pathology in California Agricultural Workers
Katie Edwards, Graduate Student, UC Davis

Agricultural workers in the Central Valley of California are exposed to a wide variety of airborne toxicants that place workers at increased risk for respiratory disease compared to the general population. Among these airborne toxicants are inorganic minerals (metals). This research examines whether metals present in the dust inhaled by farmworkers contributes to the observed lung damage. Lung tissue from 20 cases from the Fresno County Coroner's Office are being analyzed. Analysis will determine lung damage, the quantity and identity of metals present in lung tissues, and whether metals of a specific type are associated with sites of lung tissue remodeling and fibrosis. Lung tissue analysis is ongoing.

Small Grant Project 5: Organizational Risk Factors for Sexual Harassment and the Consequences for Agricultural Work Teams
Monica Cooper, PhD, UC Davis

This project examined the relationship between incidence of sexual harassment, work team factors that facilitate sexual harassment, and the consequences for vineyard workers. Investigators surveyed 295 workers in Napa County. Of the female workers, 30% reported experiencing offensive comments, jokes, and gestures in their current employment. A further 9% of these women reported unwanted sexual attention and 2% reported sexual coercion. Consequently, harassed women were more likely to intend to leave their current jobs than non-harassed women. The harassment also had a negative effect on male co-workers, who were more dissatisfied with their jobs when working in a crew where sexual harassment occurred. Surveys indicated that younger women and seasonal workers may be particularly vulnerable to sexual harassment. Findings suggest that improvements to the structure and administration of sexual harassment trainings to agricultural workers should be explored and that sexual harassment should be addressed across the organization or the industry as a whole, rather than at the level of the work team that was the focus of this study.

Small Grant Project 6: Chemical Compositions of Thomas Fire Ash and its Potential Health Risks to Farmworkers During Agriculture Recovery
Sanjai J. Parikh and Xiaoming Wan, UC Davis

Ventura County agriculture suffered $171 million in damages to over 70,000 acres of land during the Thomas Fire. In the fire's aftermath, farmworkers worked to clear debris and repair irrigation pipes. In this process, they may have been exposed to arsenic, cadmium, and other toxic elements. Investigators collected ash samples in the affected areas to evaluate health risks. This project is ongoing.

Small Grant Project 7: Healthcare in the San Joaquin Valley: Describing the Physician Population in a Diverse Agricultural Region
Michelle Ko, MD, PhD, UC Davis

Agricultural workers experience poorer health status and increased risk of work-related injury than the general public. Despite this, their access to health care is limited. Investigators conducted interviews with healthcare providers in the San Joaquin Valley to describe their experiences and identify factors that lead to successful recruitment and retention. Physicians reported receiving no training in agricultural worker health and many did

not undergo residency training in the San Joaquin Valley. Participants reported difficulties caring for agricultural workers due to social and occupational challenges.

Small Grant Project 8: All-Terrain Vehicle Rollover Hazards and Interventions
Farzaneh Khorsandi, PhD, UC Davis

Statistics of accidents involving all-terrain vehicles (ATVs) show that three in five fatalities occur in the agricultural sector. Thus, there is an urgent need to find practical ways to intervene and mitigate the number of injuries and fatalities in ATV incidents, including rollover accidents. The investigator aims to develop an autonomous ATV to simulate ATV rollover accidents. This, combined with a thorough review of ATV occupational fatalities or serious injuries in California in recent years, specifically in agriculture, will contribute to the development of new safety measures for ATV use and the reduction of worker injuries and fatalities as a result of these accidents.

Small Grant Project 9: Respiratory Health Effects of Airborne Particulate Matter from the Salton Sea
Savannah Mack, PhD student, UC Davis

The Salton Sea in southern California is shrinking with its only inflow coming from agricultural and industrial runoff. This, coupled with high asthma rates in Imperial County, has led the local community to advocate for research to understand the potential impact of polluted air on health coming from several different sources. The investigator brought high school students from the Imperial Valley study area to the lab at UC Davis to introduce the students to the scientific process and understand the relevance of the study for their community. Students attended presentations, observed researchers extract particulate matter from air samples and test for toxicity, and learned how to give effective presentations.

Small Grant Project 10: Reducing Exposure of Farmworkers to Soil Chemical Fumigants by Promoting Sustainable, Chemical-Free Alternatives
Jesus Fernandez Bayo, PhD, UC Davis

Biosolarization is an effective alternative to traditional soil fumigation methods widely used in agriculture for pest management. Chemical fumigation is dangerous for farmworker health and for the environment, and although there are sustainable alternatives, farmers don't have access to information about the findings of recent research about the economic and health benefits of these practices. The investigator will develop outreach materials on the research findings of recent soil fumigation alternatives and the experiences of growers who have adopted these practices.

Small Grant Project 11: Poultry Health and Biosecurity Management through Youth Education in California
Megan Ouyang and Lindsey Garcia, PhD students, UC Davis

Students for One Health (SOH) is a UC Davis-based interdisciplinary student team that was established to address agricultural and food supply issues in single-family businesses in Sabana Grande, Nicaragua through the improvement of poultry health and management to increase meat and egg production. The investigators and SOH group will apply lessons learned in Nicaragua to develop an adaptable One Health curriculum in California and will engage local communities, in collaboration with 4-H groups, to pilot education programs and modify them to the needs of California's rural communities.

Small Grant Project 12: Promoting the Health of Yolo County Farmworkers
Matthew Bridges, student, UC Davis

The research team partnered with Rural Innovations in Social Economics, Inc. (RISE, Inc.) to engage Yolo County community organizations to promote farmworker health through convening meetings; health fairs; and a Farmworker Advocacy Forum, a full-day workshop for students, professionals, and farmworkers. This project also gives undergraduates a first-hand experience in community organizing and coalition building.

SECTION FIVE

Outreach, Training, and Education

The WCAHS outreach core builds and maintains relationships with agricultural stakeholders throughout California and the region through free safety trainings, resources, and events. Years of collaboration and support at the individual and organizational levels has resulted in an increasing number of new opportunities to expand the reach of the program.

Trainings

The WCAHS outreach core develops bilingual agricultural safety resources and delivers trainings on a variety of topics. Areas of particular expertise include heat illness prevention, sexual harassment prevention, and pesticide safety, among others. Trainings range in length from short tailgate trainings held in the field, to three-hour train-the-trainer courses for farm supervisors. The train-the-trainer format maximizes the reach of important safety information through the subsequent dissemination by the supervisors to their workers, resulting in the education of more individuals than could be reached by a single trainer from the Center. While most trainings are offered in English and Spanish, translators have been employed to assist in the training of Punjabi or Hmong workers. Remarkably, two outreach staff members reached over 3,000 people across California in this reporting period (see Table 1).

Table 1. Outreach Totals

Activity Type	2017 – 2018		2016 – 2018	
	# Events	# Reached	# Events	# Reached
Trainings and Workshops	35	1,502	47	1,851
Health Fair/Information Table	13	997	40	1,859
Presentations	9	745	286	1,317
Other	0	0	9	695
Total	**57**	**3,244**	**382**	**5,722**

Collaboration

The outreach core collaborates closely with the administrative core to communicate health and safety resources to WCAHS stakeholders. Outreach staff also partner with the evaluation team to assist Center investigators in translating research findings for wider audiences.

In addition to internal collaboration, WCHAS has formed strong relationships with California state agencies to promote health and safety in agriculture. Through the Worker Occupational Safety and Health Training and Education Program, an initiative of the California Department of Industrial Relations to reduce injury and illness in California's workers, WCAHS conducts Injury and Illness Prevention Program trainings, among others. A particular recruitment focus is paid to newly licensed growers and farm labor contractors.

WCAHS is also partnering with the California Department of Pesticide Regulation to develop pesticide safety resources for indigenous language speaking farmworkers. In the process of developing new training materials for its farmworker outreach staff members, the Employment Development Department of California sought input from WCAHS on training content and format to enhance the utility and cultural competency of the curriculum.

New Initiatives

Building on the success of working with the Health Initiative of the Americas at UC Berkeley, this year the outreach program created a small grant funding opportunity for organizations throughout the Western region. Of the 13 proposals that were submitted to WCAHS, five projects will be funded in the coming year including pesticide safety training in Arizona, outreach support for female farmers in Hawaii, and the development of safety materials for indigenous language speakers in California. These projects will expand the reach of the Center and advance the development of new resources for the agricultural community.