2021/2022 Annual Report
Year 5 Extended: Supplement

Southeastern Coastal Center for Agricultural Health and Safety

For More Information

Contact the Southeastern Coastal Center for Agricultural Health and Safety at http://sccahs.org

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Section I – Who We Are

Center Summary

The **Southeastern Coastal Center for Agricultural Health and Safety** (SCCAHS) explores and addresses the occupational safety and health needs of people working in agriculture, fishing, and forestry in Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Puerto Rico, and the U.S. Virgin Islands. The University of Florida is the lead institution of this center, partnering with the University of South Florida (USF), Florida State University (FSU), Florida A&M University (FAMU), Georgia Southern University (GSU), Emory University, and the University of the Virgin Islands. These universities are working together on a range of interdisciplinary research and educational projects designed to promote occupational health and safety among the 240,000 farms — estimated by U.S. Department of Agriculture — to be operating in the region, their operators, families, employees, and contractors, as well as those in the forestry and fishery industries.

Our Focus Areas

- Coastal fishery worker safety and health
- Heat stress and related illness
- Pesticide/herbicide exposure
- Opioid epidemic impact on farming communities
- Disaster vulnerability of migrant and seasonal farmworkers
- Feasibility of using electronic health records to describe the health of migrant and seasonal farmworkers, inform research and measure impact of interventions.
- Geospatial Analysis of agricultural worker and fisher health: Partnering to map regional clinical indicators and neighborhood environments
- Development and implementation of training programs
- Innovative approaches to foster research to practice

Goals of the Center

- Provide occupational safety and health education and training to the agriculture, fishing, and forestry workforce.
- Bring evidence-based, safety and health programs, developed through the other NIOSH-funded agricultural centers into the southeastern coastal region.
- When appropriate, translate programs into Spanish, and assist in supporting multilingual training efforts throughout the region.
- Conduct research to practice projects focused on:
  - Evaluating whether safety and education materials produce changes in safety behaviors.
  - Documenting hazards and risks in fishery workers; testing training materials aimed at reducing injuries.
  - Utilizing remote sensing technology to map pesticide uses.
  - Looking at heat stress tolerance.
- Conduct further research and applied projects based on needs as they arise.

Key Personnel

Planning and Evaluation Core

Center Administration

J. Glenn Morris, Center Director
University of Florida, jgmorris@epi.ufl.edu

Andrew Kane, Deputy Director
University of Florida, kane@ufl.edu

Tara Sabo-Attwood, Senior Advisor and Gator WATCH™ Director
University of Florida, sabo@phhp.ufl.edu

Joan Flocks, Emerging Issues Program Director
University of Florida, flocks@law.ufl.edu

William Hogan, MD, OneFlorida Surveillance Director
University of Florida, hoganwr@ufl.edu

Farah A. Arosemena, SCCAHS Program Manager, Co-Director Pilot/Feasibility Program
University of Florida farah.arosemena@ufl.edu

Evaluation Program

Sebastian Galindo, Evaluation Program Director
University of Florida, sgalindo@ufl.edu

Glenn Israel, Co-Investigator
University of Florida, gdisrael@ufl.edu

David C. Diehl, Co-Investigator
University of Florida, dcdiehl@ufl.edu

Cassandra Ward, Evaluation Coordinator
University of Florida, misscassw@ufl.edu

Outreach Core

Tracy Irani, Outreach Core Director
University of Florida, irani@ufl.edu

Ricky Telg, Public Issues Education (PIE) Director
University of Florida, rwtelg@ufl.edu

Ashley McLeod-Morin, Director of Communications
University of Florida, ashleynmcleod@ufl.edu

Angela Lindsey, Co-Investigator
University of Florida, ablindsey@ufl.edu

Lisa Lundy, Co-Investigator
University of Florida, lisalundy@ufl.edu

Martie Gillen, Co-Investigator
University of Florida, mgillen@ufl.edu

Key Personnel

Research Core

Occupational Health and Safety Surveillance of Gulf Seafood Workers
Andrew Kane, Research Project PI
University of Florida, kane@ufl.edu

Melvin Myers, Consultant
Emory University, melvinmyers@charter.net

Robert Durborow, Consultant
Kentucky State University, durburow@kysu.edu

Extent of Agricultural Pesticide Applications in Florida Using Best Practices
Gregory Glass, Research Project PI.
University of Florida, gglass@ufl.edu

Jane Southworth, Co-Investigator
University of Florida, jsouthwo@geog.ufl.edu

PISCA: Pesticide & Heat Stress Education for Latino Farmworkers That is Culturally Appropriate
Joseph Grzywacz, Research Project PI
Florida State University, jgrzywacz@fsu.edu

Antonio Tovar-Aguilar, Co-PI
Farmworkers Association of Florida, tonytovar@hotmail.com

Melinda Gonzales-Backen, Co-Investigator
Florida State University, mgonzalesbacken@fsu.edu

Thomas Bernard, Consultant
University of South Florida, tbernard@health.usf.edu

Heat Stress and Biomarkers of Renal Disease
Linda McCauley, Research Project PI
Emory University, linda.mccauley@emory.edu

Vicki Hertzberg, Co-Investigator
Emory University, vhertzb@emory.edu

Valerie Mac, Co-Investigator
Emory University, valerie.mac@emory.edu

Using Social Marketing to Prevent HRI and Improve Productivity Among Farmworkers
Paul Monaghan, Research Project PI
University of Florida, paulf@ufl.edu

Fritz Roka, Co-Investigator
Florida Gulf Coast University, froka@fgcu.edu

Maria Morera, Co-Investigator
University of Florida, mmorera@ufl.edu

Key Personnel

Research Core

Agricultural chemical exposure impact on kidney function in farmworkers
Christopher Vulpe, Research Project PI
University of Florida, cvulpe@ufl.edu

Nancy D. Denslow, Co-Investigator
University of Florida, ndenslow@ufl.edu

Stephen Roberts, Co-Investigator
University of Florida, smroberts@ufl.edu

Pilot/Feasibility Program

Pilot study of the acute psychological and health impacts of Hurricane Irma in UFAS extension workers
Lynn Grattan, Pilot Project PI
University of Maryland, LGrattan@som.umaryland.edu

Uncovering patterns of mental, physical, and occupational health issues among migrant farmworkers with different socio-cultural networks: A pilot study among Haitian and Mexican farm workers in Immokalee, FL
Gülcan Önel, Pilot Project PI
University of Florida, gulcan.onel@ufl.edu

Chronic low back pain in seafood workers: a pilot intervention study to identify modifiable work and movement solutions
Kim Dunleavy, Pilot Project PI
University of Florida, kdunleavy@phhp.ufl.edu

Pilot study of mobile app monitoring to prevent heat-related symptoms among Hispanic farmworkers
Juan Luque, Pilot Project PI
Florida A&M University, john.luque@famu.edu

Understanding the scope of the opioid epidemic for agricultural industries
Heidi Radunovich, Pilot Project PI
University of Florida, hliss@ufl.edu

A novel approach (sweat patches) to monitoring pesticide exposure in farmworkers
Gregg Stanwood, Pilot Project PI
Florida State University, gregg.stanwood@med.fsu.edu

Agro-ecological practices in the face of climate change: Resilience, sustainability, and preparedness in Puerto Rico
Antonio Tovar-Aguilar, Pilot Project PI
University of Florida, atovar@ufl.edu

Key Personnel

Pilot/Feasibility Program

Field evaluation of N95 filtering facepiece respirators against airborne dust and microorganisms during cotton harvest
Atin Adhikari, Pilot Project PI
Georgia Southern University, aadhikari@georgiasouthern.edu

A pilot study to assess personal PM2.5 exposure and respiratory virus Infections among farmworkers in the Southeast
Eric Coker, Pilot Project PI
University of Florida, eric.coker@phhp.ufl.edu

Developing an integrated decision support tool and network for WPS respirator compliance in Florida agricultural industries
Maria Morera, Pilot Project PI
University of Florida, mmorera@ufl.edu

Exploring mental health and natural disasters in agricultural communities in Puerto Rico
Marysel Pagán-Santana, Pilot Project PI
Migrant Clinicians Network, mpagan@migrantclinician.org

Section II – Planning and Evaluation Core

Administration

Overview

Led by Dr. J. Glenn Morris, Administration manages the overall activities of the Center to ensure the administrative structure (Figure 1) works synergistically to accomplish the following, 1) the coordination and integration of the Core Center grant components and activities; 2) oversight of the utilization of funds, including funds for pilot and feasibility studies; and 3) support active interaction among the Director, Core leaders, research project Principal Investigators, relevant institutional Division of Sponsored Programs personnel and the CDC/NIOSH Program Officer/Grants Management Specialist.

Key Accomplishments in 2021-2022

Throughout Year 5 Extended, Administration provided project coordination for faculty/staff to manage their programs and research studies – guiding decisions and allocating resources where most strategically needed. The administration component of the Planning and Evaluation Core fulfills many organizational objectives, bringing together internal collaborators, such as biostatisticians, data managers/analysts, evaluation/content area specialists, budget management and information technology, with external collaborators who include study investigators, pilot awardees, and advisory board members.

The roles of data management, analysis, and administration were reviewed during the monthly IOC meetings and bi-quarterly PI-to-PI/Program Director meetings, specifically in monitoring the quality of the data and adherence to study protocols and procedures, standard and ad hoc reporting, and working with biostatisticians to generate analysis data sets as Research Core and Pilot projects matured.

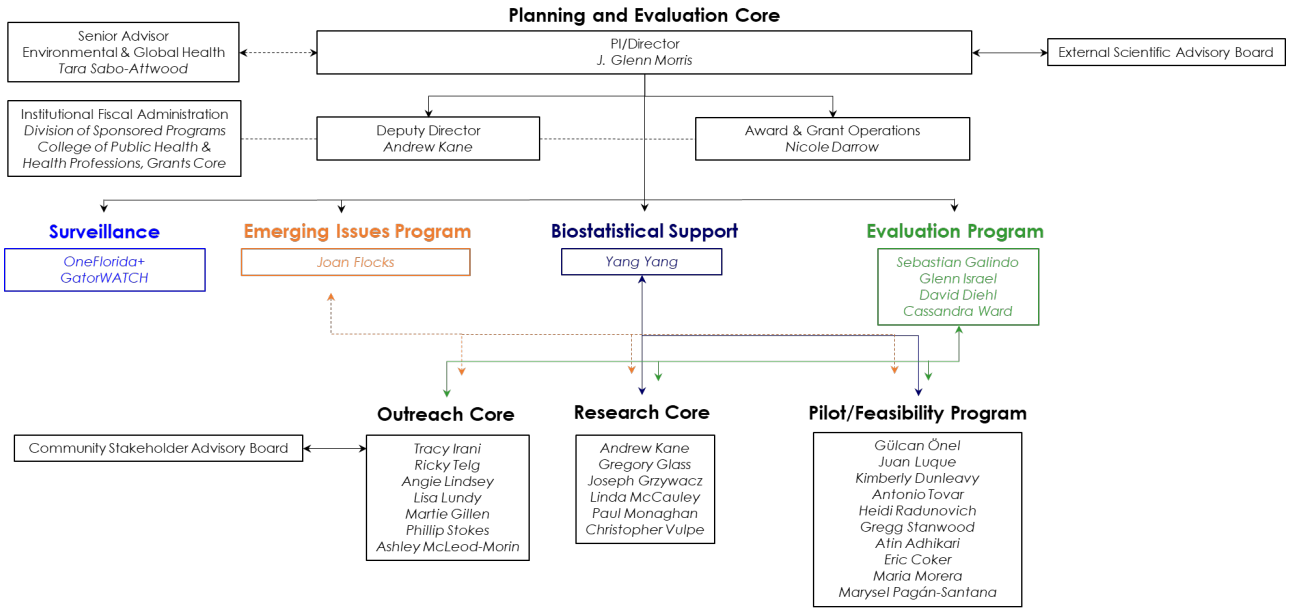


FIGURE 1. Organizational Chart, Southeastern Coastal Center for Agricultural Health and Safety (SCCAHS)

2021 – 2022 Supplement: Year 5 Extended

The 2021-2022 1-year extension of Year 5 was granted through the CDC/NIOSH research supplement, adding funds to the existing U54 grant to bridge Ag Center activities into the next award cycle. The supplement was used to enhance surveillance and outreach addressing emerging and other existing COVID-related issues among farmworkers and, partnered with OneFlorida+ Clinical Research Network to facilitate the preliminary collection of electronic health record (EHR) data to a centralized data repository. OneFlorida+ Is a valuable resource that brings together health data, research expertise and patient insights to deliver fast, trustworthy answers to important health issues, and to advance health outcomes across Florida. Specifically, two surveillance projects were designed that targeted electronic health records and waste-water based epidemiology. The projects developed for the Year 5 extended supplement provided a stronger baseline profile of the state of farmworker and fisher health so that we can improve on impact evaluation and better design activities and projects that have the greater potential to lead to the prevention of injury and disease.

Although projects in the Research Core offer active, population-based surveillance, Administration is exploring the geographic distribution of chronic disease/injury and associated cultural, occupational, environmental health and built-environment factors of Florida farmworkers. Establishing the surveillance program facilitated the preliminary collection of EHR data to a centralized data repository. The data collected will help investigators and the Community Stakeholder Advisory Board identify priority areas of concern for the Emerging Issues and Pilot/Feasibility Programs.

- Developed/submitted/awarded renewal application electronic health records (EHR) surveillance project with William Hogan, MD, MS, Director of Biomedical Informatics, Clinical Translation Science Institute. Dr. Hogan works with the Center and participating Federally Qualified Health Centers to embed EHR from farmworkers and fishers into the UF Health Integrated Data Repository (IDR), a large-scale database that collects and organizes information from across UF Health's clinical and broader research enterprises. The IDR will enable the Center to identify the state of the health of Southeast U.S. farmworkers and fishers and support stronger measurement of health impact from Ag Center interventions implemented.

- Developed renewal wastewater-based epidemiology (WBE) surveillance approaches with Tara Sabo-Attwood, PhD, SCCAHS Senior Advisor and Chair/Professor of Global Environmental Health. WBE is a rapid and cost-effective technique that measures human metabolic excretion products in wastewater as indicators of the health of a population. This tool provides near real-time information on a community scale about health, lifestyle behaviors and wellness without the need for individualized testing/monitoring. This approach has been successfully used to determine population level exposures to chemicals of concern (i.e. pesticides, metals), mental health (i.e. suicide mortality, depression), antibiotic resistance, and pathogen transmission. WBE has also been applied to estimate illicit drug consumption that include drug targets of common concern (i.e. cocaine, amphetamine, hydrocodone) and the emergence of new psychoactive substances. Measuring biological products that are excreted into sewer systems as a measure of 'health' has several advantages over routine public health/epidemiology methods and approaches, such as surveys; (1) wastewater analysis is not subject to response/non-response bias; (2) trends can be determined over short time frames and therefore can serve as an early warning or hot spot locator; (3) identification of true drugs of pathogens are determined by molecular approaches rather than recollection/belief; (3) contemporary non-targeted chemistry approaches can identify new emerging drugs; It is important to note that comparing data obtained from WBE with data obtained through other indicators (i.e. surveys, medical records) is an important area of continued work.

Surveillance

The Center has made continued to make surveillance a priority in the supplement Year 5 Extended. Year 5 laid the foundation to have a stronger baseline profile of the state of farmworker and fisher health so that we can improve on impact evaluation and better design activities and projects that have the greater potential to lead to the prevention of injury and disease.

The OneFlorida+ Clinical Research Consortium. The partnership with UF's OneFlorida+ has been led by Dr. William Hogan. One Florida is a collaboration of four research universities and 10 health systems in the state of Florida to build a robust research infrastructure for translational, comparative effectiveness, and implementation science research (Figure1). With its expansion to OneFlorida+, it will add two research universities and health systems from Georgia and Alabama.

OneFlorida+ was just approved for renewal funding as a Clinical Research Network (CRN) in the National Patient Centered Clinical Research Network (PCORnet) from the Patient Centered Outcomes Research Institute. OneFlorida+ thus has moved forward as one of eight CRNs in PCORnet phase 3 (beginning January 2022). Furthermore OneFlorida+ has a commitment to health equity and ensuring that it is broadly representative of the state of Florida 11,12. It also seeks to actively address health disparities by representing the diversity of Florida's people and leading and participating in studies that seek to understand and redress disparities. Inclusion of CMHCs that care for vulnerable populations such as migrant farmworkers and others with precarious employment is therefore a key goal of OneFlorida+.

The OneFlorida+ Data Trust is a centralized data repository operated at the University of Florida. It houses data on 17.2 million unique individuals dating back to January 2012. It includes EHR, claims, and death data, among other data types. Ten OneFlorida+ providers contribute EHR data (Figure 1), including patient demographics, diagnoses, procedures, observations (including vital signs), prescriptions, laboratory tests, and immunizations. Since its inception, the Data Trust has housed complete, statewide Medicaid data through a partnership with the Florida Agency for Healthcare Administration (AHCA). Each healthcare partner includes information about the deaths of patients occurring within their institutions. In 2020, OneFlorida+ purchased and linked a commercial death dataset from Datavant, fulfilling one of OneFlorida+ researchers' most common requests for new data. Datavant death data are refreshed monthly.

The goal was to determine the feasibility of leveraging OneFlorida+ resources for surveillance of various conditions in migrant farmworkers, especially chronic kidney disease of uncertain etiology. If the project demonstrated feasibility, we could then propose a larger project that would implement such surveillance to look for one or more such conditions. The components in service of the overarching project goal were: obtaining OneFlorida+ Executive Committee approval for both the pilot and larger possible project, evaluate the availability of occupation data from existing OneFlorida+ Data Trust sources, and work with Diane Gaddis at the Community Health Centers Alliance (CHCA) to identify Migrant and Community Health Centers (MCHCs) that would be valuable to onboard for the R01 and assess the availability of occupation data from these MCHCs that not currently part of OneFlorida+.

One Florida+ Accomplishments.

1. OneFlorida+ Executive Committee Approval

OneFlorida+ obtained Executive Committee approval for the upcoming R01 project. This includes approval to use the data in the OneFlorida+ Data Trust as well as the initiative to onboard new MCHCs into the Data Trust during the R01 project period.

2. OneFlorida+ Data Trust Occupation Data

Inquiries with existing EHR partner sites to the OneFlorida+ Data Trust showed that occupation data is not a required field in their EHR systems, is sparsely populated where available, and is often not a discrete data element.

3. Migrant and Community Health Centers

a. The team worked with Diane Gaddis at the CHCA to generate a list of ten MCHCs whom we can engage to participate in the upcoming R01. With Ms. Gaddis's help we have had preliminary discussions with two sites. While one site has declined to participate, positive communication is still ongoing with Manatee County Rural Health Services, Inc. Ms. Gaddis has already suggested a new site to engage and surveillance team is in preliminary communication with them.
b. MCHCs have an occupation data field with structured, codified values. This enables identification of migrant farmworkers. Initial results on how often the field is populated indicate a low rate of population of this field, based on which we can still identify thousands of migrant farmworkers among the 10 MCHCs.

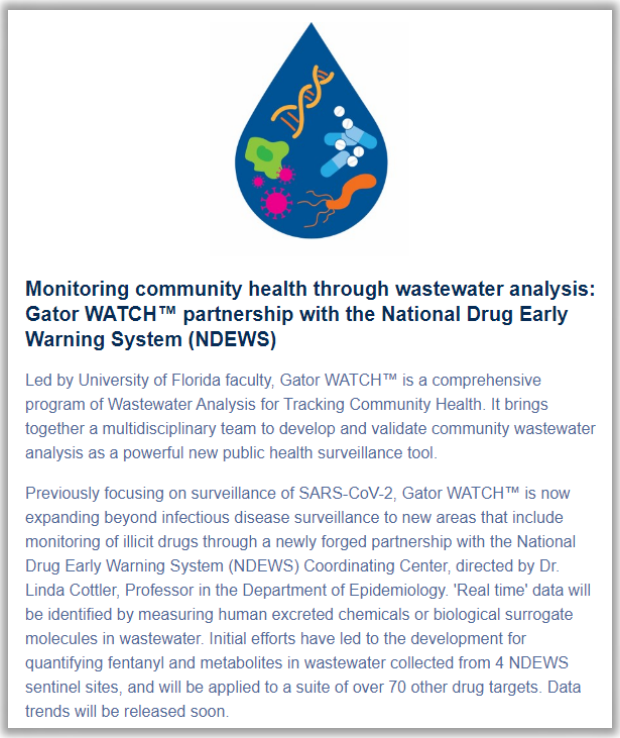
Products

This project generated preliminary data that was incorporated into the R01 proposal in the successful U54 renewal.

Gator WATCH™. The Gator WATCH™ Program, led by Dr. Tara Sabo-Attwood, is a powerful interdisciplinary public health surveillance tool for monitoring agricultural community health. Wastewater-based epidemiology (WBE) is a rapid and cost-effective technique that measures human metabolic excretion products in wastewater as indicators of the health of a population. This tool provides near real-time information on a *community scale* about health, lifestyle behaviors and wellness without the need for individualized testing/monitoring. This approach has been successfully used to determine population level exposures to chemicals of concern (i.e. pesticides, metals), mental health (i.e. suicide mortality, depression), antibiotic resistance, and pathogen transmission. WBE has also been applied to estimate illicit drug consumption that include drug targets of common concern (i.e. cocaine, amphetamine, hydrocodone) and the emergence of new psychoactive substances.

Measuring biological products that are excreted into sewer systems as a measure of 'health' has several advantages over routine public health/epidemiology methods and approaches, such as surveys; (1) wastewater analysis is not subject to response/non-response bias; (2) trends can be determined over short time frames and therefore can serve as an early warning or hot spot locator; (3) identification of true drugs of pathogens are determined by molecular approaches rather than recollection/belief; (3) contemporary non-targeted chemistry approaches can identify new emerging drugs; It is important to note that comparing data obtained from WBE with data obtained through other indicators (i.e. surveys, medical records) is an important area of continued work.

SCCAHS supported the development of GatorWATCH™ (now trademarked), a comprehensive program of *W*astewater *A*nalysis for *T*racking *C*ommunity *H*ealth. This program brings together a multidisciplinary team of research microbiologists, aquatic toxicologists, analytical chemists, environmental engineers, and small business partners to examine current limitations of community wastewater measurements for various biological and chemical markers which can increase the effectiveness of this public health surveillance tool. While the impetuous for Gator WATCH™ was the surveillance of SARS-CoV-2 in several wastewater systems in Florida (including Cedar Key since March 2020), our platform design affords us the ability to accommodate surveillance of other distinct markers that inform community health. In fact, we are now working with the current National Drug Early Warning System (NDEWS) Coordinating Center, housed at the University of Florida, to provide real-time surveillance chemical data that can be used as part their early warning systems to predict epidemics based on drug consumption. We intend to integrate data from several sentinel sites across the U.S that is collected through traditional (e.g. medical records, hospital admissions) and novel (e.g. rapid street reporting, social media) surveillance.



Monitoring community health through wastewater analysis: Gator WATCH™ partnership with the National Drug Early Warning System (NDEWS)

Led by University of Florida faculty, Gator WATCH™ is a comprehensive program of Wastewater Analysis for Tracking Community Health. It brings together a multidisciplinary team to develop and validate community wastewater analysis as a powerful new public health surveillance tool.

Previously focusing on surveillance of SARS-CoV-2, Gator WATCH™ is now expanding beyond infectious disease surveillance to new areas that include monitoring of illicit drugs through a newly forged partnership with the National Drug Early Warning System (NDEWS) Coordinating Center, directed by Dr. Linda Cottler, Professor in the Department of Epidemiology. 'Real time' data will be identified by measuring human excreted chemicals or biological surrogate molecules in wastewater. Initial efforts have led to the development for quantifying fentanyl and metabolites in wastewater collected from 4 NDEWS sentinel sites, and will be applied to a suite of over 70 other drug targets. Data trends will be released soon.

FIGURE 2. National Drug Early Warning System Weekly Briefing, February 11, 2022

As disease transmission and mental health are two health outcomes that can have tremendous impact on **agricultural communities in the Southeast**, Gator WATCH™ could provide rapid surveillance data (SARS, drugs, mental health-relevant medications) that would direct follow-up epidemiology/community efforts in several communities for which we already are interfacing with through SCCAHS. Of note, we have been successful at implementing Gator WATCH™ at varied locations, wastewater treatment plants (indicator of overall community) and in sewer systems (indicator of select sub communities). The overall goal would be to identify and prioritize several communities where this type of first-time surveillance would be performed, sampling as much as weekly. Surveillance data will be the first of its kind – creating the first WBE datasets for the agricultural communities and 2) provide early indicators of health of the communities that will be shared with our epidemiologists and community partners.

Publications

Rainey, A.L., Loeb, J.C., Robinson, S.E., Davis P., Song, L., Lednicky, J.A., Coker, E., Sabo-Attwood, T., Bisesi, J.H., and Maurelli, A.T. Assessment of a mass balance equation for estimating community-level prevalence of COVID-19 using wastewater-based epidemiology in a mid-sized city. *Sci Rep* **12**, 19085 (2022). https://doi.org/10.1038/s41598-022-21354-6

Emerging Issues

Overview

The Emerging Issues Program (EIP) assists SCCAHS in addressing new, emerging and re-emerging problems within their region. EIP works within the center to maintain connections with all projects, cores, advisory boards, and other stakeholders to identify, prioritize, and address issues that appear during the life of the center. The tasks of the EIP include identifying new AgFF worker safety and health issues in the region; prioritizing these issues; addressing prioritized emerging issues through small investments; and referring other emerging issues to appropriate resources.

Key Accomplishments in 2021-2022

Effort during Year 5 Extended reflects the specific aims as initially stated. The EIP continues to work within the Center, maintaining connections will all projects; cores; advisory boards; and other stakeholders to identify, prioritize, and address issues that appear during the life of the Center. The activities to date demonstrate progress within each of the program's four primary tasks.

Task 1. Identify new agriculture, forestry and fishing worker safety and health problems in the SCCAHS region.
Task 2. Prioritize emerging issues.
Task 3. Address prioritized emerging issues through small investments.
Task 4. Refer other emerging issues to appropriate resources.

Identify, Prioritize and Address Arising Concerns

The unique design of EIP allows SCCAHS to streamline the identification of new occupational health and safety issues, map their geographic/demographic span, assess the significance of the problem(s), and respond accordingly. EIP work coincides with the Pilot/Feasibility Program to target relevant, real-time need for research and encourage new investigators to apply for pilot funding to address emerging issues; contributes to the Outreach Core by promoting SCCAHS at meetings and conferences and participating in the development of materials; and, when necessary, rapidly funds programs to improve the health and well-being of disproportionately affected communities. In the past, examples of emerging issues identified and addressed by the program have included:

- Health status of temporary agricultural guest workers.
- Heat-related illness and kidney disease.
- Health impacts of sugarcane burning in Florida.
- Revised Worker Protection Standard respirator requirements.
- Domestic violence and reproductive health of farmworker women.
- Post-disaster housing and other needs in farmworker communities.

Joan Flocks, Director, played an integral role in exploring critical community concerns. In Year 5 Extended she contributed her extensive expertise to farmworker housing surveillance and heat related illness training. EIP is credited with providing a better understanding of the nature and cause of farmworker health disparities so that research PIs and the Outreach Core can work synergistically to address health and safety concerns.

Heat-related Illness - EIP continues to promote SCCAHS extensive research on heat-related illness (HRI) among agricultural workers by supporting R2P efforts by SCCAHS researchers. In Year 5, EIP collaborated with SCCAHS and other investigators in applications for continued research in monitoring and intervention related to HRI. EIP continues to contribute to the literature in this area and consults regularly with ongoing HRI researchers affiliated with SCCAHS.

The EIP completed the following activities during the supplemental year:

- Continued comprehensive research on the H-2A temporary agricultural guestworker program, and regional farmworker health for publications in *Journal of Immigrant and Minority Health and Ecology Law Quarterly*.

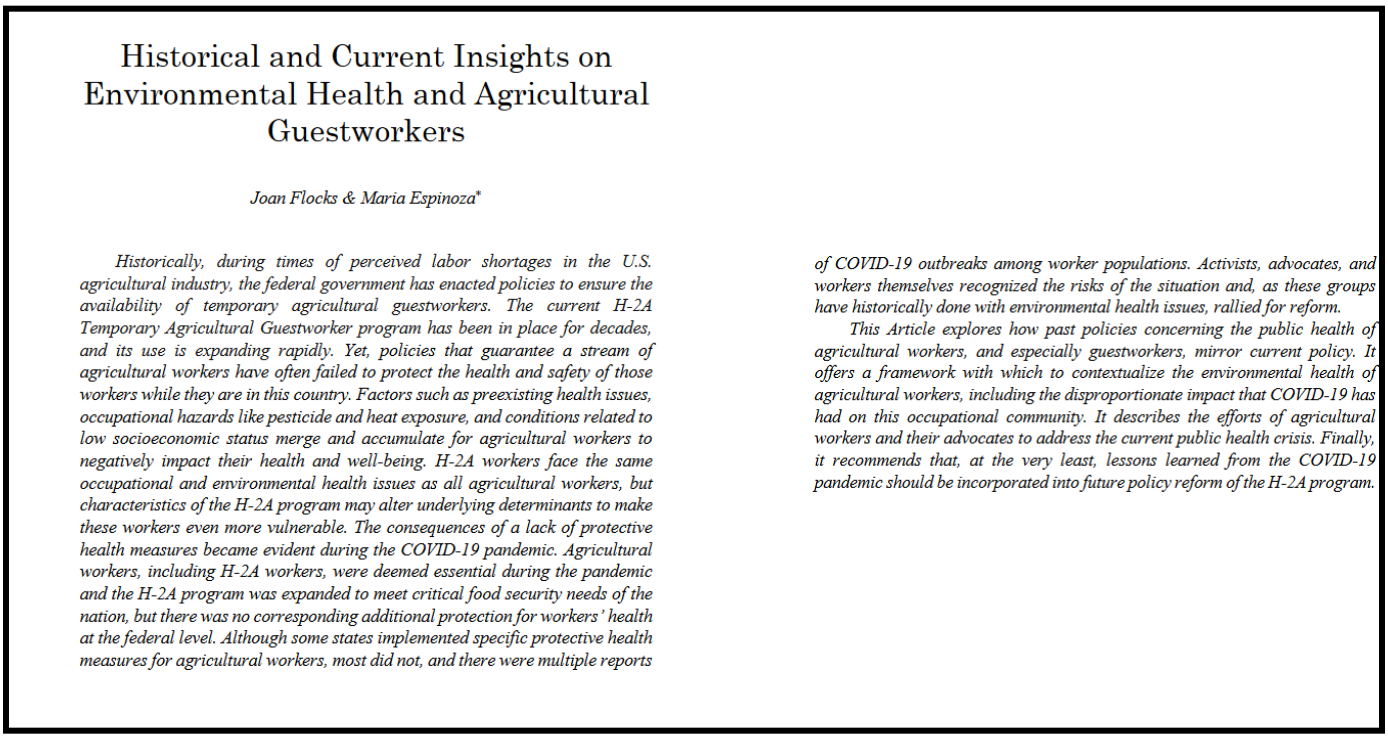
- Continued support and consultation for researchers applying for extramural funding to investigate field-based interventions to prevent heat-related illness and chronic kidney disease among agricultural workers.

- Provided input and support for ongoing SCCHAS research on agricultural worker housing in Florida. (See Figure 2. ISES International Society of Exposure Science, Poster)

- Made presentations on community-based research with agricultural workers; heat-related illness; and general agricultural worker health to Northeastern University's Myra Kraft Open Classroom; Farmworker Justice's symposium on environmental health; and the Florida Health Policy Leadership Academy.

- Prepared public comment document re: the Advanced Notice of Proposed Rulemaking for the Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings Docket No. OSHA 2021-0009 on behalf of a group of community-based and academic researchers who have worked together for more than a decade to address occupational and environmental health concerns, including heat exposure and heat-related illness (HRI), facing farmworkers in the United States. https://www.regulations.gov/comment/OSHA-2021-0009-0678

- Reviewed and provided commentary on the Farm Bill Law Enterprise's June 2022 Report on Farmworkers, developed to provide concrete recommendations for the 2023 Farm Bill. *http://www.farmbilllaw.org/wp-content/uploads/2022/06/Farmworkers-Report.pdf*



Historical and Current Insights on Environmental Health and Agricultural Guestworkers

*Joan Flocks & Maria Espinoza**

Historically, during times of perceived labor shortages in the U.S. agricultural industry, the federal government has enacted policies to ensure the availability of temporary agricultural guestworkers. The current H-2A Temporary Agricultural Guestworker program has been in place for decades, and its use is expanding rapidly. Yet, policies that guarantee a stream of agricultural workers have often failed to protect the health and safety of those workers while they are in this country. Factors such as preexisting health issues, occupational hazards like pesticide and heat exposure, and conditions related to low socioeconomic status merge and accumulate for agricultural workers to negatively impact their health and well-being. H-2A workers face the same occupational and environmental health issues as all agricultural workers, but characteristics of the H-2A program may alter underlying determinants to make these workers even more vulnerable. The consequences of a lack of protective health measures became evident during the COVID-19 pandemic. Agricultural workers, including H-2A workers, were deemed essential during the pandemic and the H-2A program was expanded to meet critical food security needs of the nation, but there was no corresponding additional protection for workers' health at the federal level. Although some states implemented specific protective health measures for agricultural workers, most did not, and there were multiple reports of COVID-19 outbreaks among worker populations. Activists, advocates, and workers themselves recognized the risks of the situation and, as these groups have historically done with environmental health issues, rallied for reform.

This Article explores how past policies concerning the public health of agricultural workers, and especially guestworkers, mirror current policy. It offers a framework with which to contextualize the environmental health of agricultural workers, including the disproportionate impact that COVID-19 has had on this occupational community. It describes the efforts of agricultural workers and their advocates to address the current public health crisis. Finally, it recommends that, at the very least, lessons learned from the COVID-19 pandemic should be incorporated into future policy reform of the H-2A program.

FIGURE 3. Critical publication on policy reform of H-2A Program

Addressing the scarcity of Florida farmworker data: Using geographic information systems to assess vulnerability in H-2A and migrant labor camp housing

Farah A. Arosemena, MPH[1], Joan Flocks, JD[2] and J. Glenn Morris, MD, MPH&TM[3]
University of Florida, [1]Emerging Pathogens Institute, Director, Pilot/Feasibility Program [2]Levine College of Law, Emeritus Associate in Law and Director, Social Policy Division Center for Governmental Responsibility
[3]Emerging Pathogens Institute, Professer of Medicine and Director

INTRODUCTION

Research examining farmworker housing is scant in the Southeast United States. The top five states with the highest number of H-2A workers are located in the southeastern coastal area, namely, Florida, North Carolina, and Georgia. The H-2A program allows U.S. employers or U.S. labor contractors who meet specific regulatory requirements to bring foreign nationals to the United States to fill temporary or seasonal agricultural positions. Florida, from 2017 – 2020 (Figure 1), had the highest number of H-2A workers petitioned with 40,018 workers (2017), 51,681 (2018), 67,137 (2019), and 67,802 (2020). Each of these employer-granted H-2A certifications are obligated to provide housing at no cost to their H-2A workers. Additionally, Florida migrant labor camp (MLC) permit holders are mandated to furnish housing to their migrant/seasonal workers as an incidence of employment, however the state of housing camps and sites in Florida have not been adequately researched.

FIGURE 1. FY 2020 H-2A workers petitioned by employers' states (Source: USCIS Office of Policy & Strategy)

This project aims to explore the use of Geographic Information Systems (GIS) mapping of Florida farmworker housing. Although GIS techniques are often utilized in occupational health and safety research and practice, serving as an integral tool for public health surveillance, it has not been utillilized to map Florida H-2A MLC sites.

METHODS

A secondary data analysis using GIS and electronically available published county-level Florida data was conducted. Data was collected through two methods:

1. Mapping aspects of the built environment related to health care access and transporation.
2. Exporting existing datasets and abstracting information published within the U.S. Census Bureau and Behavioral Risk Factor Surveillance System (BRFSS).

Five types of data were collected for each of the three regional areas targeted in the Northeast, Central and Suncoast (16 counties - Collier, DeSoto, Hardee, Hendry, Highlands, Hillsborough, Indian River, Lake, Lee, Okeechobee, Orange, Osceola, Polk, St. Lucie, Volusia):

1. farmworker housing inspection status and violations,
2. H-2A employer certification approvals,
3. county-level population demographics,
4. migrant health center locations, and
5. public transportation availability.

FIGURE 2. Tri-regional area with unsatisfactory H-2A housing sites

Data source	Years and population coverage	Size and geography	Agency
Migrant Labor Camps Inspection Reports and Data	2021 – 2022	Florida, Migrant Labor Camp Program: currently issues over 700 permits in 33 counties.	Florida Department of Health
H-2A Employer Certifications: H-2A Employer Data Hub	2015-2022: agricultural employers	United States, 257,000 H-2A worker positions certified	U.S Department of Labor
FL Health Charts: Community Health Assessment Resource Tool Set	2016-2020	Florida, U.S. Census Bureau and Behavioral Risk Factor Surveillance System (BRFSS) county-level data	Florida Department of Health: Division of Public Health Statistics and Performance Management
HRSA Data Warehouse: Find a Health Center	Current as of 8/10/2022	50 U.S. states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, Guam, and Palau.	Health Resources & Services Administration (HRSA)

TABLE 1. Candidate surveys/data sources for modeling farmworker housing inequities

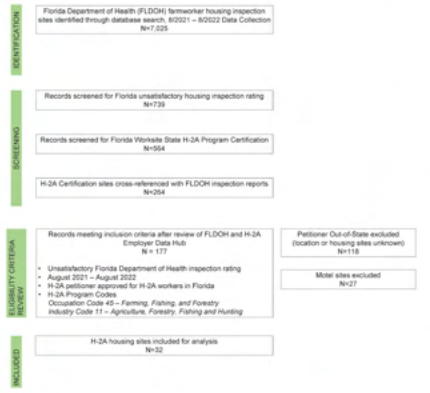


FIGURE 3. Flow diagram: Outline of the search and study selction process.

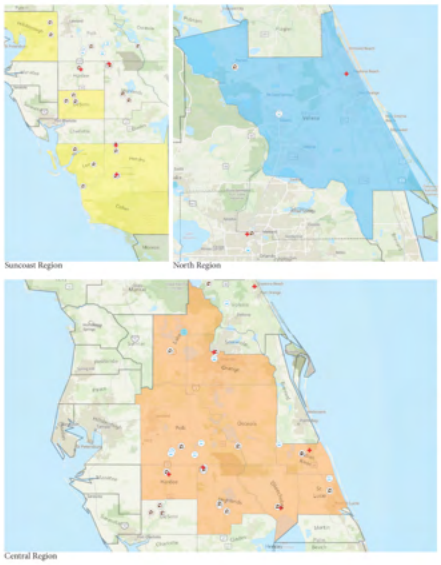


FIGURE 4. H-2A housing sites, migrant health centers and public transportation

RESULTS

The Florida Department of Health county inspection data spanned from August 9, 2021 to August 4, 2022. 32 H-2A certification holding sites (not incluing motels) were given an unsatisfactory inspection report. There are clear trends in resource distribution across the Northeast, Central and Suncoast Florida regions. There were no close proximity public transportation bus routes (i.e. within walking distance) to housing location. Migrant Health Centers were not easily accessible without reliable ground transportation. The tri-regional area has a lower Hispanic population (26%) than the U.S. national and state averages and a higher rate of the population living under the poverty level (16%) compared to 13.3% for the state and 11.6% in the U.S.

Agricultural worker population demographics are difficult to capture and are not accurately represented in the U.S. Census due to their unconventional housing arrangmenets, language/literacy barriers and mobility. The Hispanic population in the region are expected to be higher and resources tailored to their needs are not adequately available. Findings suggest area disadvantage, residential isolation, and limitations for broader social inclusion. This assessment underscores the need for greater built environment research and strategies to eliminate disparities among Florida farmworker populations and a stronger understanding of the health implications associated with neighborhood factors.

DISCUSSION

How do we move the needle from science to action and change the state of farmworker housing in Florida? Each year 150,000 to 200,000 migrant and seasonal agricultural workers and their families travel and work in Florida. Permits are issued to migrant labor camps so that housing can be evaluated against standards set by law. There are challenges though -

- H-2A housing petitioners are not required to be growers/employers and are often private companies/contractors out-of-state.
- Motels are often used for seasonal workers and because of short-term use and location, inspections must be timely, or sites close for the season and are missed.

Recruiting farmworker participants is difficult, and there is a need for evolved research design for investigating housing quality and health. Other data collection methods that could provide comparative data to data collected by research teams in California and North Carolina include,

1. Unsatisfactory inspection reports of migrant labor camps.
2. GIS mapping of housing sites, migrant health centers and other community infrastructure.
3. Physical inspection of housing units - photography and satellite imagery.
4. U.S. Bureau of the Census and BRFSS data.

Physical inspection of housing can add objective data. Macroenvironmental factors, (socioeconomic variables and the built environment), are among the principal determinants of inequalities in health among agricultural workers. These factors influence the living and working conditions of the individual, although there effect is moderated by local community conditions. A multisectoral action plan is required to tackle the problem of disadvantaged H-2A worker housing and the greater potential for place-based inequalities.

ACKNOWLEDGEMENTS

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UF UNIVERSITY of FLORIDA

Southeastern Coastal Center for Agricultural Health and Safety

FIGURE 4. International Society of Exposure Science (ISES), 2022: Poster Presentation.

Publications and Presentations

Publications

Chicas R, Elon L, Houser M, Mutic A, Gallegos E, Smith D, Modly L, Xiuhtecutli N, Hertzberg V, **Flocks J,** Sands J, and McCauley L. "The Health Status of Hispanic Agricultural Workers in Georgia and Florida." *Journal of Immigrant and Minority Health* 24:1129-1136 (2022).

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Lauzardo M, Kovacevich N, Dennis A, Myers P, **Flocks J**, Morris J. "An Outbreak of COVID-19 Among H-2A Temporary Agricultural Workers." *American Journal of Public Health* 111:571-573, 2021.

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Flocks J. "The Potential Impact of COVID-19 on H-2A Agricultural Workers." *Journal of Agromedicine* 25(4): 367-369, 2020.

Presentations

Arosemena, FA, **Flocks, J**, & **Morris, JG**. (2022, September 28-29). *Addressing the scarcity of Florida farmworker data: Using geographic information systems to assess vulnerability in H-2A and migrant labor camp housing* [Poster Presentation]. International Society of Exposure Science 2022 "From exposure to human health: New developments and challenges in a changing environment" Lisbon, Portugal. https://intlexposurescience.org/

"Farmworkers and Heat-Related Illness" (invited presenter). *Farmworker Justice – Environmental Justice Symposium,* Online, May 18, 2022.

"Agricultural Safety and Health" (invited presenter) with Serap Gorucu. *Florida Health Policy Leadership Academy*, Online, May 6, 2022.

"Centering Unheard Voices: Community-Driven Collaboration for Health and Safety with Farmworkers in the U.S." (panel) with Becca Berkey, Maria Carmona, Jeannie Economos, Joseph Grzywacz, and Benita Lozano. *Northeastern University's Myra Kraft Open Classroom,* Online, March 2, 2022.

"An Overview of Farmworker Issues in a COVID Environment" *Presentation for Class XI of the Wedgworth Leadership Institute*, Gainesville, FL, August 17, 2021.

"Environmental Justice" *Florida Natural Resources Leadership Institute – Justice, Equity, Diversity, and Inclusion Discussion Series,* Online, June 17, 2021.

"Facing the Sun: Farmworkers and Heat Impacts" *University of Florida Institute of Food and Agricultural Sciences Extension Symposium*, Online, May 5, 2021.

"Essential Workers" (panel) with Claudia Polsky, Mike Wilson, Estella Cisneros, and Fernando Torres. *University of California Berkeley Environmental Law Quarterly Symposium*, Online, April 16, 2021.

"An Outbreak of COVID-19 among H-2A Temporary Agricultural Workers in Florida" (lightning talk) *Agricultural Safety and Health Council of America Safety Summit*, Online, March 22-24, 2021. https://www.accelevents.com/e/ASHCASafetySummit.

"Forgotten Essential Workers: How Farmworkers Face More Environmental Justice Issues Amidst the Pandemic" (panel) with Kent Pinkerton, Fernando Serrano, Guadalupe Luna, and Margarita Garcia. *University of California Davis School of Law Symposium*, Online, February 25, 2021.

"Southeastern Coastal Center for Agricultural Health and Safety (SCCAHS)" *Environmental Protection Agency's Virtual Farmworker Community Visit*, Online, October 28, 2020.

Occupational Pesticide Exposure and Pregnancy Health in Vulnerable Workers" *Florida Local Section of the American Industrial Hygiene Association,* Online, October 16, 2020.

"Environmental Justice Panel" (panel) with C Zimring, T Thomas-Burton, and H Young. *Gators Going Green,* Online, October 8, 2020.

"Climate Change and Health: Understanding and Action" (panel) with JG Morris and L Chacos. *League of Woman Voters of Alachua County,* Online, August 26, 2020. https://www.facebook.com/watch/live/?extid=KsGIX3ufYDDYjjzZ&v=344960079868984&ref=watch_permalink

Evaluation Program

Overview

A formal monitoring and evaluation strategy is an interwoven component of SCCAHS. The Evaluation Program provides a framework for longitudinal, center-wide evaluations to assess the processes, outcomes, and impact of program and core activities; assists the leadership team in developing and implementing evaluation plans/logic models; and provides timely reporting as well as accountability information to the sponsoring agency.

The Evaluation Program aims to 1) Engage stakeholders to maintain a responsive and focused evaluation program; 2) Collect relevant monitoring and evaluation data from the center as a whole, the Outreach Core, and individual research projects; 3) Analyze and interpret data to establish the quality and effectiveness of the center as a whole, the Outreach Core, and the individual research projects; 4) Report and share evaluation findings and recommendations with key stakeholders; and 5) Maintain an open line of communication and engagement with other Ag Centers across the country.

The Evaluation Program provides leadership and guidance to connect program activities and goals for strengthened PI evaluation capacity and improved quality measurement. As research projects near completion and center efforts have reached the estimated point of producing intended outcomes, the evaluation program turned a significant portion of energy on assessing the impact of our Center during its first cycle to allow the evaluation team to have a better perspective of what has been produced since the Center's inception and develop materials that can provide an aerial view highlighting products, outcomes, and impact.

- The team joins the PI-to-PI/Director meetings to review ongoing work through the lens of each project's logic model – assisting PIs/Director's in connecting their short-term outcomes with broader long-term goals.

- The Evaluation Program continues to build a culture of evaluation that internally is broken down into simpler set of steps, beginning with brief indicator reporting forms that help guide the PI-to-PI meetings and externally links NIOSH Ag Centers core evaluation strategies.

- SCCAHS Impact Assessment: Developing a Common Evaluation Framework

- NIOSH: Heat Related Illness (HRI) Logic Model Development. The collaboration with NIOSH leaders and other Ag Centers to develop a cross-center logic model using contribution analysis as an approach to impact assessment

- Extension and Stakeholder COVID-19 Impact Evaluation

- Strategic planning is an ongoing Year 5 process that will expand the SCCAHS network, by identifying priorities and developing a feasible strategy to take the Center to its next level (from initiation/development to establishment and consolidation). This includes building strategic relationships and collaborations with other universities, organizations, and professionals in agricultural health and safety.

Key Accomplishments in 2021-2022

Monitoring

Data analysis on specific subsets and focus areas were conducted in 2021 and 2022 as a part of the larger evaluation program project that provided data on the impacts of the COVID-19 pandemic on Cooperative Extension personnel in the Southeast Coastal region.

Quantitative analysis. Dr. David Diehl led a study titled, "Work-Life Balance during the COVID-19 Pandemic: Insights from a Survey of Extension Professionals", with contributions from evaluation team members PhD Candidate July Nelson, Dr. Glenn Israel, and Dr. Sebastian Galindo. Results were presented at the Rural Sociological Society Conference in August 2022 and a complete manuscript submitted to the Journal of Human Sciences and Extension is currently in review. The conceptual model for the study is depicted in Figure X, followed by key findings from the leading research question.

Data analysis on specific subsets and focus areas were conducted in 2021 and 2022 as a part of the larger evaluation program project that provided data on the impacts of the COVID-19 pandemic on Cooperative Extension personnel in the Southeast Coastal region.

Research Question 1 focused on how work-life variables changed during the pandemic, with the hypothesis that work interference with personal life and personal interference would increase, and that work-personal life enhancement would decrease from before the pandemic to during the pandemic. As shown in Figure 2, the average score in the work interference with personal life subscale in April 2021 was not significantly different from the score in February 2020. In contrast, the personal life interference with work subscale significantly increased while the work-personal life enhancement subscale significantly decreased during the same period. For both subscales, the amount of change is relatively small, as indicated by Cohen's d.

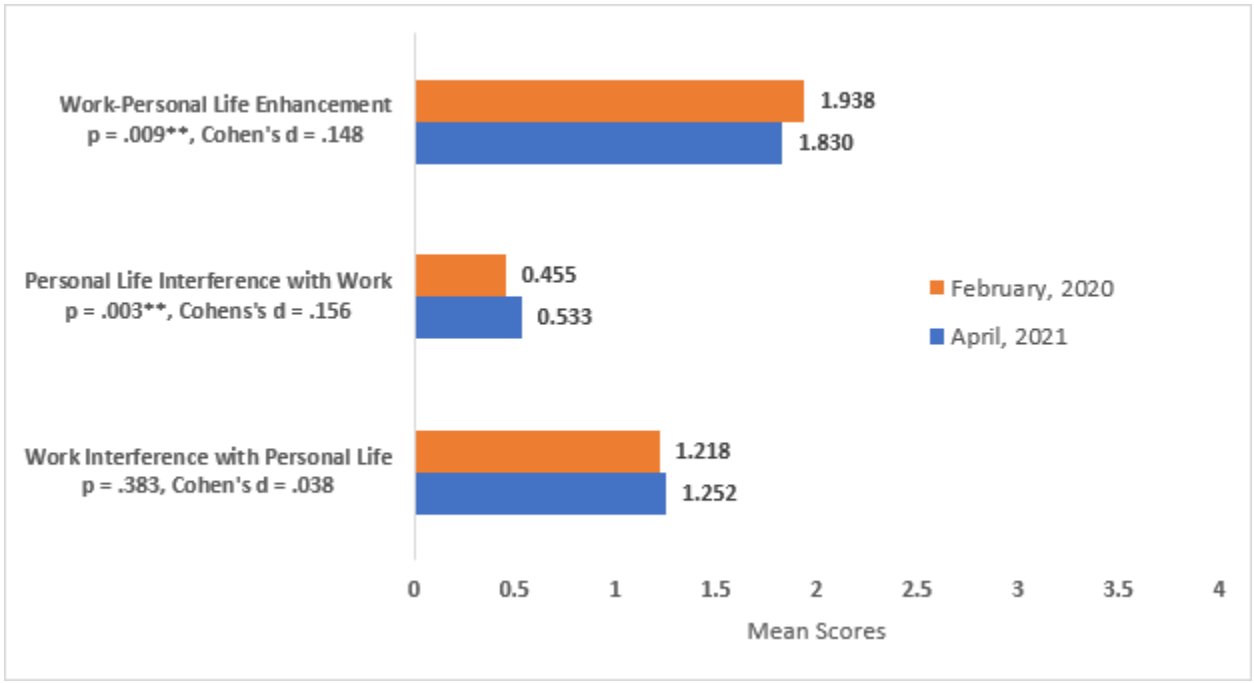

Figure 5. Mean Scores on Work-Life Variables from Pre-COVID to During COVID
Note: *p < .05, **p < .01, ***p < .001

Qualitative analysis. An additional study focused on examining qualitative data from a subset of potentially vulnerable extension professionals. Four undergraduate student interns (Anna Gonzalez, James Di Loreto, Sam Latsko and Mauro Columbo) trained and mentored by the SCCAHS Evaluation Director and Coordinator completed a study titled, "Examining Work-related Challenges of Extension Professionals during the COVID-19 Pandemic". The study focused on Extension professionals who reported experiencing Generalized Anxiety Disorder (GAD) symptoms in the 2021 survey to identify work-related challenges and possible strategies for addressing these. The specific subset included Extension respondents with GAD-2 scores greater than 3 and utilized thematic analysis of reported challenges. Coding and thematic analysis of responses were conducted using NVivo-12.

Stress was the most prevalent emotion during the pandemic, affecting individuals' ability to cope with various responsibilities and work tasks. Extension professionals reported feeling stressed about meeting work expectations while balancing the health concerns of family, coworkers, and themselves. Exposure to health risks when working in-office or traveling for work contributed to negative feelings of anxiety and worry. Extension professionals reported feeling isolation during the pandemic due to the restrictions placed on social interactions, especially in the workplace (Figures 5 and 6) .

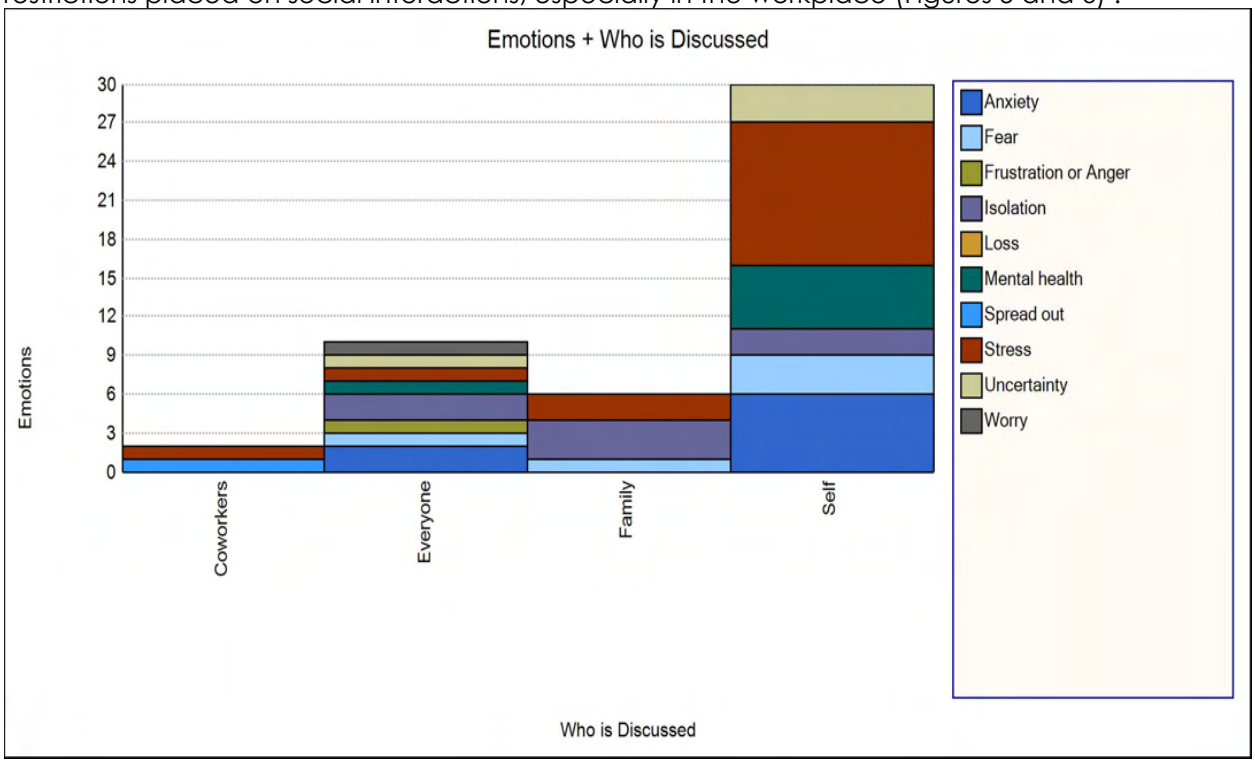

Figure 6. Prevalence of emotions reported by Extension professionals with heightened GAD-2 scores

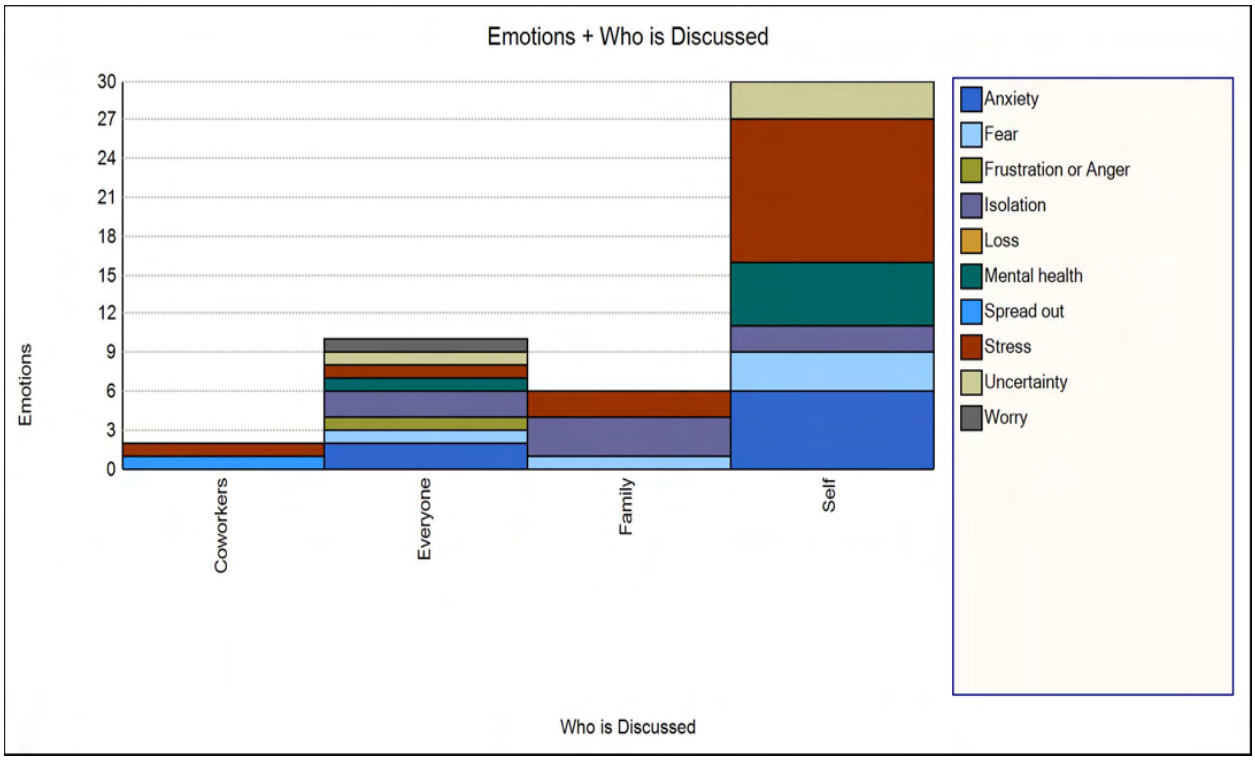

Figure 7. Prevalence of emotions reported by Extension professionals with heightened GAD-2 scores

Anxiety from the pandemic in general was reported by many respondents to cause difficulty focusing on work. Many respondents reported struggling with time-management, citing the need to have more time to create and modify virtual programs. Lack of direction and support from supervisors, especially the CEDs and DEDs, was reported heavily. Feelings of overall anxiety and worry associated with this. Productivity was the greatest reported work-related challenge associated with emotional distress. The lack of access to an office as well as the absence of face-to-face contact with clients contributed to reported feelings of isolation and loss of productivity (Figures 3 and 4). Implications for action by Extension administrators and supporting groups were identified. Results are highlighted here and were shared through oral presentations at the International Society of Agricultural Safety and Health Conference in June 2022 and Rural Sociological Society Conference in August 2022.

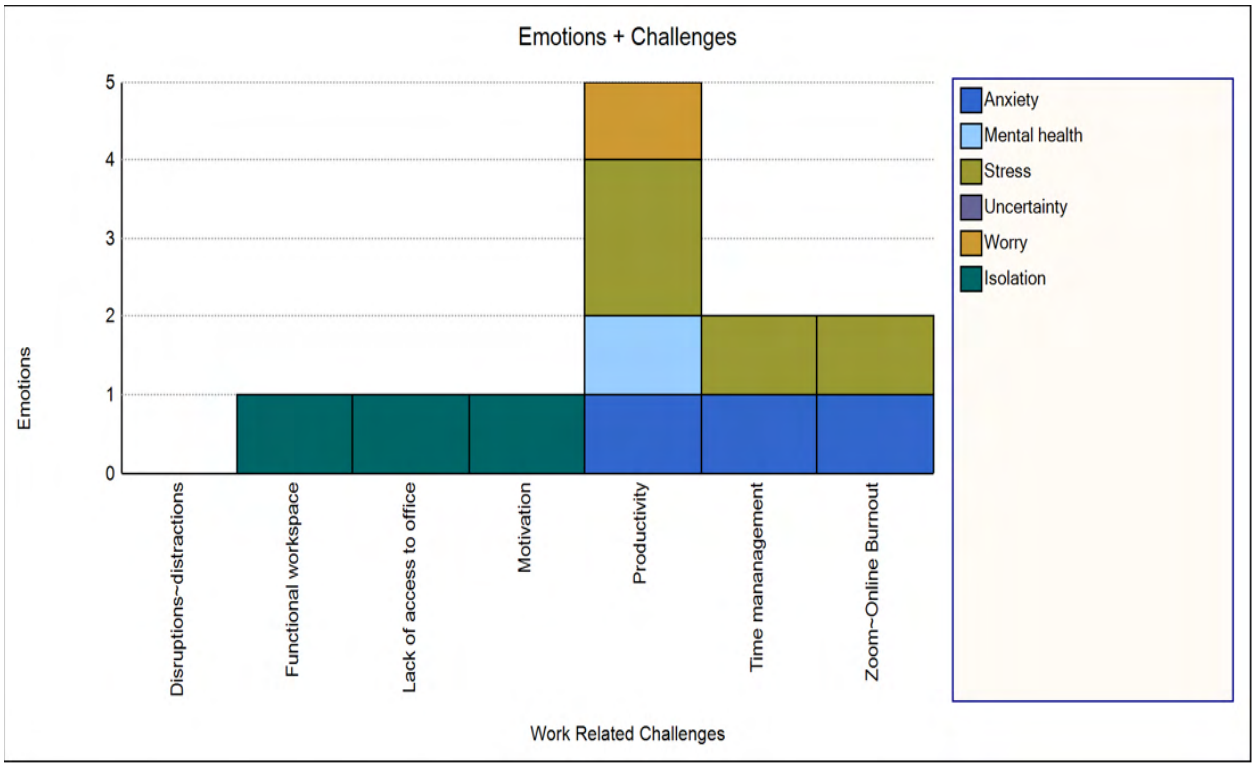

Figure 8. Reported emotions and associated challenges endured by Extension Professionals with heightened GAD-2 scores

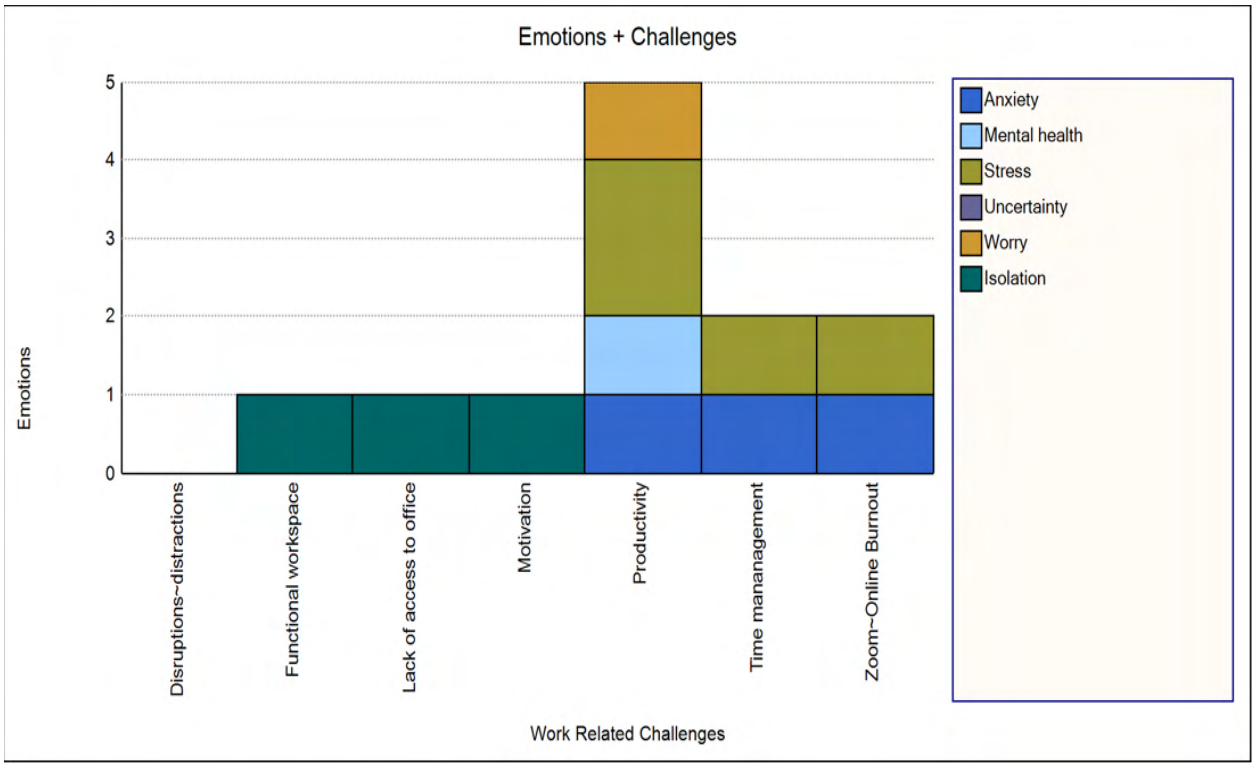

Figure 9. Reported emotions and associated challenges endured by Extension Professionals with heightened GAD-2 scores

Common Evaluation Framework

Due to challenges associated with the COVID-19 pandemic, particularly the difficulty in bringing people together, changes were incorporated into the development of the common evaluation framework. Instead, using the exploratory sequential design, suggestions, and recommendations on how to best approach this effort were developed, given the need for NIOSH to integrate data, to show contribution to impact, and to communicate the impact and value of the overall program. Two of the NIOSH programmatic areas (occupational pesticide exposure and mental health) were used for this study.

Using participatory approaches guided by the principles of developmental evaluation, this multi-stage mixed methods research project was meant to assist the NIOSH's Centers for Agricultural Safety and Health by providing recommendations for the development of tools and procedures that will foster a better exploration of their overall impact. Consequently, this study made the case for the use of theory-based evaluation approaches, particularly Contribution Analysis, to both gather strong evidence of impact and make solid contribution claims when assessing program impact. The data collection methods included archival research, informal group interviews, and a survey questionnaire. Statistical analyses were used for the numerical data and thematic analysis was used for the narrative data.

The purpose of the study was to strengthen the process of making contributions claims to impact by using Contribution Analysis, which is a theory-based evaluation approach already favored by NIOSH. From an evaluation perspective, it was important to come up with a solution that could help address the challenges associated with assessing the impact of a large-scale program. It was also important to understand the feasibility of capturing high quality data at the intermediate outcome level. Research was guided by the following objectives:

1. To engage key stakeholders in a participatory approach to help guide the development of the framework;
2. To develop evidence-based problem trees for two relevant thematic areas across Ag Centers;
3. To identify impact pathways and meaningful indicators for both thematic areas;
4. To validate the indicators, and impact pathways through a participatory approach;
5. To offer solutions for developing a rigorous common evaluation framework that supports the utilization of strengthened theory-based evaluation methods for impact assessment

This research was central to the successful doctoral defense presented by July Nelson in 2022 and presented at the International Society of Agricultural Safety and Health in June 2022.

Contribution Analysis

Alongside partners from the PNASH and SWAG centers, Dr. Sebastian Galindo a pilot project. Efforts contributed valuable insight on the use of contribution analysis to assess the impact the research centers are having within priority research areas. The cross-center logic model, evidence table, and narrative report that were produced are also useful materials that can be used by NIOSH and Center leaders to share with policymakers and leaders that can influence the future of AgFF workers.

Publications and Presentations

Anna Gonzalez, Jimmy DiLoreto, Mauro Colombo, Samantha Latsko, Cassandra Ward, Sebastian Galindo, Serap Gorucu, and Glenn D. Israel. "Examining Work-related Challenges of Extension Professionals during the COVID-19 Pandemic". Annual meeting of the Rural Sociological Society, Westminster, Colorado, August, 2022. Oral presentation.

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Diehl, D., Nelson, J., Israel, G., Galindo, S. (pending). Changes in Work-Life Balance during the COVID-19 Pandemic: Insights from a Survey of Extension Professionals. Journal of Extension. Submitted February 2022.

Gonzalez, A., Di Loreto, J., Colombo M., Latsko, S., Ward, C., Galindo, S., Gorucu, S., Israel, G. "Examining Work-related Challenges of Extension Professionals during the COVID-19 Pandemic." Rural Sociological Society Conference. August 2022. Oral Presentation.

Israel, G. D., Gariton, C. E., & James, H. E. 2022. Anxiety Symptoms among Extension Professionals' During the COVID-19 Pandemic with the GAD-2. Journal of Rural Social Sciences, 37(2), Article 6. Available at: https://egrove.olemiss.edu/jrss/vol37/iss2/6

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Galindo, S., Sampson, S., & Ramos, A. (2020). Agricultural Centers Roundtable – Impacts of COVID-19 on Extension Agents. 2020 State of the Science Meeting focused on Global Pandemics and the Agricultural Workforce: Research and Policy Implications, Virtual, Sept 18. http://www.sccahs.org/wp-content/uploads/2020/09/SOS-Impacts-of-Covid-19-on-Extension-Session7-compressed.pdf.

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Section III – Research Projects

Occupational Health and Safety Surveillance of Gulf Seafood Workers

Project PI: Andy Kane, UF Environmental and Global Health
Consultant: Melvin Myers, Emory University
Consultant: Robert Durborow, Kentucky State University

Overview

Commercial fishing represents some of the most dangerous work sectors in the world. Occupational fatalities and injuries in the fishing sector occur at rates much higher than national averages for all occupational fatalities and injuries. In the southeastern US, Florida has the highest fatality rate for seafood workers, and this third nationally only to Alaska and Massachusetts. Non-fatal, work-related injuries and negative health outcomes are common in many of the highly productive fishery sectors in the Southeast, including traumatic injuries including amputations and fractures, trunk and lower back strains; sprains; skin cancers; infections due to cuts, bites, punctures, entanglement; thermal exposure; inflammatory and rheumatoid conditions associated with repetitive motion; and work-related stress outcomes including depression, anxiety, fatigue, and alcohol and drug abuse (which, in turn, serve as secondary risk factors).

The overarching goal of this community-based research project is to support the safety and well- being of our fishery workforce through collaborative engagement with coastal seafood workers in Florida, Alabama and Mississippi, using a translational research-to-practice approach. This Ag Center project has two specific aims focusing on surveillance and hazard intervention.
Surveillance will be conducted using in-person survey interviews, and by making direct field observations to discern workplace hazards and risk factors associated with the dominant Gulf coast fishery subsectors: shrimping, fishing, crabbing, and oyster and clam harvesting.
Surveillance data will be used to identify and support relevant points of intervention for hazards in the different fishery subsectors throughout the study region. Through our Ag Center Outreach Core, we will engage with regional extension agents and fishery associations to translate project-related support materials, and lessons learned and intervention tools (from this project and from other NIOSH centers), to extended networking capacity and provide sustainable support for fishery workers in the study region and nationally. Specific aims for the proposed efforts are described below and represent TO (surveillance) to T2 (intervention and evaluation) phase contributions in translational public health research.

Specific Aim 1: Conduct 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. Focus will be in Cedar Key, Steinhatchee, Apalachicola, Eastpoint, Carrabelle, Pensacola and Mobile, where we have established community partnerships and working relationships with seafood workers.

Aim 1a: Establish project-specific working relationships with community partners and seafood workers in the five port cities within the study area to facilitate participant recruitment, survey piloting and implementation, collection of workplace observational data, and engaging with the seafood worker community to provide project-related feedback and support.

Aim 1b: Develop, pilot, validate and implement a questionnaire instrument in Gulf coast fishery communities to relate occupational health and safety with environmental and personal risk factors.

Aim 1c: Conduct workplace observations with fishery workers on boats, in fish, crab, oyster and clam processing facilities, and at points of distribution, to supplement questionnaire-based health and safety data; and

Aim 1d: Analyze survey and observational data to examine industry-related injuries, illnesses and mortalities as related to risk factors, past experiences and perceptions, individual understanding of best practices and protective technologies, and demographic attributes.

Specific Aim 2: Assess the potential to apply functional intervention(s) to address risk factors associated with specific hazards and negative health outcomes in the different fishery subsectors in the study region.

Aim 2a: Guided by outcomes of Aim 1, collaboratively engineer behavioral and/or mechanical interventions with community partners and seafood workers, and conduct field piloting. Points of intervention focus on outcomes that have greatest adverse impacts (morbidity, death), and that are common and contribute to (a) lost productivity and/or (b) reduced quality of life.

Aim 2b: Implement a limited number of hazard interventions germane to the occupational health and safety of the eastern Gulf coast seafood worker community and provide metrics to discern acceptance tonality of the interventions.

Key Accomplishments in 2021-2022

This community-based surveillance project focuses on filling an important gap on non-fatal injuries health outcomes for Gulf coastal commercial fishers. Data from in-person interviews and workplace observations has provided feedback, empowerment, and some interventions to support a culture of safety and reduce the burden of injuries and medical care for this vulnerable and mostly self-insured population.

Specific Aim 1a. Establish project-specific working relationships with community partners and seafood workers in participating port cities within the study area. These partnerships are critical to gain trust in the community, facilitate participant enrollment, support the project team in piloting and implementing in-person interviews, conduct workplace observations, and engagement with the seafood worker community to develop community-specific project feedback and support.

Dr. Kane and project team members have engaged with partners in participating communities in Florida, Alabama, and Mississippi, representing shrimping, fishing, oystering, crabbing, and coastal shellfish aquaculture. Project communications and updates have been shared with partners and stakeholders through with OysterSouth (national shellfish growers association with focus on Gulf and southeastern US), Cedar Key Aquaculture Association (clam farmers), Franklin County Seafood Workers Association and Water Street Seafood in Apalachicola (oyster harvesters, fishers, crabbers, shrimpers), Panacea Oyster Growers Association (oyster farmers), and Mississippi Commercial Fisheries United (shrimpers, oyster harvesters, fishers, crabbers, shellfish farmers).

Specific Aim 1b. *Develop, pilot, validate and implement an in-person questionnaire in Gulf coast fishery communities to relate occupational health and safety with environmental and personal risk factors.*

The questionnaire was validated and piloted in YR01 and 02 and implemented in YR02-04. Full set data analyses were conducted in YR05 with extension into "YR05-Extended." Expansion of participant numbers was limited in the second half of the project due to COVID-related travel restrictions and logistics. Excluding pilot studies, 55/73 participants representing 113 cross-sector commercial fishing jobs contributed data for 184 self-reported injuries. Participants represented multiple work sectors including commercial shrimping, oyster dredging, crabbing, oyster tonging, oyster farming and clam farming, each with varying vessel configurations, equipment and job tasks (Figure 1).

Participants across fishing sectors were predominantly white, male, with average age of 49 years. representing an aging workforce. Worker age and number of years work experience appear to be risk factors for number of injuries reported per FTE-year. Higher injury rates per FTE-year were associated with lower age quartiles (p=0.026); similarly, higher injury rates per FTE-year were associated with fewer years work experience (p=0.001).

Injury classifications and severity were defined by BLS's Occupational Injury and Illness Classification System (OIICS) and injury reports were normalized to worker FTE-years in their respective fishing sectors. Two-thirds of participants reported working in more than one fishing sector. Across fishing sectors there were 3,793 injuries per 10,000 FTE-worker years, including 2,104 injuries per 10,000 FTE-worker years that were associated with days away from work (DAFW) and/or limited worker ability to perform job tasks. Injury rates determined from this study are comparable to non-fatal injury rates reported for dungeness crab harvesters (2,470/10,000 FTE), and for workers engaged in multiple fishing sectors in North Carolina (5,836) and in Denmark (2,048). Comparatively, BLS non-fatal injury rates for commercial fishers in 2020 under-reports by an order of magnitude (490/10,000 FTE).

Figure 1. Typical work environments in commercial Gulf fishing subsectors represented in the present study. Left to right, first row: clam harvesting using overhead winch, clam harvesting by hand from the water; second row: oyster cage farming, oyster long line farming; third row: blue crab pot retrieval, oyster tonging; forth row: winch operation and setting shrimping gear

Traumatic injuries and disorders were the most commonly reported types of injuries, followed by diseases and disorders of body systems, and infectious and parasitic diseases. Open wounds were the most common traumatic injury reported, primarily associated puncture injuries from stingray and catfish spines, followed by traumatic injuries to muscles, tendons, ligaments, joints, that were associated with overexertion, back and shoulder strain, and soft tissue injuries to the hand or ankle. Overexertion across fishing sectors was associated with heavy lifting of harvest containers, baskets, bags, or coolers, and soreness/pain/hurt. Soft tissue traumatic injuries also included back strains, shoulder strains, and hand/ankle strains, as well as jellyfish contact dermatitis. More commonly reported injuries tended to have lower injury severity scores compared with infrequently-reported injuries that tended to be more severe and associated with more DAFW. The majority of reported injuries were involved with the work processes of setting/fishing/retrieving gear and processing the catch, with most injuries affecting upper and lower extremities (Figure 2).

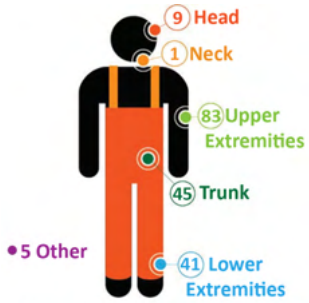

Figure 2. Body parts injured, all fishing sectors.

Specific Aim 1c. *Conduct workplace observations with fishery workers on boats, in processing facilities, and at points of distribution to supplement questionnaire-based health and safety.*

Workplace observations were recorded using photos and video, and when possible, engine room and grading equipment noise levels were measured. Workplace observations were conducted in YRS03-05 when COVID- related travel restrictions permitted. Onboard workplace observations from provided crucial insights to interpret survey data and provide hazard imagery to assess and compare across vessels and fisheries. Photo- and videographic data from workplace observations have been compiled and have been used to visualize risk factors as described by surveyed participants, discern variability of vessel structure and operations within fishing sectors, and consider opportunities for risk and hazard reduction that can be communicated in participating communities as part of project outreach and feedback.

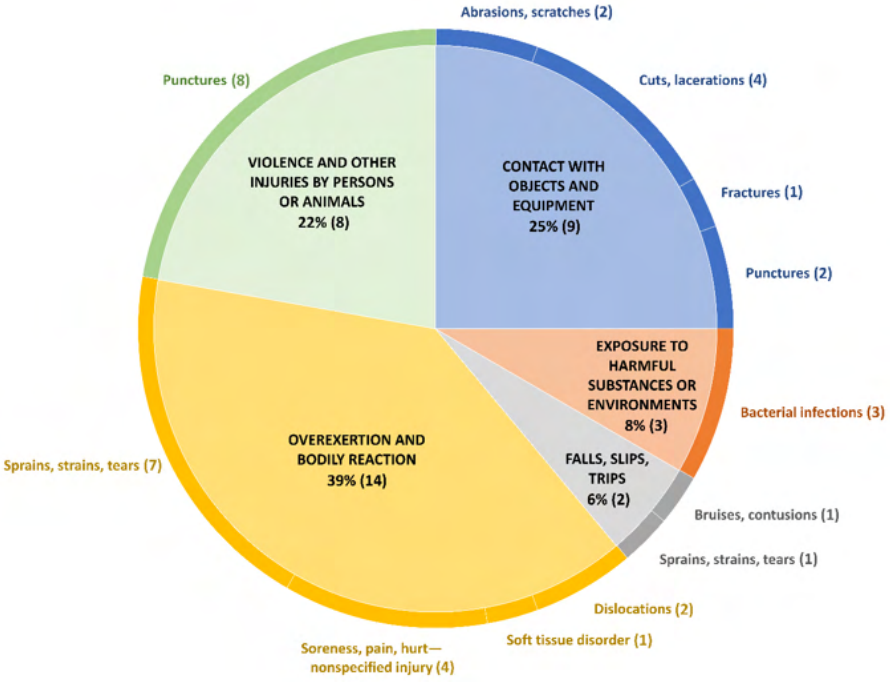

Figure 2. Distribution of Injury Events, i.e., interactions between the worker and their work environment (inner elements), and associated Injury Natures (outer elements) across fishing subsectors. Note that injuries associated with contact with oysters or barnacles reported by oyster farmers is included as "contact with objects and equipment" rather that contact with shellfish.

Specific Aim 2. *Assess the potential to apply functional intervention(s) to address risk factors associated with specific hazards and negative health outcomes in the different fishery subsectors in the study region.*

Data from questionnaires, workplace observations, and stakeholder discussions were used to inform a list of intervention opportunities to reduce injury risk hazards. With input from community partners, we observed severe or acutely debilitating injuries were more common on shrimp boats compared with vessels used in other fishing sectors and included winch-related injuries and being struck by gear. Less severe, but more common types of injuries include chronic lower back pain from heavy lifting and repetitive tasks, and hearing loss from working adjacent to engines, tumblers or sorters. Rushing, fatigue and working solo are risk factors across fishing sectors associated with a spectrum injury outcomes. Relevant intervention opportunities will be complied from surveillance data and shared with stakeholders as part of community outreach. Discussions for implementation options will provide pilot data to inform future adoption frameworks and the development of evidence-based intervention that provide efficacy and value across work sectors. Intervention opportunities discerned from current data include (1) dampening pads to reduce noise exposure associated with shellfish sorters, (2) hearing protection to reduce noise exposure associated with shellfish tumblers, (3) mechanical and behavioral adaptations to reduce risk of traumatic stingray puncture injuries, and (4) job task ergonomic considerations to reduce lower back strain and pain.

Workplace observations provided important perspectives for surveillance data analyses, discerning opportunities for hazard risk reduction and interventions that could have value and can be adopted by working fishers. **Top**, L to R: Discussions with the captain in the wheelhouse while underway on shrimp boat out of Biloxi, MS; Harvesting clam bags by hand in Cedar Key, FL; Harvesting clam bags using overhead winch. **Middle:** Setting skimmer frames (and nets) on shrimp boat using winch catheads; and Sorting clams - this process can take several hours each workday and involves noise levels that are associated with hearing loss. **Bottom:** Oyster tonging in Apalachicola Bay. Intervention opportunities pictured include: (1) use of overhead winch to reduce worker time in the water, risk of stingray puncture injury and lower back strain; (2) consistently using shuffle technique when doing in-water job tasks to avoid stingray encounters; (3) relocating

access for power take-off controls and extending level-winders away from winch drums; (4) Acoustic dampening pads for sorting machine diverters to reduce chronic noise exposure; and (5) Hydration, closed-heeled shoes and swimming lessons for oyster tongers who reported dehydration, slips, trips and falls, and drownings because many are not good swimmers or cannot swim.

Dissemination

Project updates and summary results have been shared with participating communities and fishing sectors during online or in-person stakeholder meetings throughout the project. This includes project engagement with the Cedar Key Aquaculture Association, Panacea Oyster Growers Association, Franklin County Seafood Workers Association, Mississippi Commercial Fisheries United and OysterSouth. Efforts in YR05+ have included communications with community and project partners to organize and implement outreach and future opportunities based on lessons learned. Partners included Mississippi Commercial Fisheries United, OysterSouth, Cedar Key Aquaculture Association, the Panacea Oyster Cooperative, the Florida Shellfish Aquaculture Association and the Seafood Management and Resource Recovery Team.

Conclusions

This community-based NIOSH research project developed new, and strengthened existing, academic-industry partnerships in commercial fishing communities along the northeastern Gulf coast. Research efforts provide non-fatal injury surveillance data for commercial Gulf fishers in Florida, Alabama and Mississippi. Project efforts have expanded stakeholder networks based on engagement with the project team. Working relationships with community partners within these industry sectors afford prospects for long-term working partnerships, opportunities for longitudinal surveillance, and development of numerous behavioral and mechanical interventions. Application of dissemination and implementation science approaches to discern intervention barriers and facilitators offers great opportunity to have "culture of safety" discussions, offer interventions based on community input and surveillance data, and develop evidence-based interventions that can be adapted for different stakeholder groups with similar hazard exposures.

Dissemination and translation of surveillance data, and application of implementation research in out-years will provide metrics to discern diffusion of knowledge shared with stakeholders, intervention adaptability for individuals and specific work sector environments, and facilitators and barriers to intervention adoption. Topical areas informed by our current studies might include: (a) "Winch Talk:" Community forum to discern self-reported winch injuries and close calls, risk factors, solutions, alternate configurations, and procedures for operating specific gear; (b) being a professional; (c) keeping your deckhand; (d) hearing loss; (e) chronic lower back pain; and (f) use of PFDs (life jackets).

Publications and Presentations

Dunleavy, K, Kane, AS, Coffman A, Reidy J, & Bishop, MD (2022). Outcomes of participatory ergonomics and self-management in commercial clam farmers with chronic low back pain: a feasibility study. *Journal of Agromedicine*, *27*(2), 217-231.

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Rash R, Brooks RM, Myers M, Durborrow R and Kane AS. 2022. Environmental and Human Behavioral Risk Factors for Traumatic Stingray Puncture Injuries in Cedar Key Clam Harvesters. Journal of Shellfish Research *In preparation*.

Kane, AS, Brooks RM, Rash R, Myers M, Durborrow R and Kane AS. 2022. Occupational health and safety of commercial clam farmers in Cedar Key, FL: Injury severity, job task limitations and intervention opportunities. Journal of Shellfish Research *In preparation*.

Kane AS, Brooks RM, Coker E, Gorucu S, Myers M, Durborrow R. 2022. Non-fatal injuries of commercial seafood harvesters in Gulf coastal Florida, Alabama and Mississippi. Journal of Agromedicine *In preparation*.

Kane AS. Co-host and Panel Lead: Emerging Issues in Occupational Health and Safety in the Southeastern US at 5th Southeast Regional Research Symposium (SERRS), March 21-23, 2022. This symposium serves five NIOSH centers in the SE region including faculty, professional students and trainees, departments of health and industry stakeholders within the region. Over 250 registrants and approximately 175 attendees with active engagement in sessions.

Website(s) and other Stakeholder outreach – include URL(s)
5th Southeast Regional Research Symposium (SERRS) website: https://www.serrsouthon.com
Kane, Co-host and co-organizer. This symposium serves five NIOSH centers in the SE region including faculty, professional students and trainees, departments of health and industry stakeholders within the region. Kane led an OHS Emerging Issues session during the 5th Southeast Regional Research Symposium.

Gulf Coast Grown, Online Support for Beginning Oyster Farmers. Website: https://oyster-culture.teachable.com
In association with the Institute for Food and Agricultural Sciences (UF IFAS) and Florida Sea Grant this NIOSH project will support occupational health and safety needs of coastal oyster farmers with safety outreach informed by studies with clam and oyster farmers in Florida, Alabama and Mississippi.

Contributions to these outreach programs provides an excellent research-to-practice conduit, and valued stakeholder support. https://oyster-culture.teachable.com/courses/1373938/lectures/34711172

Below the Waterline, an outreach exhibit focusing on a lost oyster fishery, disappearing oyster habitat, climate change, shell parasitism and oyster disease, species shifts. This art-and-science installation includes 23 framed photographs and mixed media and invites viewers to jump back in time through a portal, back before 2011, to when oysters grew at densities that supported a world-class fishery. The exhibit was designed to provoke discussion about the value of the habitat, the fishery, habitat management and restoration, and ecosystem services provided to the environment and to coastal communities. The exhibit was inspired and supported by oyster tongers from Apalachicola, Florida that we have worked closely throughout this project and who have greatly supported this occupational health and safety surveillance study. The exhibit was installed in the Education Center of the Apalachicola National Estuarine Research (Eastpoint, FL), where the seafood harvesting and resource management communities, in addition to the general public, can visit and engage with the exhibit and its content. Over 15,000 visitors from across Florida, the Southeast region, and the nation visit the Center annually.

Pesticide & Heat Stress Education for Latino Farmworkers That is Culturally Appropriate

Project PI: Joseph Grzywacz
Co-PI: Antonio Tovar-Aguilar

Overview

Farmworkers, the majority of whom are Latino immigrants from Mexico, experience elevated rates of occupational injury and illness. Chronic low-dose exposure to pesticides and extreme heat and humidity are major sources of poor occupational health outcomes. Recent revisions to the EPA's Worker Protection Standard (WPS-r) and growing concern about heat-related illness (HRI) necessitate the creation of safety education curricula that to minimize pesticide exposure and the deleterious effects of exposure to heat and humidity. Use of community health workers or *promotoras de Salud* (*promotoras*) is common in farmworker occupational health, but few WPS or HRI curricula have been developed for dissemination by *promotoras*, and there is scant evidence that *promotoras* are equally effective as "professional educators" who often have college degrees or highly specialized training in the cognate material. The growing concern over heat illness and recent revisions to the U.S. Environmental Protection Agency (EPA) Worker Protection Standard focused on pesticide exposure training led to PISCA's work on a new safety education tool.

PISCA's overall goal is to reduce the burden of poor occupational health outcomes among Latino farmworkers resulting from pesticide exposure and heat illness. To achieve this goal the proposed project has built a community-advocate-university partnership to accomplish three primary aims –

1. Create reproducible, culturally- and contextually-appropriate curricula for Latino farmworkers targeting pesticide exposure (suitable for meeting employer requirements under the revised WPS) and heat-related illness (HRI).

2. Determine the effectiveness of the developed pesticide and HRI curricula implemented by professional educators in promoting advocated safety behaviors.

3. Identify the comparative effectiveness of promotora-based implementation of developed pesticide and HRI curricula relative to the use of professional educators.

Key Accomplishments 2021-2022

In September 2021 the PISCA team collected social network, behavioral economics, and recent occupational injury and health concepts from immigrant Latino farmworkers in five labor crews. The five crews were deliberately selected to reflect distinct types of workers and corresponding implications for ensuring clearly defined boundaries of working-crew membership. The first was a new H-2A worker crew from a large operation. This crew had an established roster of members and photos with proper names of each farmworker that was used to guide workers' responses to the social network questions. The second crew represented an H-2A worker crew from a smaller operation without a formal membership roster. The third crew was a mixed crew of H-2a and seasonal farmworkers, and the fourth crew will be a crew of seasonal workers only. For these three types of crews our team created a complete roster of crew members before data collection, and then used that roster to guide workers' responses to the social network questions. The fifth and final crew was from a nursery whose crew is comparatively small and stable.

Table 1. Farm characteristics and pesticide use by study county and state, 2017 Census of Agriculture

County	Crop Operations	Crop Land Harvested, Acres	Insecticide applied, Acres	% Harvested Cropland treated with Insecticide
Georgia				
Echols	25	6,376	8,914	139.8%
Lowndes	217	19,345	15,439	79.8%
Lanier	60	22,263	23,507	105.6%
Cook	24	43,101	36,095	83.7%
Brooks	202	77,557	65,953	85.0%
Colquitt	269	112,217	91,423	81.5%
Florida				
Madison	336	35,012	20,263	57.9%
Hamilton	122	33,599	24,918	74.2%
Orange	320	10,624	7,147	67.3%
Volusia	556	17,020	11,440	67.2%
Putnam	255	10,943	7,885	72.1%

Source: https://www.nass.usda.gov/Quick_Stats/CDQT

PISCA was successful in recruiting crews and their members. There was a clear "opinion leader" as indicated by the large number of nominations by other farmworkers in the crew. A similar pattern emerged in the remaining 4 crews mapped. These preliminary data indicated: (1) farmworkers operative in discernible social networks, (2) those networks can be mapped, and (3) opinion leaders capable of disseminating OSH messages within the crew can be identified.

Preliminary analyses reinforce the basic precepts of social network science. First, there was substantial clustering of OSH outcomes within social networks. Next, for several OSH outcomes, the association of "opinion leader's" OSH beliefs and the average OSH belief for the crew was stronger than the association of a random crew member's OSH beliefs and the average OSH belief for the crew. These observations suggest that opinion leader's beliefs about OSH may set the tone for the beliefs of the entire working crew.

Finally, the data also demonstrate strong proof of concept that delay discounting underlies a variety of OSH outcomes. As expected, delay discounting had small-to-medium effect size correlations with physical health-related quality of life, mental health-related quality of life, perceived severity of pesticide exposure, intention to adhere to behaviors that minimize dehydration, and recent symptoms of pesticide illness. Collectively these data reinforce Bickel's and colleagues' (2012) belief that delay discounting is an etiological factor that transcends health outcomes through maladaptive behavior, showing consistent associations with several OSH outcomes.

Publications and Presentations

Publications

Grzywacz, J. G., Gonzales-Backen, M., Liebman, A., Trejo, M., Ordaz Gudino, C., Trejo, M., Economos, J., Xiuhtecutli, N., & Tovar-Aguilar, J. A. (2022). Comparative Effectiveness of Training Alternatives for the EPA's Worker Protection Standard Regulation Among Immigrant Latino Farmworkers. *Journal of occupational and environmental medicine*, *64*(2), 140–145. https://doi.org/10.1097/JOM.0000000000002368, PMID: 34456324.

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Grzywacz, J.G., Greer, A., Salzwedel, M., Crawford, K., Corwin, C., & Ramos, A.K. (April, 2021). Recommendations for efficient rollout of COVID-19 vaccine in the agricultural sector. Oral Presentation at the 2021 Planting Seeds of Partnership Virtual Conference, Co-Sponsored by the Central States Center for Agricultural Safety and Health and the Great Plains Center for Agricultural Safety and Health.

Trejo, M., & Marin, A.J. (July, 2021). Sociocultural dimensions and accessibility in instructional design. Workshop presentation at the Pesticide Applicator and Trainer Certification meeting. Denver, CO.

Grzywacz, J.G., Gonzales-Backen, M., Liebman, A., Trejo, M, Xiuhtecutli, N., Economos, J., Marin, A.J. & Tovar-Aguilar, J. A. (October, 2021) Comparative effectiveness of training alternatives for the EPA's Worker Protection Standard Regulation among Immigrant Latino Farmworkers. Oral presentation at the Annual Meeting of the American Public Health Association. Denver, CO.

Using Social Marketing to Prevent HRI and Improve Productivity among Farmworkers

PD/PI: Paul Monaghan
Co-I: Maria Morera
Co-I: Fritz Roka
Co-I: Neza Xuiticutli

Overview

Ongoing heat-related illnesses (HRI) and fatalities among Florida farmworkers underscore the need to identify economic incentives to occupational heat safety implementation in agriculture. Although culturally- and linguistically- responsive safety promotion interventions have proven effective in delivering important agricultural safety information to diverse farmworker populations, workplace barriers, such as piece-rate pay and limited access to rest breaks, continue to discourage HRI preventive practices. Three key problems limiting greater investment in heat safety are: i) insufficient documentation of the comparative effectiveness of competing models of farmworker safety promotion, ii) a paucity of observational data linking safety behaviors to health outcomes, and iii) a lack of translation between health outcomes and industry benefits.

The overall goal of this research project is to elucidate factors linked to organizational demand for farmworker safety. The project is guided by the following three aims:

1. Utilize social marketing research to educate and motivate field supervisors and piece rate harvesters to follow HRI recommendations, including through culturally appropriate social media platforms to reinforce behavior adoption in the field.

2. Determine the effectiveness of the social marketing approach in comparison to existing HRI educational programming currently used in Extension and employer-based models of safety promotion.

3. Establish the relationship between hydration interventions, changes in safety culture and productivity levels by measuring output per worker in order to incentivize investment in farmworker safety.

Key Accomplishments in 2021-2022

Summary

The R21 project had three aims; to use social marketing research to help workers and supervisors to follow HRI recommendations, compare that approach with existing HRI educational programming currently used by employers and establish a relationship between hydration interventions and productivity by measuring output per worker. Measures included pre and post knowledge surveys for those groups that received training, daily surveys of heat safety practices and symptoms experienced, urinalysis (USG) at the beginning and end of each workday, detailed productivity on each worker provided by the employer and environmental data (WBGT) during the hours worked using the Florida Automated Weather Network (FAWN).

The investigative team implemented the research in the field three times. First, as a pilot study in May 2019 to test our tools and methods with a tomato producer in Manatee County, 39 workers were enrolled, and data collected over three days of harvesting. In May 2021 a partnership was established with a new grower in Clewiston and the team repeated the data collection with four

harvesting crews (n= 89). Two of these crews (n=51) received a 45- minute training one week before data collection using the PISCA heat safety curriculum. The third round of field data collection in May 2022, compared a modified training intervention with one crew (n=21) with two crews (n= 38) that only received company provided training. In addition to the field data, we conducted three focus groups in Immokalee with tomato harvesters in February 2020 to better understand worker's perceptions and behaviors toward heat safety. During the COVID pandemic, we conducted a phone survey with the Farmworker Association of Florida of 67 farmworkers using their membership list. These interviews focused on the impact of COVID on their work, their knowledge of COVID and attitudes towards a vaccine.

Our accomplishments include the development of a comprehensive data base that documents worker's perceptions and experiences of working in high heat conditions. The three field data collection efforts yielded over 900 variables from nine days of harvesting work, including baseline measures of BMI and USG, mid-day measures of USG, and end of day measures of USG for a total of 1,300 urine samples. In addition, we collected detailed information from 177 workers on their knowledge, attitudes and self-reported behaviors regarding heat safety, hourly measures of their productivity along with the environmental conditions (WBGT) for each of the hours they worked over those nine days. We have established partnerships with researchers in IFAS (Agricultural and Bio Engineering, Food and Resource Economics Department), the University of South Florida (Dr. Tom Bernard, Dr. Rebecca Lopez) and with faculty in occupational safety at the School of Public Health at the University of Illinois, Chicago. Each of these partnerships will help to fully analyze and publish results from different segments of the data base.

The project conducted a complete review of available heat safety programs including PISCA, the WCAHS Heat Illness Prevention curriculum, the PNASH Heat Education Awareness Tools (HEAT) and NIOSH materials. We have synthesized the most relevant components for Florida into a draft curriculum called PROTECTORES which highlights 11 best practices for farmworkers. We will continue to work with The Farmworker Association of Florida to adopt this comprehensive program in its future trainings and our grower partner has requested that we conduct a heat safety training with their entire labor force. A future goal of this research effort is to update all IFAS Extension heat safety training with this new curriculum that is culturally relevant, tailored to the conditions and agricultural workplaces in Florida and which uses social marketing insights to change behaviors.

Implementation and Evaluation of Heat Safety Intervention: Final Year

The final year of the project was devoted to preparation and execution of the third wave of field data collection in Clewiston, developing the modified training curriculum, and the cleaning and organizing of the complete database into SPSS. Weekly meetings were held with the community partner (FWAF) to plan for the field data collection, and we made several trips to Clewiston to meet with our grower partner and make visits to farmworker housing to introduce the project and establish relationships. This was the first opportunity for the new director of FWAF (Neza Xuiticutli) to participate in this NIOSH grant and to get to know our grower partner and his operation. A review was conducted of existing online heat safety curricula (PNASH, WCAHS, PISCA) and a synthesized version focusing on best practices was developed and delivered in April and May, 2022, followed by three days of data collection. Since May, the team has been cleaning and organizing the data set, editing a draft publication, and meeting with researchers (IFAS, University of South Florida, University of Illinois Chicago) to begin collaborations on data analysis and publications. These collaborators have expertise in occupational health, agricultural economics and statistics. In July the team worked together to submit a successful award nomination to the EPA "Lets Talk About Heat Challenge" (https://www.epa.gov/innovation/lets-talk-about-heat-challenge).

Publications and Presentations

The project produced one journal publication (Morera et al. 2020), one Extension publication (What the Agricultural Sector Needs to Know about HRI, Monaghan et al., 2020), which is currently being translated into Spanish, one published conference abstract (Agromedicine, 2021), and presentations at ASHCA (2020) and the Society for Applied Anthropology (2021). Two additional publications are in draft form and are currently being revised by the authors. A PhD student in Agricultural Education and Communication is drafting a publication using results from the COVID phone interview study conducted in 2021.

Morera, M.C., Tovar-Aguilar, J.A., Monaghan, P.F., Roka, F.M., & Perez-Orozco, J. (2021). Going the [social] distance: Safety and productivity in Florida agriculture during COVID-19. Presented at the 2021 Virtual Meeting of the Society for Applied Anthropology, March 26.

Morera, M., Tovar, A., Monaghan, P. and Perez-Orozco, J.J. (2021). Going the distance: Safety and productivity in Florida agriculture during COVID-19. *Society for Applied Anthropology*. Linking Social, Cultural and Physical Ecologies. Virtual.

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Heat and Pesticide Stress in the Kidney

PD/PI: Christopher Vulpe

Overview

Agricultural workers in hot and humid climates are subjected to a unique combination of occupational stressors that impact health. An epidemic of chronic renal disease of unknown etiology in primarily young agricultural workers of Central America and other countries has focused concern on potential occupational hazards affecting kidney function. Specifically, heat stress in agricultural workers may alter and interact with chemical exposure to impact kidney function. However, no study to date has examined whether heat stress increases the renal toxicity of agricultural chemicals to which farmworkers are exposed. Ultimately, it will be important to determine whether such an interaction occurs among workers under field conditions. A first step is demonstration under controlled conditions whether or not this interaction exists in a systematic animal study. The central hypothesis in this two-year exploratory study is that heat stress comparable to that experienced by farmworkers increases the renal injury from nephrotoxic insecticides and herbicides.

Aim 1: Characterize the nephrotoxicity of the most commonly used formulations of an insecticide, permethrin, and two herbicides, paraquat and glyphosate in the rat. These pesticides are chosen based upon existing evidence of nephrotoxicity in laboratory animals, evidence of an association between exposure and renal disease in farmworkers, and extensive agricultural use in the Southeastern U.S.

Hypothesis: Sub-chronic exposure to permethrin, paraquat, and glyphosate commercial formulations produces renal injury in the rat.
The study team will: a) establish dose-response relationships for nephrotoxicity of each pesticide formulation; b) develop a descriptive profile of the renal toxicity of each agent based upon histopathology and patterns of elevation of existing renal injury biomarkers; c) comprehensively assess the biological response of the exposed kidney through coordinated assessment of changes in gene expression and metabolism.

Aim 2: Develop a model of hyperthermia and mild dehydration in the rat resembling heat stress in Southeastern US agricultural workers.

Hypothesis: Hyperthermia and dehydration comparable to that observed in Southeastern U.S. farmworkers produces minimal evidence of renal injury using standard assessment methods.
The study team will: a) determine the influence of elevated ambient temperature on core body temperature and dehydration in rats; b) develop a set of exposure conditions producing core body temperature elevations and dehydration comparable to those observed in farmworkers in the ongoing NIOSH Girasoles study; and c) determine whether hyperthermia produced in the model is associated with renal injury, and if so, develop a descriptive and molecular profile of renal toxicity as in Aim 1.

Aim 3: Determine the combined effect of heat stress and pesticide exposure on renal injury in rats.

Hypothesis: Heat stress produces a significant increase in the renal injury produced by pesticides.
The study team will: a) assess the nephrotoxicity of permethrin, paraquat, and glyphosate in the presence and absence of heat stress using doses and conditions established in Aims 1 and 2; b) determine whether the effects of heat stress and pesticides on the kidney are interactive, i.e., greater than additive; c) evaluate the biological and pathological effects using both traditional and molecular endpoints. Together, this two-year study will provide a critically needed animal

study on the potential role of two commonly encountered conditions for Southeastern farmworkers, heat stress and pesticide exposure, on kidney function. This effort will inform the development of mitigation strategies, if necessary, to prevent or minimize risk to farmworkers. In addition, this work establishes a framework for the subsequent evaluation of additional pesticides of concern identified by ongoing work within the NIOSH Agricultural Health Center at the University of Florida.

Key Accomplishments in 2021-2022

The project was designed to begin to understand factors influencing chronic kidney disease of unknown etiology (CKDu) that afflicts agricultural workers. This disease is also known as Mesoamerican Nephropathy due to the agricultural workers, of relatively young age (<40 yrs), that were first diagnosed. These workers have little evidence of diabetes or hypertension. Various causes have been suggested for this disease including dehydration, heat stress and exposure to pesticides or other nephrotoxic substances such as heavy metals or silica. We proposed to use rat as a model to determine if exposure to pesticides or heat stress could influence kidney disease. We designed our project around current use pesticides that had been linked to kidney disease and aimed to test whether heat and mild dehydration could also affect the disease.

Additional activities were included for the research supplement to compare the effect of repetitive versus single acute heat stress and pesticide exposure on renal injury and renal function recovery in rats and to assess novel urinary biomarkers of renal disease in farmworker population with documented kidney disease. The investigative team found the rat to be an excellent model for studies. Several pilot studies were performed to determine the concentrations and times of exposure of the pesticides that could produce kidney disease. It was also determined how the team could gently raise the core body temperature of rats by one degree to simulate what workers in the field may experience. In initial studies, the focus was on the renal effects of acute short-term continuous exposures, similar to what a farmworker would be exposed to during 7-14 days of shift work. Investigators evaluated glyphosate, paraquat, and permethrin exposure across a range of relevant doses and time periods varying from one day to 14 days for evidence of renal toxicity, and importantly evidence of kidney histopathologic changes. Importantly, all of these studies were done at sub-lethal doses with no observable systemic toxicity.

In addition, kidney markers in a farmworker population with documented kidney disease seem to parallel the biomarkers we have found in rats. We also developed novel biomarkers based on extracellular vesicles, their lipid composition, and their miRNAs.

Results

The major goals were (1) to refine our exposure studies using a repetitive exposure model and (2) use canonical biomarkers for kidney disease in a human population and compare these to novel biomarkers associated with extravesicular particles extracted from human urine.

A repetitive exposure dosing study of glyphosate (200 mg/kg-day), and paraquat (25 mg/kg-day) on rats was conducted for 8 weeks. Rats were gavaged with glyphosate for 5 days per week or paraquat for 1 day per week. Control group rats were dosed with water for 5 days per week. Urine samples were collected at baseline (0 wk), every two weeks, and at the endpoint (8 wk) for renal function biomarker investigation. Rat kidneys, livers, and blood samples were harvested every two weeks, and at the endpoint for time-response renal damage analysis. Rat kidneys from exposed and control rats will be examined through histology with multiple stains and different analyses. Analyses will include complete hematoxylin and eosin (H&E), Jones stain, PAS (Periodic acid–Schiff) and selected trichrome and immunohistochemistry (IHC) for desmin,

smooth muscle actin (SMA). Interstitial inflammation will be assessed with IBA1 (Monocytes), CD3 (T lymphocytes), CD20 (B-lymphocytes) and CD79a (B-lymphocytes).

Based on previous histologic findings, a change in glomerular size and an increased size of podocyte nuclei and increased cytoplasm is expected, noted initially with trichrome staining and confirmed with IHC for desmin antibody in selected glyphosate and paraquat exposures. It The team did not observe any evidence for interstitial inflammation or fibrosis in any of the exposure regimens used, although we did note increased desmin immunoreactivity in glomerular podocytes in paraquat and glyphosate exposed rats. Digital analysis software (Halo, Indica labs) was used to quantify desmin immunobiological expression and Image J to quantitate glomerular area in randomized manually selected renal glomeruli for various concentrations of glyphosate and paraquat. Quantitative analysis of pilot data revealed glomerular size was decreased by exposure to paraquat for 3 weeks as analyzed by one-way ANOVA and Tukey's multiple comparisons test, which demonstrated a significant decrease in the 25 mg-3wk group compared to the controls ($p<0.01$). There was a significant difference between 25 mg-2wk and 25 mg-3wk groups ($p<0.01$). Additionally, in rats subjected to acute exposure to paraquat for 24 hours glomerular shrinkage was observed.

Biomarker studies. For the pilot studies, existing biomarkers were evaluated for a relationship with chemical exposure in the rats that were treated with pesticides above. Urine collected over 24 hours after the last dose had creatinine concentrations within normal limits, as well as BUN. Biomarker studies were conducted on collected rat urine with a Luminex panel containing 5 biomarkers of kidney disease. Osteopontin (OPN) and KIM1 showed a dose-related increase above control values. Other biomarkers evaluated were not increased by the pesticides at these doses. We plan to investigate the repetitive exposure group for these biomarkers in the near future.

Heat Stress. Pilot trials of different housing temperatures were conducted to induce heat stress in rats. Core body temperature was monitored with telemetry implants in a temperature and humidity controlled environmental chamber for 7-8 h and noted that 35 °C housing condition successfully raised rat core body temperature about 1 °C (median 37.27 °C to 38.30 °C) similar to that noted in heat stressed farmworkers. The study team is currently evaluating the effects of heat stress, using controlled environmental chambers on renal function and histopathologic changes.

An extended 8-week heat exposure study in rats was performed. Heat exposure rats (N=4) were placed in the environmental chamber (35 °C, 55% humidity) for 8 hours per day and 5 days per week. Control rats (N=3) were housed at room temperature (24 °C, 55% humidity). Similar to the previous pilot study, it was observed that rat core body temperature started increasing after being exposed to heat stress for about 1 h, with an average raise of 1.32 °C for the entire 8-h period (median 37.89 °C to 39.21 °C).

Urine samples were collected at baseline (0 wk), every two weeks, and at the endpoint (8 wk) for future renal function biomarker investigation. Rat kidneys, livers, and blood samples were harvested at the endpoint for histopathologic analysis.

Human Agricultural Workers. A collaboration began with investigators at the University of Colorado who have an existing cohort of well characterized farmworkers to determine how the Luminex biomarkers may work with these individuals. This original study was conducted across the 2016 to 2017 sugarcane harvest in a population of 105 fieldworkers employed by a sugarcane agribusiness in Guatemala. The sugarcane harvest season runs from November until May each year. In this longitudinal study, we prospectively assessed cross-work shift changes in

eGFR, biomarkers of renal function, and biomarkers of heat stress in 105 workers at three separate time points during the harvest season. Urine samples were collected immediately before and after each work shift. We took a subgroup of 40 samples from 20 workers, including urine collected before the work-shift and after the work shift.

Urine samples were used from 14 seemingly healthy individuals, 10 individuals with acute kidney injury (AKI) individuals, and 13 with reduced kidney function were evaluated using the Human Kidney Biomarker Magnetic Luminex Performance Assay. The farmworkers were assigned to one of these groups based on normal kidney function, reduced kidney function at the start of the work shift (<60 eGFR), and those with acute kidney injury during the work shift. Pre-work shift (AM) and post-work shift (PM) urine samples were analyzed. The urine samples for all of the individuals were collected during the last study time point in April. Urine samples that were collected in March were also analyzed for 3 individuals.

The urine samples were tested with two novel Luminex kidney panels, provided as beta test kits by ThermoFisher. In aggregate we measured urine response to 21 biomarkers. Response to biomarkers were analyzed statistically. The most promising protein biomarkers for cKDU are retinol binding protein 4 (RBP4), Calbindin, Renin, monocyte chemoattractant protein-1 (MCP_1), clusterin, neutrophil gelatinase-associated lipocalin (NGAL), Beta_2_microglobulin, tissue inhibitor of metalloproteinases, (TIMP_1), Trefoil Factor 3 (TFF3), and Cystatin_C.

Initial analyses: nonparametric analysis of variance (Kruskal-Wallis test)

Luminex	**Group Trends (n=37)**	**Group Trend, PM ONLY (n=19)**	**Group Trend, AM ONLY (n=18)**
IP_10	AKI > RKF > C, Near S		
Osteoactivin_GPNMB	AKI > RKF > C, Near S		
RBP4	AKI > RKF > C, Sig		AKI > RKF > C, Sig
Calbindin	AKI > RKF > C, Sig		AKI > RKF > C, Sig
GSTA1	No trend		
Renin	AKI = RKF > C, Sig		
MCP_1	AKI > RKF > C, Sig		AKI > RKF > C, Sig
KIM_1	RKF higher, NS		
EGF	AKI higher, NS		
NAG	No trend		
IL_18	No trend		
Clusterin_APOJ	AKI > RKF > C, Sig	AKI > RKF > C, Sig	
VEGF_A	AKI > RKF > C, Near S		
NGAL	AKI > RKF > C, Sig	AKI > RKF > C, Sig	AKI > RKF > C, Sig
Beta_2_microglobulin	AKI > RKF > C, Sig		
TIMP_1	AKI > RKF > C, Sig		AKI > RKF > C, Sig
TFF3	AKI > RKF > C, Sig		AKI > RKF > C, Sig
Cystatin_C	AKI > RKF > C, Sig		AKI > RKF > C, Sig
Uromodulin	RKF > AKI > C, NS		
Osteopontin	No trend		
Alph_1_microglobulin	AKI > RKF > C, NS		

Exosomes were extracted from the human urines and the study team characterized them via Nanosight. Libraries were constructed from 20 farmworkers' AM and PM collected urine samples, then sequenced on the NovaSeq 6000 system. miRNA NGS data showed that 1) PM collected urines identified more differentially expressed miRNAs; 2) miR-30a-5p and miR-10a-5p were significantly elevated in the individuals with reduced kidney function (FDR<0.05, p-value<0.01). NGS-identified potential human miRNA biomarkers will be further validated and compared to the urine exosomal miRNA profile of herbicide-exposed and heat-exposed rats.

Initial lipidomic studies also indicated the potential for some phospholipids such as ceramide (CER 24:00), Sphingomyelin (SM16:0) and the ether linked phosphatidyl ethanolamine (PE(O-16:0/22:4)) to serve as biomarkers, with potentially higher sensitivity than the protein biomarkers.

The similarity in responses between the rats exposed to pesticides and the farmworkers will continue to be examined in future experiments.

The investigative team collaborated with a biomarker company (ThermoFisher) to help them improve the Luminex panels for human kidney disease.

Publications and Presentations

Three publications on this work are being prepared for publication.

1. Roberts, J. F., Zhou, J., Manrique, A. F., Roberts, S., Denslow, N. D., Vulpe, C. Sublethal exposure of rats to agricultural pesticides and heat alter kidney morphology and biomarkers of kidney disease.
2. Zhou, J., Butler-Dawson, J., Manrique, A. F., Roberts, J. F., Roberts, S., Denslow, N. D., Vulpe, C. Evaluation of a cohort of farmworkers from Central America with a panel of kidney disease biomarkers.
3. Zhou, J., Butler-Dawson, J., Manrique, A. F., Roberts, J. F., Roberts, S., Denslow, N. D., Vulpe, C. Isolation, characterization, and analysis of urine exosomal biomarkers that correlate with cKDu.

Pilot/Feasibility Program

J. Glenn Morris, Jr.
Farah A. Arosemena

Overview

The Pilot/Feasibility Program is a key component of the Southeastern Coastal Center for Agricultural Health and Safety (SCCAHS). This program provides seed funds to stimulate original projects relevant to health and safety in the agricultural, forestry, and fishery (AFF) industries. The Pilot Program awards high quality research that promotes collaboration between the Center and the Southeast partner communities, as well as builds a nexus for mentorship and development of new/early-stage investigators as they aspire to establish independent research. Projects may include basic/etiologic research, translational research, intervention studies, and/or surveillance.

The goal is to provide seed support to projects that ask innovative and important questions, and which lay the groundwork for subsequent research grant submissions or interventions. Successful implementation of the Pilot/Feasibility Program will ultimately expand research in health surveillance, air quality, respiratory health, pesticide exposure, mental health and health disparities of migrant and seasonal farmworkers and/or fishers. Some of the projects selected will be "high risk, high reward" novel ideas and approaches, with limited preliminary data, but with the potential for having a major impact. Cumulatively, across years 1 through 3, the *Southeastern Coastal Center for Agricultural Health and Safety* awarded 9 pilot research projects to improve the safety and health of agricultural workers.

Pilot Grant Awards

Cumulatively, the Southeastern Coastal Center for Agricultural Health and Safety has awarded a total of 11 pilot awards across the University of Florida, Florida State University, Florida A&M University, University of Maryland, Georgia Southern University and Migrant Clinicians Network.

Kimberly Dunleavy, PhD – Associate Clinical Professor, Physical Therapy, University of Florida
Chronic low back pain in seafood workers: a pilot intervention study to identify modifiable work and movement solutions
Dr. Dunleavy's pilot study has established the feasibility of methods and continues with bridge funding from the UF Office of Research as she seeks to sustain the project longer term with federal funding. Clam farmers with low back pain (LBP) in the Cedar Key Florida area participated in the study.

The first paper from this pilot study outlines the feasibility and extent of adoption of the participatory ergonomic strategies. Twenty-eight clam farmers from 7 teams met inclusion criteria; 19 completed the study. Participants were mostly male (90%), white (93%), achieved high school or beyond education (70%), with a mean age of 34 and 9.5 years' experience in the industry. They reported lifting >50 lbs on average for 17.3 hours per week and experiencing back pain for an average of 4 years.

Dunleavy, K., Bishop, M., Coffman, A., Reidy, J., & Kane, A. (2022). Chronic lower back pain in aquaculture clam farmers: adoption and feasibility of self-management strategies introduced using a rapid prototype participatory ergonomic approach. *International journal of occupational safety and ergonomics : JOSE*, *28*(3), 1829–1839. https://doi.org/10.1080/10803548.2021.1935543, PMID: 34121632; PMCID: PMC8738770.

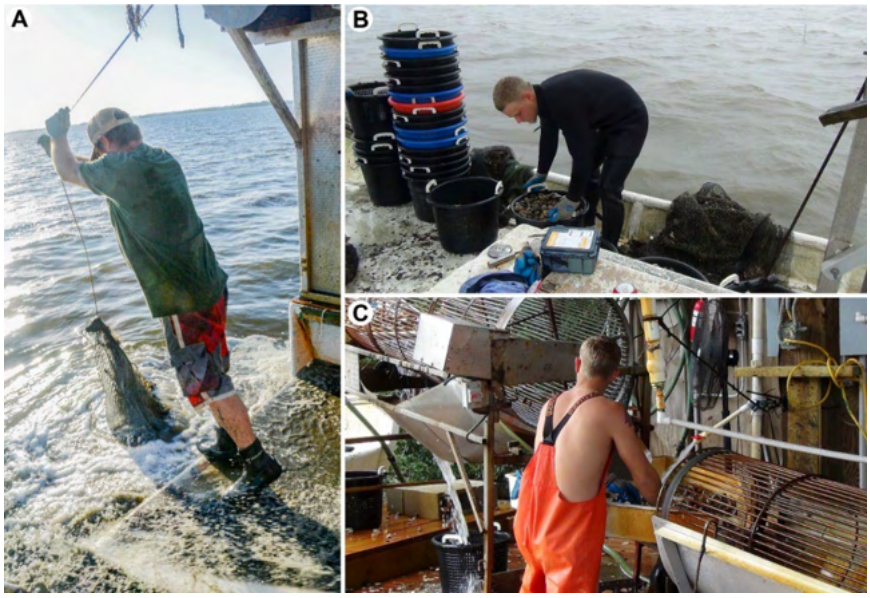


Figure 1. *The most common work activities regarded as difficult due to back pain were: A) lifting bags on/off the boat (11/19, 58%), B) moving baskets or boxes (16/19, 84%), and C) standing while working (10/19, 53%). From Dunleavy et al. 2021 Int J Occ Safety Erg.*

Team and individual movement and ergonomic concepts were discussed in the workplace. Participants selected and used 3 strategies for 8 weeks. Individual strategies included breaking up repeated positions or activities as well as lifting techniques. Team strategies involved using or adjusting mechanical equipment, team lifting or workflow/process adjustment. Workers were video recorded for feedback and they received weekly text or phone reminders.

Results: Participants selected a mix of team and individual strategies. The 3 most frequent choices were team strategies; team lifting (58%), rotating tasks in the team (47%), and using mechanical equipment (42%). The most frequent individual strategies chosen were pacing or taking small breaks (42%) and changing lifting position (32%). Participants used individual strategies 3 to 6.5 days per week, and 46-92% of the time. Although workers selected more team rather than individual strategies, team approaches were used slightly less often. Participants felt that the strategies were relatively easy to use (30 on a scale of 0=*very easy* to 100=*very difficult*). (see Figure 2- Appendix) Most strategies were recommended (74%) or possibly recommended (19%).

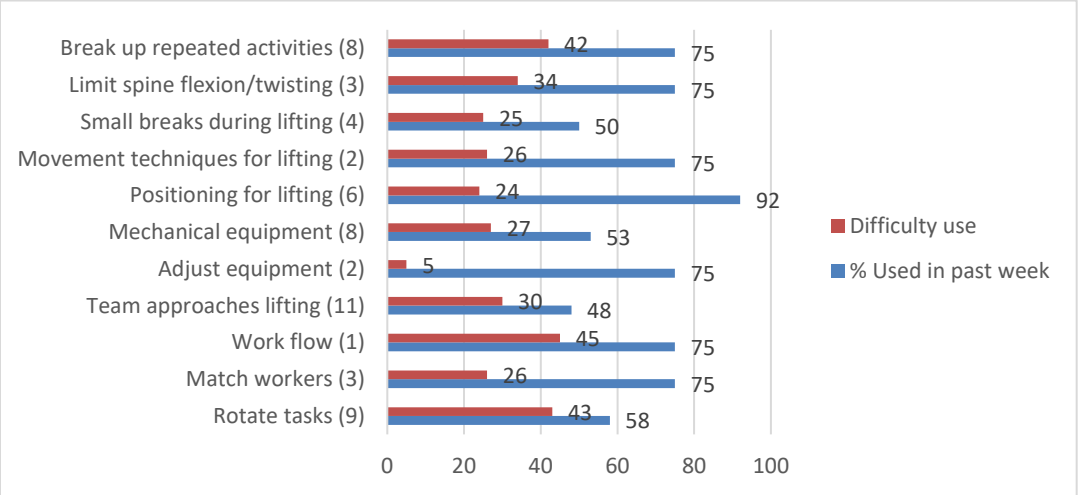


Figure 2.

Ease/difficulty of strategies, frequency of use. From Dunleavy et al. 2021 J Agromedicine.

Participants reported general appreciation of the importance of training, with those individuals who had been in the industry for a long time commenting on the relevance for their longevity in the industry. The videos of themselves or other crews were noted as being very helpful; along with reminders both from the researchers and their team. One of the concerns often expressed during initial focus groups was the potential that any work process change would impact productivity. In the final survey, most strategies assisted productivity, particularly if there was less pain, and some participants reported that they were able to lift for longer or work faster. There were a few strategies that did not change productivity or slowed down processes. Challenges for uptake included changing habit, culture, and team dynamics. Some participants were more comfortable with their routine while others did not want to be perceived as being unable to do the job or less capable than others. Culture, ego, and team dynamics were a barrier in some teams, but participants did comment on positive changes with asking for help. Time and workflow pace were mentioned as factors limiting implementation.

Conclusions and recommendations: Participatory methods provided opportunities to introduce, support, and build worker capacity to adjust processes in the workplace and build team buy-in. Overall, participants were receptive and appreciative of opportunities to manage pain and implemented strategies relatively consistently. Future projects using these methods will need to build strong community linkages, buy-in, and local presence to facilitate workplace intervention and data collection. **Participatory ergonomic approaches provided a viable option to introduce work-related changes in this pilot study of clam farmers with small teams, variable work processes, time restrictions and workloads**.

The second paper describes the outcomes of the interventions in the pilot using a within-subject time-control design with repeated baseline and post-intervention assessment.

Dunleavy, K., Kane, A., Coffman, A., Reidy, J., & Bishop, M. D. (2022). Outcomes of Participatory Ergonomics and Self-management in Commercial Clam Farmers with Chronic Low Back Pain: A Feasibility Study. *Journal of agromedicine*, *27*(2), 217–231. https://doi.org/10.1080/1059924X.2021.2004961, PMID: 34772318.

Participants reported mild disability (16.4%), mild to moderate difficulty with the most difficult work activities (73.3/100) and moderate pain levels with work activities (44.8/100). Overall, this group of active workers reported high self-efficacy (8.6/10) and low fear avoidance (1.8/4), mild to moderate anxiety (21.1/50) and low to moderate coping strategies (6.5/12). Statistically significant improvements in disability, work-task pain, pain anxiety and coping were noted in comparison to baseline.(Table 1) No changes in task difficulty, fear, self-efficacy and average resting pain were reported. Pain improvements > published minimal detectable change were reported by 74% with 56-64% > personalized variability for lifting tasks. Pain-related disability, work activity pain ratings and related pain anxiety and coping improved beyond individual variability in this feasibility study.

Conclusions and recommendations: Multiple strategies allowed workers to choose relevant self-management options. Introduction of work-related changes in the workplace, supported by visual demonstration, review of team videos and reminders. We were unable to make definitive conclusions of intervention effectiveness due to the pilot nature of the study and lack of a comparison group but the pilot results were promising support the **need to establish whether these approaches are effective in a larger cohort over longer timeframes, in different contexts, and with follow-up.** Additional recommendations to strengthen the design were to: 1) use additional objective outcome measures, and 2) develop strong community linkages, buy-in, and local presence. The combination of video clips, strategy choices, video feedback and text reminders were useful and have informed design for this proposal. **This pilot provided insight into feasible options to adjust activities in the workplace with less requirements for time off and direct relevance for work practices. We concluded that participatory ergonomic self-management strategies are worthy of further investigation, hence the development of this proposal.**

Table 1: Baseline and Final Disability, Pain and Pain-related affective factors. (n=19)

	Mean diff Baseline/Final (SD)	**95% CI diff**	***t* (df =18)**	***p***
Disability (ODI/50) %[1]	4.96 (7.0)	1.6-8.3	3.10	0.006*
Functional difficulty (PSFS/100)[2]	7.5 (28.2)	-21.1-6.1	-1.16	0.26
Work task Pain (PSFS Pain/100)[3]	16.1 (18.8)	7.0-25.2	3.72	0.002*
Mean (average, most, least pain)[4]	5.2 (17.3)	-3.2-13.6	1.31	0.21
Days experiencing pain	0.5 (2)	-4.8 – 1.5	1.07	0.35
Pain anxiety (PASS/50)[5]	8.9 (12.9)	2.7-15.1	3.0	0.008*
Fear avoidance (FAQ/4)[6]	0 (1.5)	-0.7-0.8	0.76	0.94
Self-efficacy (PSEQ/10)[7]	0.3 (1.2)	-0.9-0.3	-1.1	0.28
Coping (CSQ/12)[8]	-1.9 (2.0)	-2.9- -0.9	-4.2	0.001*

*Comparisons using paired *t*-tests ($p < 0.05$). 1. ODI - Oswestry Disability Index, 2. PSFS – Patient Specific Functional Scale for most difficult work tasks, 3. PSFS Pain – Pain with most difficult work tasks, 4. VAS – Visual analogue scale, 5. PASS - Pain anxiety symptom scale, 6. FAQ -Short-form fear avoidance scale, 7. PSEQ – Patient Self-efficacy Questionnaire, 8. CSQ – Coping strategies Questionnaire

Marysel Pagán-Santana – Program Manager, Migrant Clinicians Network
Exploring mental health and natural disasters in agricultural communities in Puerto Rico

Migrant Clinician's Network: CBPR

The overarching goal of this project is to adapt and pilot an assessment tool to explore mental health status using previously developed resources. The investigative team expects that the implementation and use of the developed tools will provide a pathway to effectively assess the mental health and resilience of agricultural workers in Puerto Rico as it relates to climate change and disasters (e.g. earthquakes). During Year 4, Dr. Pagán-Santana continued to identify culturally appropriate research methods and tools to better understand agricultural workers' mental health as it relates to natural disasters and climate change. The team analyzed/classified validated instruments related to agricultural workers health, climate perception, mental and behavioral health, and resilience using the following variables:

- Purpose description: Source, purpose, type of document (report, journal), topic
- Population description: literacy level, intended population, locations where it has been used
- Survey description: language, length (amount of questions), metrics

Methods

Review of previous tools

A literature review was carried out with the objective of identifying tools related to the impact of the climate crisis on farmers or vulnerable populations and the impact of the climate crisis on the mental health of individuals. The main criterion for the use of these tools was that they be validated and accessible for use, an attempt was also made to select tools that were culturally appropriate and consistent with the educational level of the population to be served. A total of _ tools were identified. Table 2 presents a general description of each one, including authorship, year of development, original language, and category it sought to serve. Questions that could be used or adapted for use in the target population were discussed and put in a questions bank (Table 3) The questions were modified, including translation or change in terminology to adapt the Spanish used. Some of the terms were consulted through interviews with farmers to verify terms that could be considered very technical or alien to the community.

Study Location and Participants

Castañer is located the central rural and mountainous region of Puerto Rico, where a large part of the island's agricultural activity takes place. Given the amount of agricultural activity in the area, the risk and vulnerability to climate related disasters and crisis is significant. Historically, this region is severely impacted by flooding and landslides that can be either due to atmospheric events or weather-related. The number of historical events in combination with the projections that present the increase and continuation of these events, add to the need to understand how these events can impact the residents of the region, especially those whose income and source of employment is also being impacted. for these events.

In Castañer, primary health services specialized in agricultural workers are mostly provided through Hospital General Gastañer (HGC), which is a primary healthcare center founded by the U.S. Health Resources & Services Administration (HRSA). Health centers whose primary population is composed of agricultural workers act to establish programs that focus on educating on the hazards of agricultural work and how to protect farmworkers' families, providing culturally appropriate enrollment assistance, linkages to other community resources, and proper primary care. We carried out this research in collaboration with a partner community health center, Hospital General Castañer (HGC), that serves agricultural workers in rural Puerto Rico. HGC is in a high activity agricultural industry zone, and 37% of their patient population is classified as agricultural workers, providing a significant pool of participants. Individuals participating were those identified as agricultural workers by HGC and who complied with following the inclusion criteria: individual is 18 years or older, primary income comes from agriculture, and primary residence is in Puerto Rico. The recruitment process for the focus group, and pilot was a combination of self-recruitment and direct approach to possible subjects using HGC to advertise and recruit individuals that visit the clinic or participate in any of the health center programs. Taking into consideration recruitment and participation rates we established a sample size of 30 agricultural workers to take the interview and 6 to 10 workers to participate in the focus group for a maximum of 40 participants. We recruited 48 agricultural workers to participate. Due to COVID-19 restrictions and other challenges we had a significant lost of participant where only 8 participated in the interviews and 14 completed the survey.

Interviews and questionnaires

We conducted interviews with eight workers to gather input language and to explore terminology and concepts. The purpose of the interview was to discuss the questions and topics that are used in questionnaires and surveys that assess mental health and changes in climate, in agricultural workers and the general population. The goal of this discussion was to gather farmworkers' opinion and suggestions to improve the questions, words, and language used in these materials. We adapted the questions and language following the recommendations made by the participants and the observations of the interviewer. The resulting tool (Appendix 4) has the objective of gathering knowledge to understand how agricultural workers respond to climate related events like hurricanes and heat. This preliminary tool was not validated as we did not reach the sampling size required to perform internal and external validity. However, the observations and preliminary results allow us to further adapt this tool in other to validate it eventually.

Results

Despite having recruited 48 participants for the validation of the questionnaire, only 14 were able to participate. The loss of the group was largely due to the recurring postponement of interviews due to the local COVID-19 situation and the need to conduct interviews in person. Most of those registered had technological limitations, so it was not possible to carry out adaptations to the methodology to perform remote interviews. Similarly, there was a risk that some of the questions to the participants could result in the need for immediate psychological attention, so it was preferred to keep the location of the interviews in the health center, providing a private and safe environment where to carry them out.

Discussion

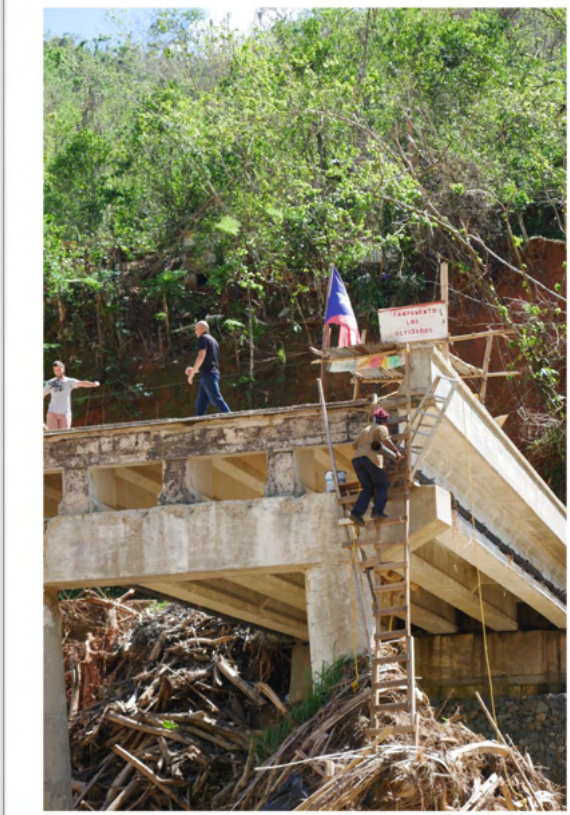
An internal and external validation process of this first instrument was not carried out given that we did not reach the number of participants needed. However, the preliminary results and observations will be used to further adapt. We hope that it can be validated in the future to continue identifying factors that could be affecting the mental health of agricultural workers in Puerto Rico. We expect to further adapt the instrument based on observations and preliminary results. These changes include decreasing the scales to be 1 to 3, modifying climate change

language, decreasing quantity of questions, and modifying behavioral health questions. In addition, we observed a limited knowledge regarding the climate crisis, its effects, and the relationship with climate-related disasters like hurricane Irma and María. We hope to develop an educational program with island stakeholders and community health centers to work on patient and worker education in this topic.

Efforts must be directed towards understanding the impact on the mental and behavioral health of agricultural workers and the relationship with disaster preparedness and impact practices, as well as available adaptation mechanism. There are educational barriers when discussing or recognizing the climate crisis as an event that can affect agricultural workers' physical and emotional health in Puerto Rico. Although the vast majority of those interviewed did not seem to have been exposed to information regarding the impacts of climate change, some could identify challenges and concerns regarding crops and access to recovery funds.

- A farmer shared how the mango and coffee crops were affected by plagues or droughts, producing low-quality fruits that could not be sold.
- Others mentioned the difficulty of accessing recovery and mitigation funds, either due to the problem of forms not being available in Spanish or the absence of recovery offices in nearby areas.
- Community health centers have an essential role in the response and mitigation of climate change impacts when it comes to agriculture workers mental health.

There is a recognition that disasters like Hurricane Maria will happen again, however the efforts to work on mitigation strategies with agricultural workers in the rural areas are limited. Furthermore, discussion on how their health can be affected by climate and disasters is also limited or non-existent.



Maria Morera – Assistant Research Scientist, University of Florida, Agricultural Education and Communication

Developing an Integrated Decision Support Tool and Network for WPS Respirator Compliance in Florida Agricultural Industries

Overview

Over the past five years, up to 27% of annual deaths from exposure to harmful substances or environments in the agriculture, forestry, fishing and hunting sector involved respiratory exposures (U.S. Bureau of Labor Statistics, 2019). Recent research reveals substantial knowledge gaps among US farmers regarding the proper selection and fitting of personal protective equipment (PPE) against respiratory hazards (Cramer et al., 2017). Findings indicate that farmers rely on local sources of information, such as farm implement dealers and retailers, yet there is evidence that these resources, including public health nurses and primary care providers, also lack appropriate technical knowledge. To improve respiratory PPE effectiveness, it is thus vital to increase knowledge among four interconnected audiences: farmers, pesticide handlers, agrochemical and PPE dealers, and healthcare providers. A key problem is a lack of respiratory safety research translation and user-friendly materials for farmers and industry intermediaries. The objective of this project is to develop customized decision support tools that address the complexities of new regulations on respirator selection, medical evaluation, and fit testing. The project is guided by the following four aims:

1. Evaluate needs for translational materials in respiratory protection through a survey of key stakeholders
2. Pilot-test the use of socially marketed audience-tailored decision support tools to clarify hazard communication labels, respirator selection, medical evaluation procedures, and fit testing
3. Perform an outcome evaluation to asses usage of translational materials per audience
4. Apply for funding to transition the support tool to a web-based format, scale up the intervention, and evaluate its impact on respiratory safety in Florida's agricultural workforce.

Key Accomplishments in 2021

Survey Research

Development and implementation of healthcare provider needs-assessment survey

A mixed-mode survey questionnaire, designed to investigate the availability of respirator medical evaluations among local healthcare providers in Miami-Dade County, their familiarity with Occupational Safety and Health Administration (OSHA) guidelines, experience with agricultural workers, and provision of assessments and forms in multiple languages, was constructed during the spring of 2021 and approved by UFIRB-02 in May. The survey was developed as part of the project's aims to evaluate the outreach needs of audiences that support the respiratory safety of farmers and pesticide handlers. Using a local directory, a list of health facilities in Homestead, Florida City, and Miami potentially providing services to agricultural workers employed in the Homestead area was subsequently compiled. Local practices and facilities specializing in occupational medicine were also included in the list. Healthcare administrators at these facilities were invited to participate in the survey and share it with their associates.

The 23-question needs-assessment survey was distributed via telephone and electronically using an anonymous link generated through Qualtrics survey software (Version 2020; Provo, UT). Survey questions, presented in multiple-choice, open-ended, and Likert-type formats, addressed the structure, frequency, and language of respirator medical evaluations, other services provided to agricultural workers, knowledge of OSHA's respiratory protection standard, and the need for resources including standardized document templates.

Results of healthcare provider needs-assessment survey

Healthcare administrators at ten of the facilities and practices contacted agreed to participate in the survey. The majority of these health facilities, however, did not offer respirator medical evaluation services or were not frequented by agricultural workers. Only those specializing in occupational medicine offered the service and just one received repeat referrals for that purpose from agricultural employers (Figures 1 -2). This facility also provided respirator fit-tests. Survey responses indicated the facilities specializing in occupational medicine more frequently based their determination of an agricultural worker's ability to use a respirator on a medical examination covering all areas included in OSHA's Respirator Medical Evaluation Questionnaire than on written responses to the questionnaire delivered in person or by mail (Figure 3). One facility relied on internal versions of the questionnaire that had been translated to Spanish and Creole. That was the only facility that reported agricultural workers frequently discussed the questionnaire or examination results with medical staff. The language most frequently spoken during these discussions was Spanish. Nonetheless, only one facility regularly used a translator to discuss examination results with patients as most had bilingual staff. All survey participants spoke Spanish at least slightly well and the majority spoke it very, or extremely, well.

Half of survey participants reported the facilities they are affiliated with rely solely on internal resources to respond to the needs of their patients. In response to an open-ended question regarding the need for additional information or resources to help agricultural employers and workers comply with respiratory protection requirements, a third expressed interest in fact sheets that could be distributed to patients. One respondent noted it would be helpful if agricultural workers were aware of factors affecting their use of respirators and better prepared for their examinations and fit-tests. Only the facilities specializing in occupational medicine had access to standardized document templates for respirator medical evaluation questionnaires and respirator medical clearance forms based on OSHA's requirements.

As expected, administrators at the facilities specializing in occupational medicine were more familiar with OSHA's respiratory protection requirements. Although all respondents answered at least three of five knowledge test questions correctly regarding these requirements, just two administrators were able to correctly answer all of them and only one reported being extremely familiar with the requirements. Respondents were most familiar with the requirement that agricultural employers provide a medical evaluation at no cost to employees who are required to use a respirator in the workplace. They were least familiar with instances in which a follow-up medical examination is necessary based on responses to OSHA's Respirator Medical Evaluation Questionnaire (Table 1).

Based on the needs articulated through the survey, compliance and outreach materials, including fact sheets and certified translations of key documents and forms, will be added to the project's repository of respiratory safety resources for growers, pesticide applicators, retailers, and healthcare professionals.

Table 1. Percentage of correct survey responses per knowledge test question.

Question topic	*Percent correct*
Medical evaluation requirements for agricultural employees who must use a respirator in the workplace.	100
Relevance of expected physical work effort and types of additional protective equipment worn to medical determination of the ability to use a respirator.	83
Healthcare professionals who can perform medical evaluation procedures to determine an agricultural employee's ability to use a respirator.	67
Application of medical evaluation requirements to required respirators regardless of the type, level of protection, or whether it is tight-fitting or loose-fitting.	67

The need for follow-up medical examinations based on responses to OSHA's Respirator Medical Evaluation Questionnaire.	50

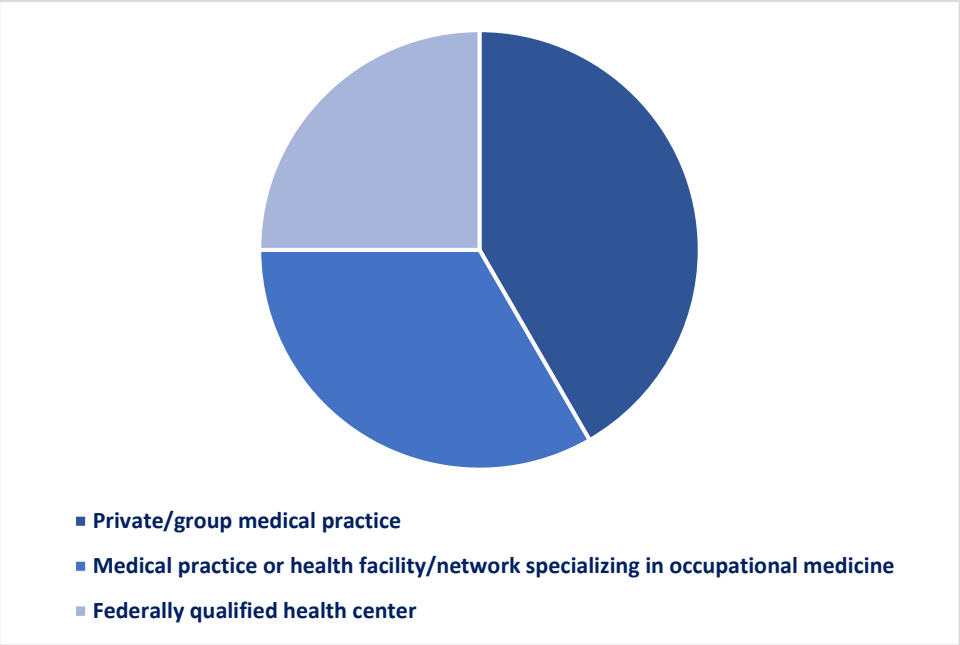


Figure 1. Types of healthcare providers survey participants are affiliated with.

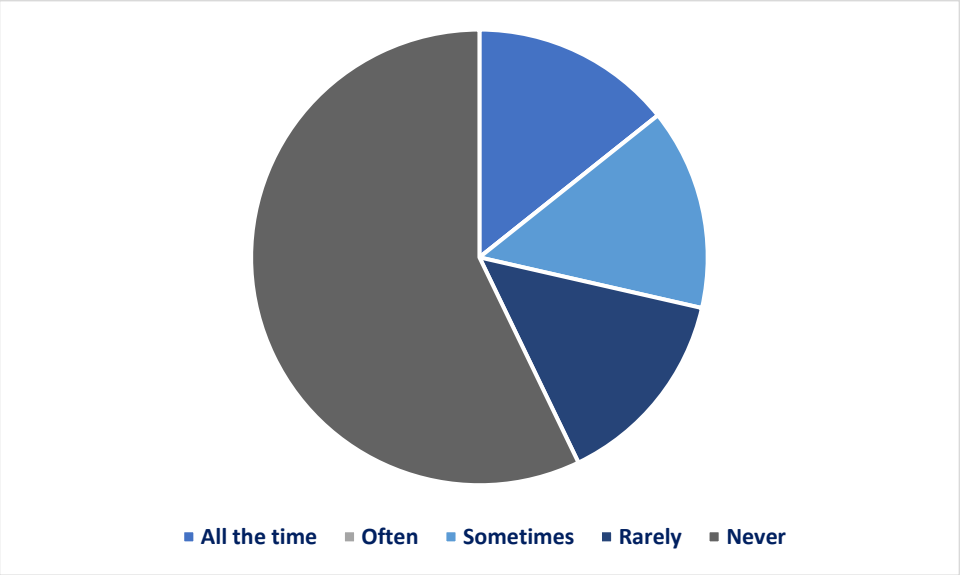


Figure 2. Frequency with which surveyed healthcare practices and facilities receive requests for respirator medical evaluation services from agricultural employers and workers.

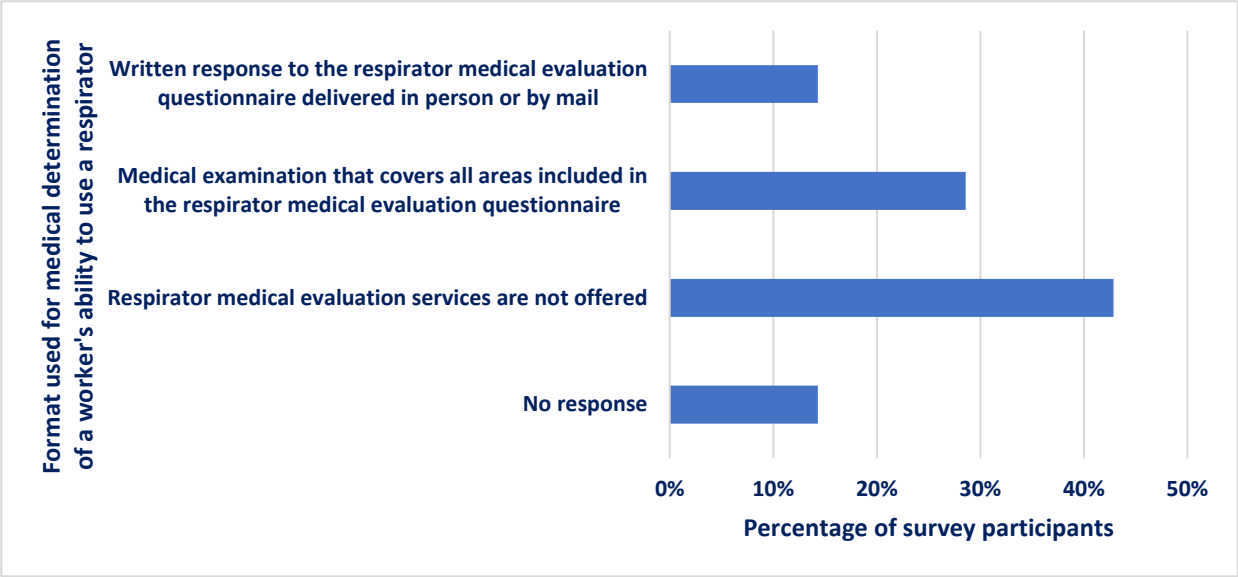


Figure 3. Format most frequently used by surveyed healthcare providers for medical determination of a worker's ability to use a respirator.

Outreach and Dissemination

Results of the previous needs-assessment survey, designed to identify barriers farmers and pesticide handlers face when adopting best practices for respirator use and complying with regulations, were presented at the Agricultural Safety and Health Council of America 2021 North American Agricultural Safely Summit. The presentation abstract is currently in press and will be published in a future issue of the *Journal of Agromedicine*.

Morera, M.C. & Campoverde, E.V. (in press). Developing a customized decision-support tool for respiratory protection in Florida agriculture: Preliminary findings of a pilot project. Presented at the Agricultural Safety and Health Council of America 2021 North American Agricultural Safely Summit. *Journal of Agromedicine*.

Eric Coker, Assistant Professor, University of Florida, Environmental and Global Health
A Pilot Study to Assess Personal PM2.5 Exposure and Respiratory Virus Infections among Farmworkers in the Southeast
The pilot generated new PM2.5 exposure assessment data among farmworkers within the southeastern U.S., including exposure data among those working on different types of crops. The investigative team is using a real-time exposure monitoring device (MicroPEM). Real-time exposure monitoring data will enable us to not only determine the distribution of farmworker exposures and differences in exposure between the types of crops worked on, but also to assess within-day variability of personal PM2.5 exposures. Capturing within-day variability could be important in terms of pinpointing high-exposure episodes that could eventually lead to more targeted investigations aimed at identifying exposure-mitigation strategies.

The collection/analysis of farmworker nasal swab samples for the detection of viral carriage is another innovative approach characterizing viral carriage for multiple respiratory pathogens provides important baseline data. This is the first study that will characterize upper airway viral infection and co-infections among agricultural farmworkers using a highly sensitive, specific and state-of-the-art molecular detection technique to explore the feasibility of accessing and utilizing electronic medical records from MHCs for the purposes of active surveillance of ARIs.

Burden: Respiratory infections and dust exposure
- NIOSH data suggests elevated respiratory infection mortality rates among crop farmworkers
- Emerging evidence suggests respiratory risks associated with exposure to respirable agricultural dusts

Need: Fill knowledge gaps by generating preliminary data
- Occupational exposure to respirable particulate matter (PM2.5) is poorly understood among crop farmworkers in the southeast
- Little is known regarding types of respiratory infections as well as respiratory infection burden among crop farmworkers

Impact: Lead to follow up research to build on findings – CDC/NIOSH R01 November, 2020 submission (PAR-18-812), *Assess Personal Air Particulate Exposure and Respiratory Virus Infections among Farmworkers in the Southeast*

This update describes the accomplishments of the final two aspects of the project
- To use OneFlorida Data Trust and geospatial analysis to conduct respiratory and chronic kidney disease surveillance among Hispanic crop farmworker communities (IRB202102349)
- To investigate whether exhaled breath condensate (EBC) is a suitable sample for identifying respiratory infections and biological biomarkers in humans.

One Florida Data Trust
The OneFlorida Data Trust request for data was initiated in July of 2021 and approval was achieved through OneFlorida Data Trust in September. Final IRB approval to receive and analyze the OneFlorida dataset was achieved on January 20, 2022. The OneFlorida dataset was requested back in November 2021. Access was provided to the OneFlorida dataset on January 24, 2022. After reviewing the dataset for completeness, gaps were identified in the dataset (missing denominator for ZIP codes). A request was submitted to fill this data gap and OneFlorida fulfilled this request on February 1, 2022.

After receiving the complete dataset, PhD student, Andres Manrique, worked to clean the dataset. Specifically, he focused on chronic kidney disease diagnoses given the fact that this diagnosis is less complex than the respiratory diagnoses. It was determined that it would be more

efficient to examine a more straightforward set of diagnoses in order to move the project forward and to establish a data cleaning and analysis workflow on a dataset that is rather complex. At this stage, the dataset is in shape for spatial and statistical analysis of chronic kidney disease. Currently, the investigative team has mapped the spatial pattern of chronic kidney disease for ZIP codes in our study area and calculated chronic kidney disease rates (all cause) and are moving on to cause-specific kidney disease rates. The data cleaning and data analysis process for respiratory diagnoses will mirror that of the chronic kidney disease data cleaning and analysis steps described below. R code for data cleaning and analysis will therefore be adapted to the respiratory outcomes. All R code will be annotated and archived for use by other SCCAHS investigators to review and use in case they wish to work with OneFlorida data for health surveillance purposes.

The literature has shown that diagnosis of CKDu will occur at the later stage of the disease (stage 3 – end stage). It was concluded that it would be ideal to create a variable that encompasses moderate to end stage chronic kidney disease. All the stages, including our variable, were mapped to identify common trends. Figure 1 – 8 demonstrate the geographical distribution of case-rates. Agricultural zip codes were highlighted in Figure 8 to demonstrate the trends of case rates. It is apparent that the majority of agricultural zip codes have high case-rates of late-stage CKD (Stage 3 – end stage).

Global Moran's I were conducted to test for spatial autocorrelation in our data. Local level cluster detection was conducted for all-cause, end stage, and late-stage (Stage 3 – end stage) CKD using Local Moran's I and Getis Ord statistic. Figures 11 and 12 show the hotspot detection results for all-cause CKD and demonstrate significant high case-rate hotspots in agriculturally rich zip codes. One zip code 33440, appeared in both hotspot cluster detection. This zip code is historically known for the cultivation of sugarcane, but other fruits and vegetables are grown in this area. This cluster is present in the Getis Ord analysis for end-stage chronic kidney disease as shown in figure 12. This finding is similar to that of another geospatial study that was performed in El Salvador that found that sugarcane rich sectors are most affected by CKDu. The results from the late-stage hotspot detection analysis yielded different results but there is commonality with hotspots still being present in agricultural rich regions. The late-stage hotspots are primarily found in the central region of Florida.

Multiple Poisson regression models were performed to determine any association between case-rates and variables that are relevant to the agricultural sector. The team wanted to see if a specific crop sector was associated with our case-rates. We used the number of crop operations as a proxy to determine how present the crop is in a zip code. Additionally, satellite data to determine the percentage of area within a zip code that belonged to crop harvesting. Two models were developed, one for late-stage and end-stage.

The model development process consisted of testing each variable with the independent variables. Significant variables were then selected for an adjusted model. The adjusted mode underwent a bidirectional stepwise regression which concluded the variables for our final models. Stepwise regression was used to assess the variables that would yield the lowest AIC and high R2 value. The two models were

$$\text{Log(N18.9)} = \text{Intercept} + \beta 1_{\text{sugarcane ops}} + \beta 2_{\text{corn ops}} - \beta 3_{\text{percent area for crop cultivation}}$$
$$\text{Log(Late-Stage RD)} = \text{Intercept} + \beta 1_{\text{sugarcane ops}} - \beta 2_{\text{peanut ops}}$$

These models indicate that the number of sugarcane operations serve as a good predictor for both of our outcomes of interest. The results are shown in figure 15 and 16, respectively.

Working with these data, we ran into a major pitfall for spatial analysis that limited the extent of our work. A major limitation was the lack of complete health data for all the zip codes within the state. This prompted the team to request data for the entire state to do a complete analysis. Hotspot and spatial clustering were limited since they use contiguity matrixes and distances between neighbors, distance between zip codes, to identify hotspots. The full data set was granted, but it is still undergoing the cleaning process. The study team will proceed with conducting spatial hotspot and cluster detection once the data is complete for both respiratory and CKD data. Also being performed is a similar analysis of the respiratory data sets which are more complex by comparison.

Results:

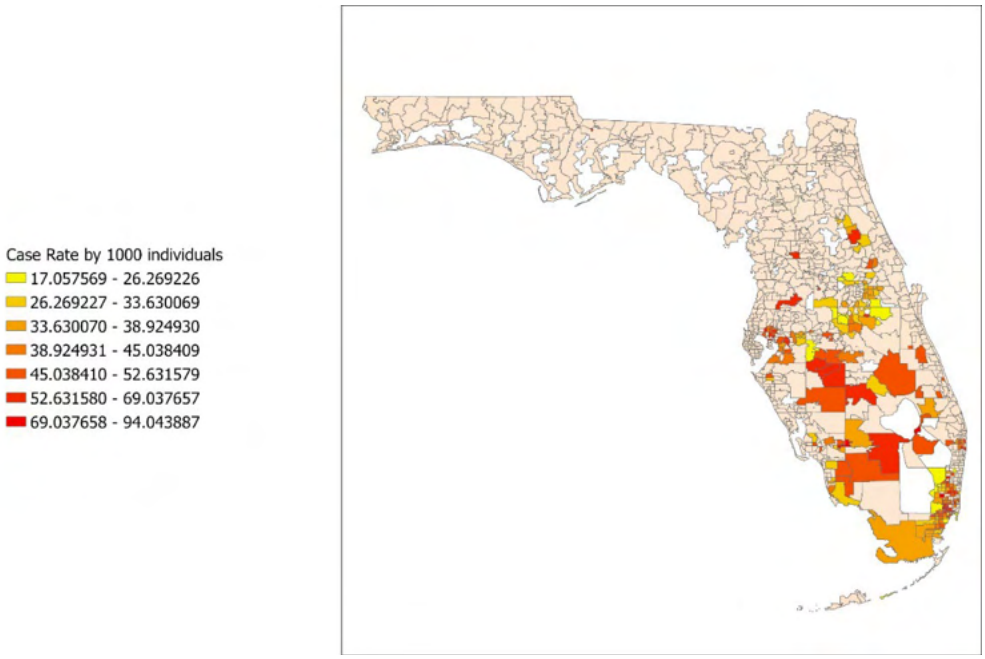


Figure 1. Chronic Kidney Disease rate among Hispanics for ZIP codes included in our study. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

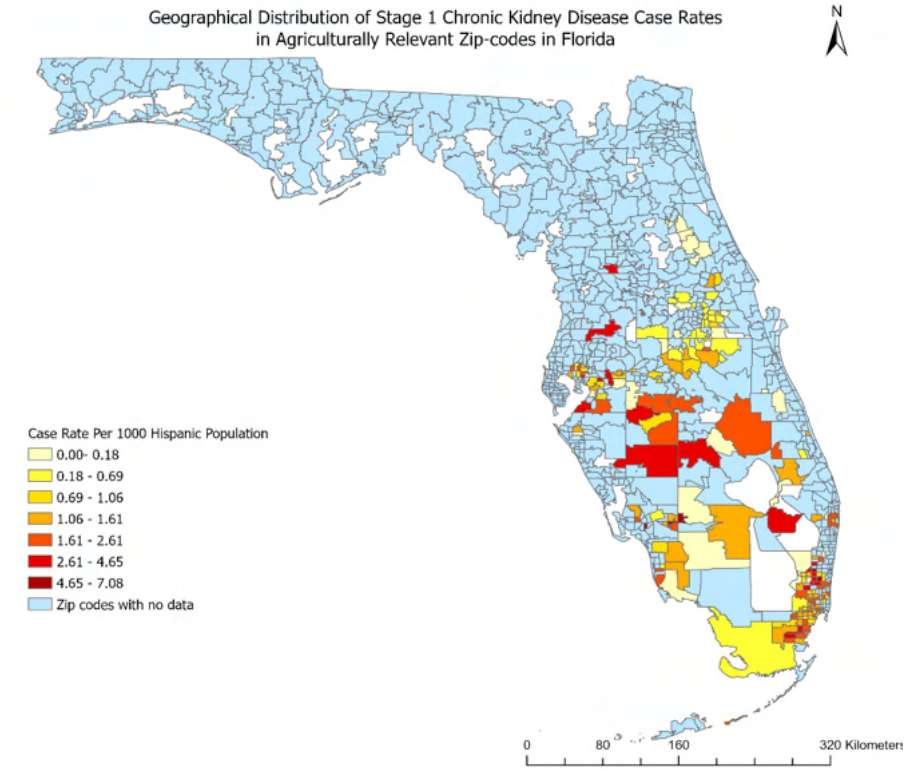


Figure 2. Stage 1 chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

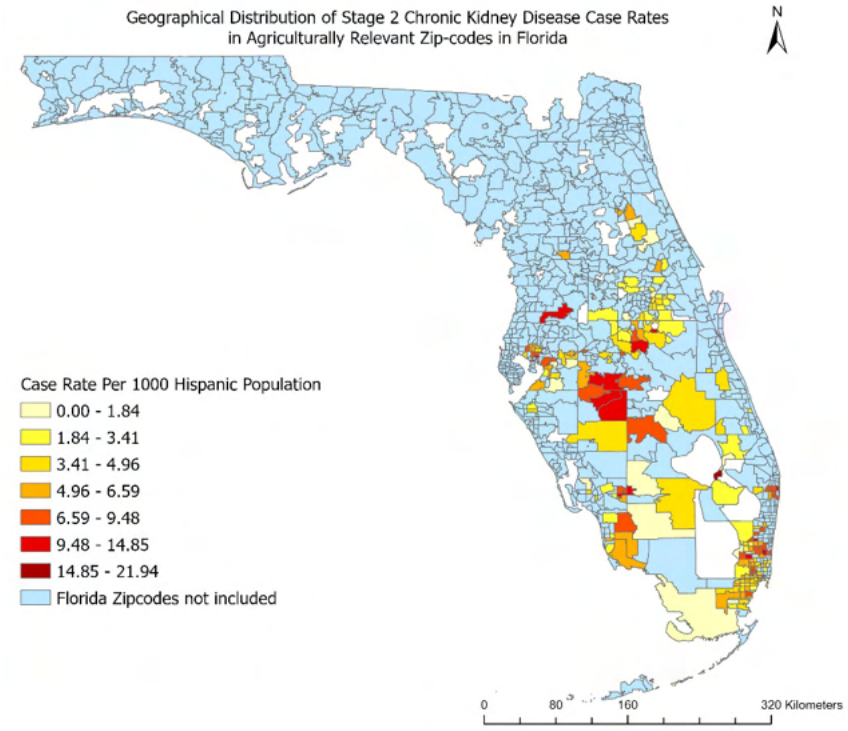


Figure 3. Stage 2 chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

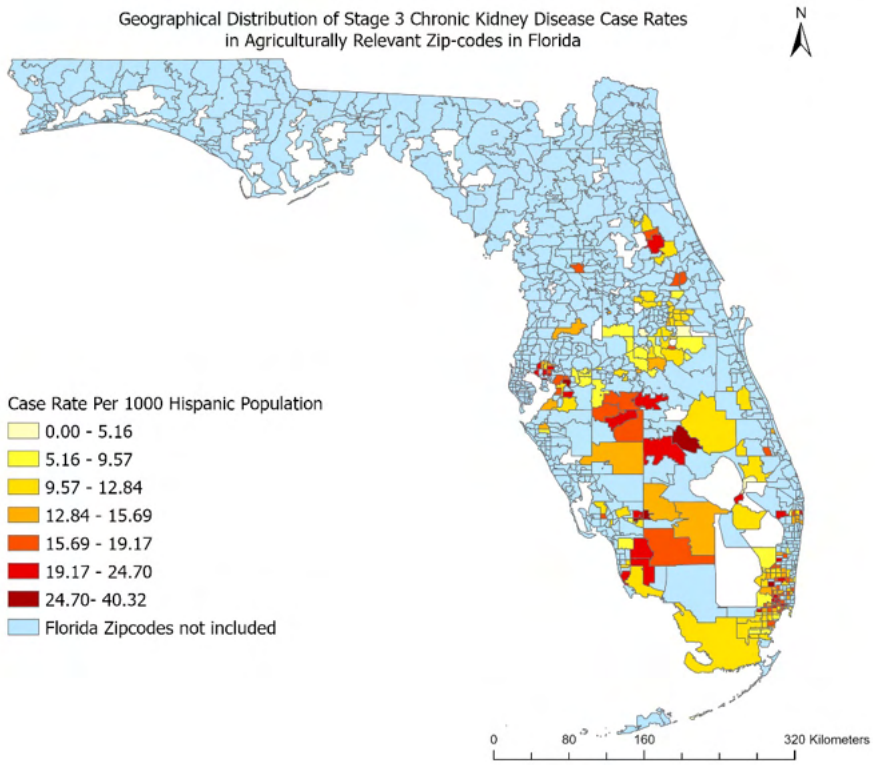


Figure 4. Stage 3 chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

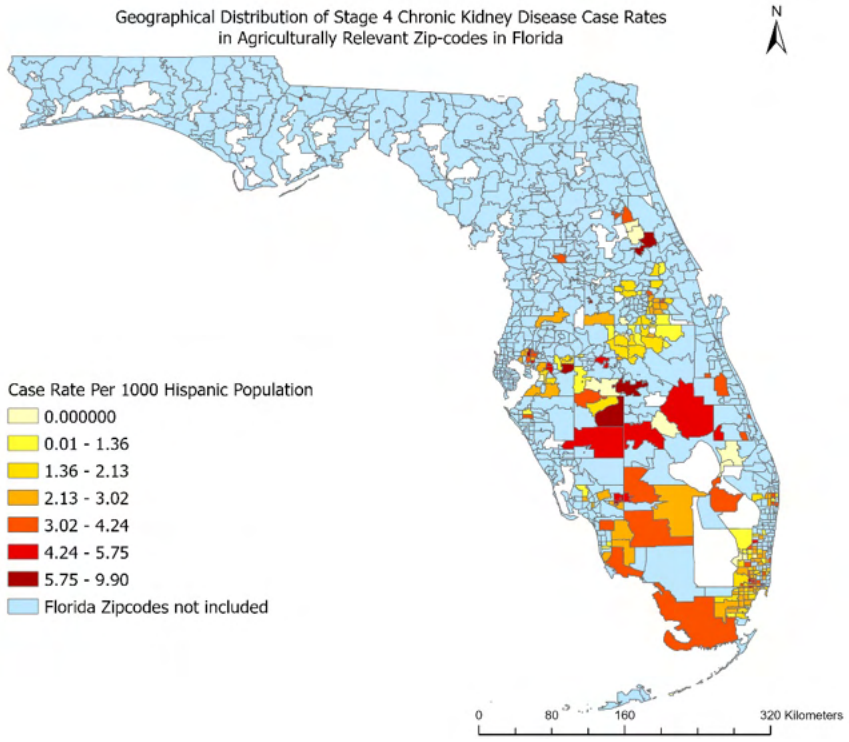


Figure 5. Stage 4 chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

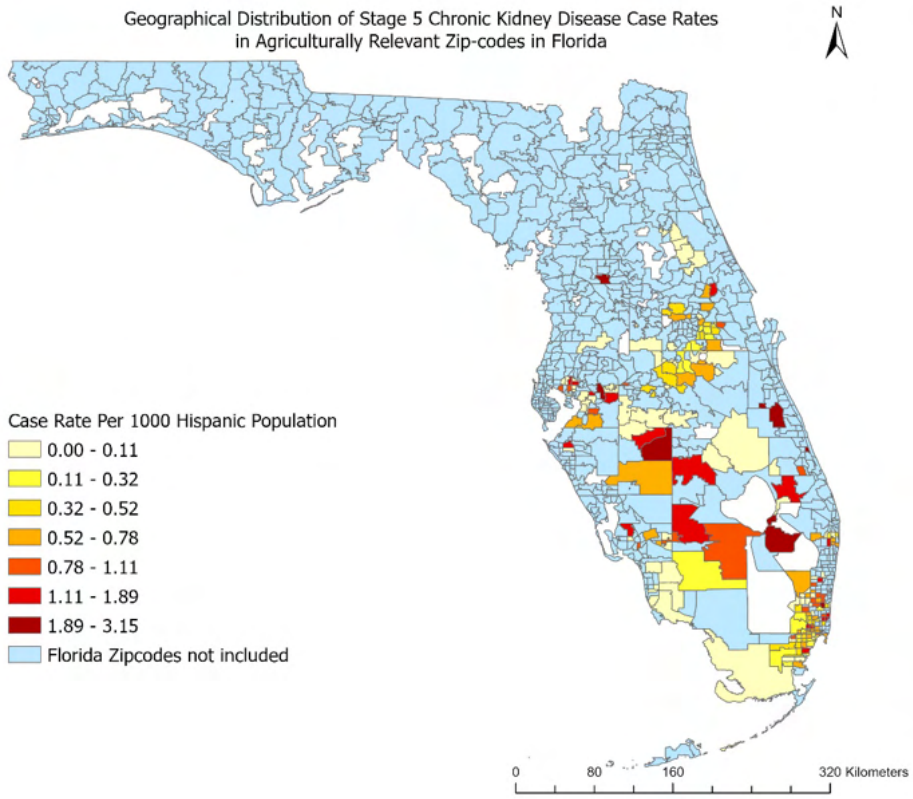


Figure 6. Stage 5 chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

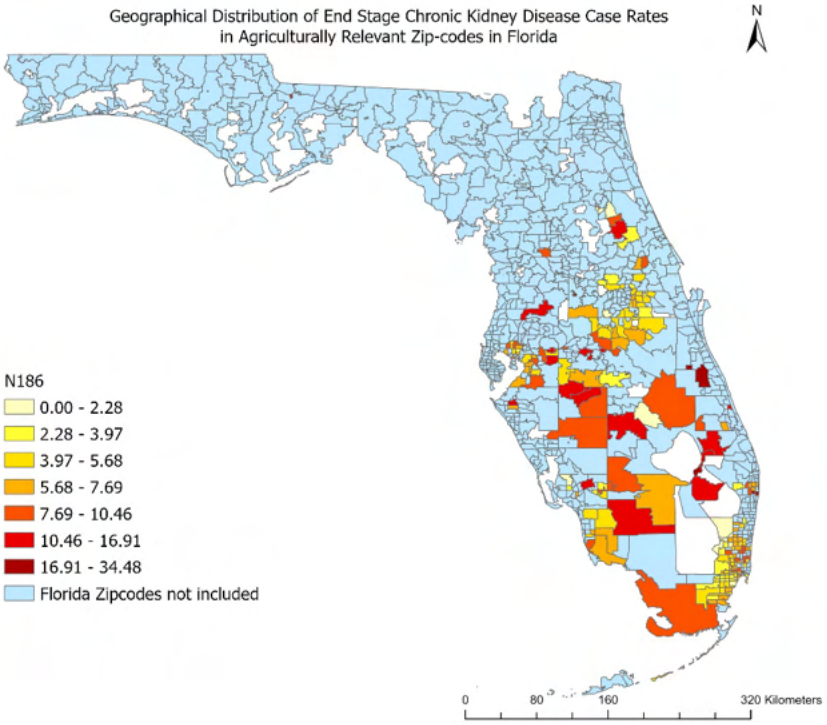


Figure 7. End stage chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

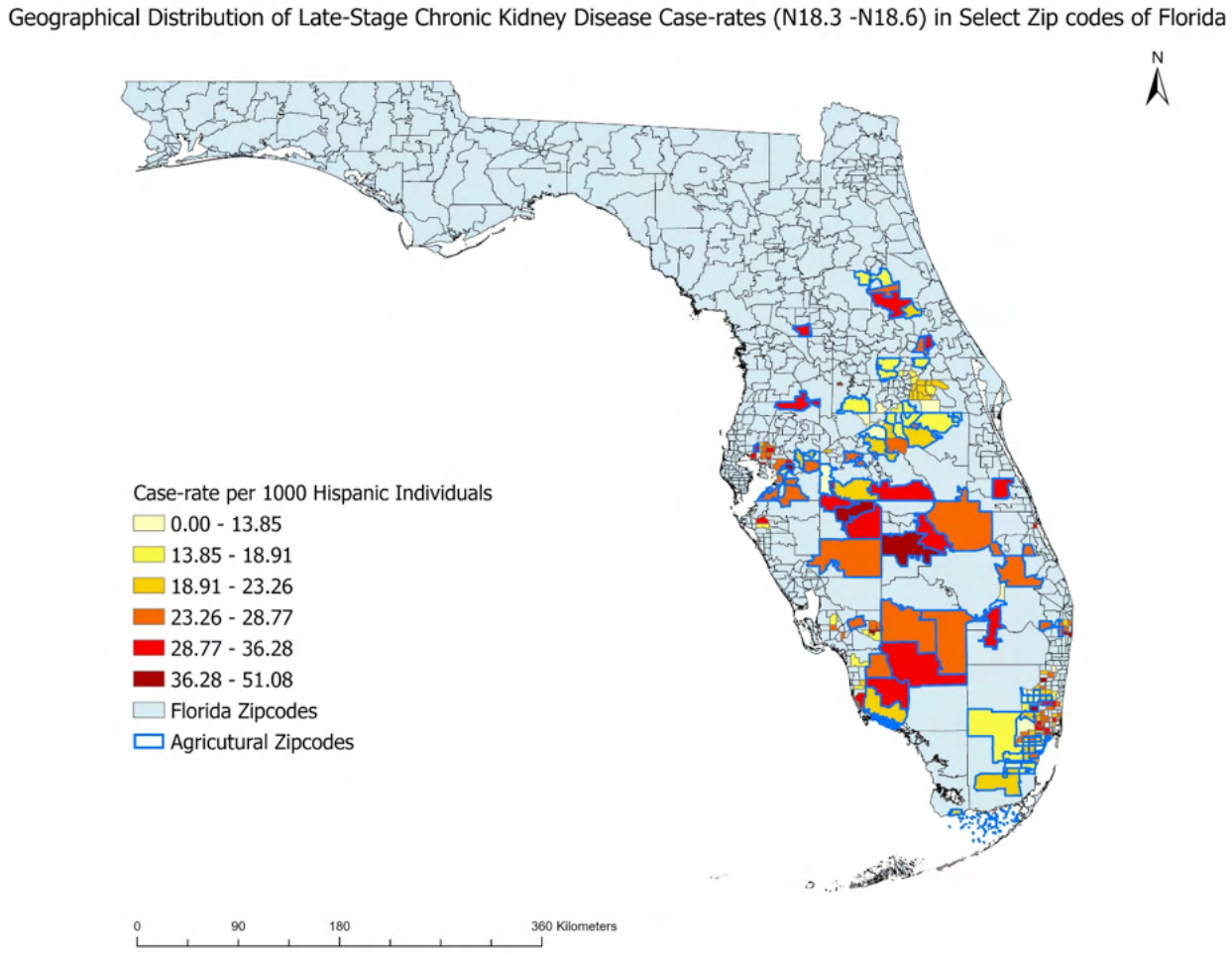


Figure 8. End stage chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

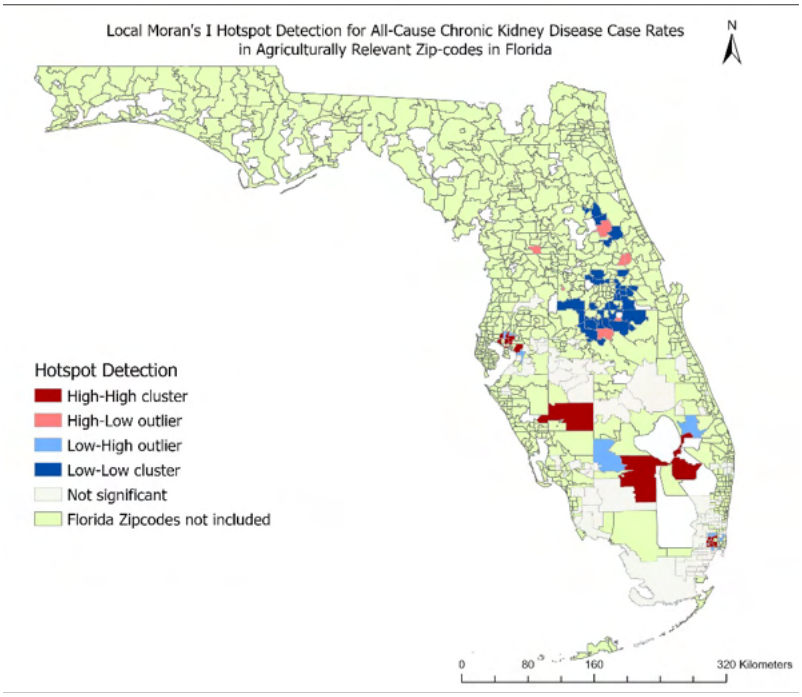


Figure 9. Local Moran's I Hotspot detection for all-cause chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Hotspots of high case-rates are denoted by red and hotspots of low case-rates by blue. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

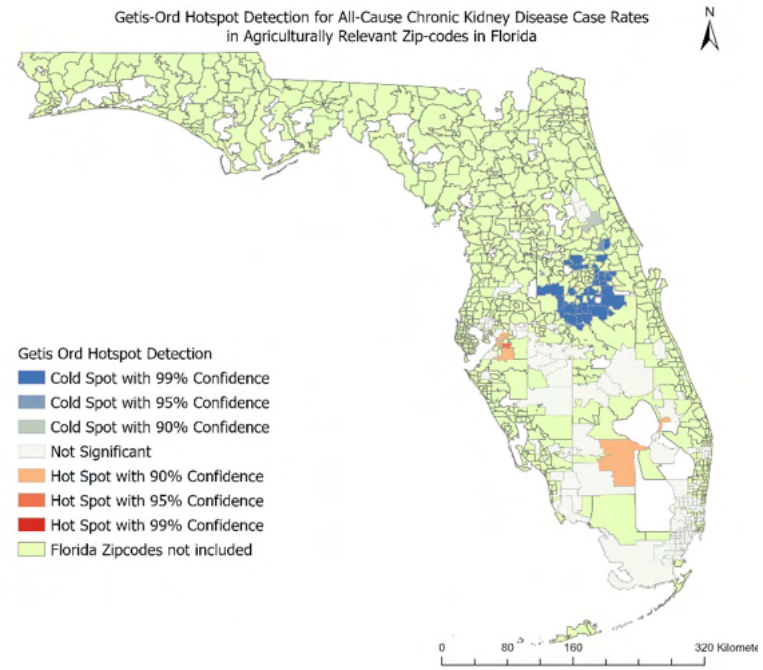


Figure 10. Getis Ord Hotspot detection for all-cause chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Hotspots of high case-rates are denoted by red and hotspots of low case-rates by blue. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

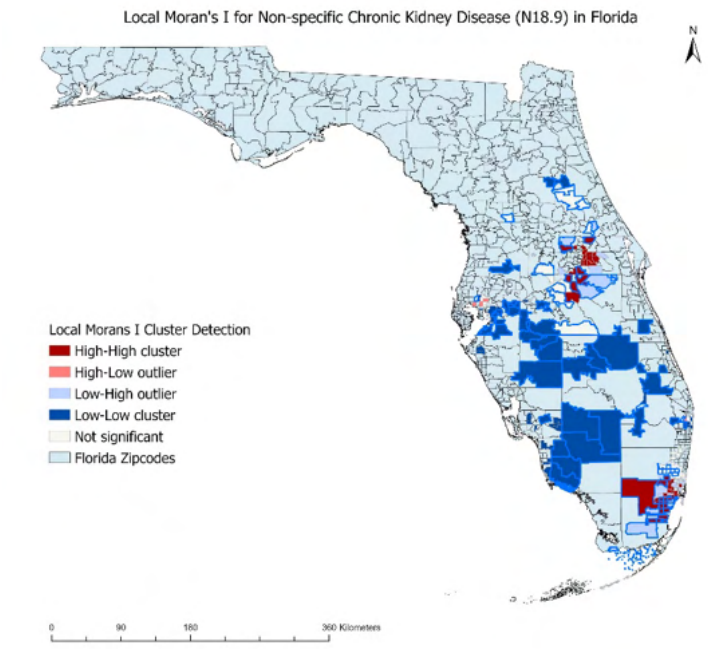


Figure 11. Local Moran's I Hotspot detection for end stage chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Hotspots of high case-rates are denoted by red and hotspots of low case-rates by blue. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

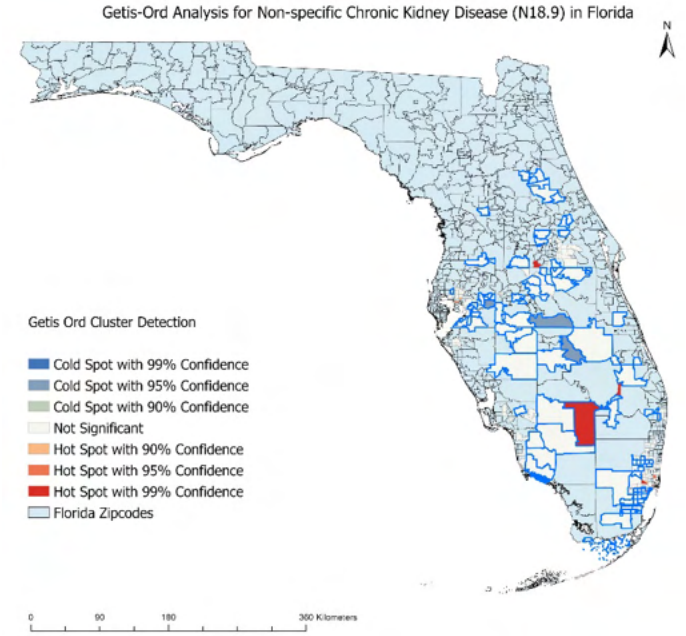


Figure 12. Getis Ord Hotspot detection for end stage chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Hotspots of high case-rates are denoted by red and hotspots of low case-rates by blue. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

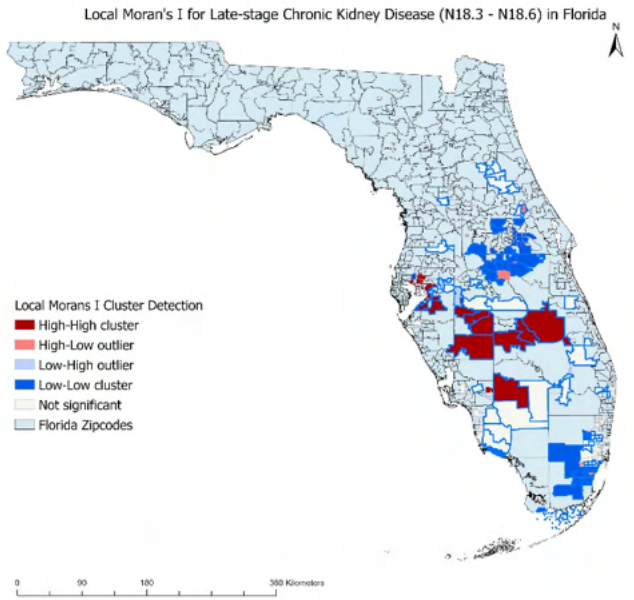


Figure 13. Local Moran's I Hotspot detection for late-stage chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Hotspots of high case-rates are denoted by red and hotspots of low case-rates by blue. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

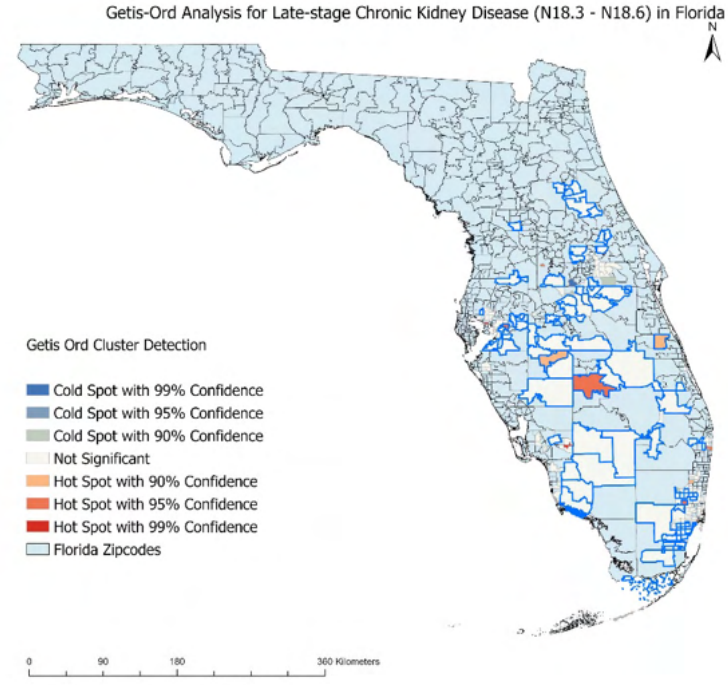


Figure 14. Getis Ord Hotspot detection for late-stage chronic kidney disease case rate among Hispanics for ZIP codes included in our study. Hotspots of high case-rates are denoted by red and hotspots of low case-rates by blue. Rates are shown as number of cases per 1000 patients in the OneFlorida dataset (2015-2020).

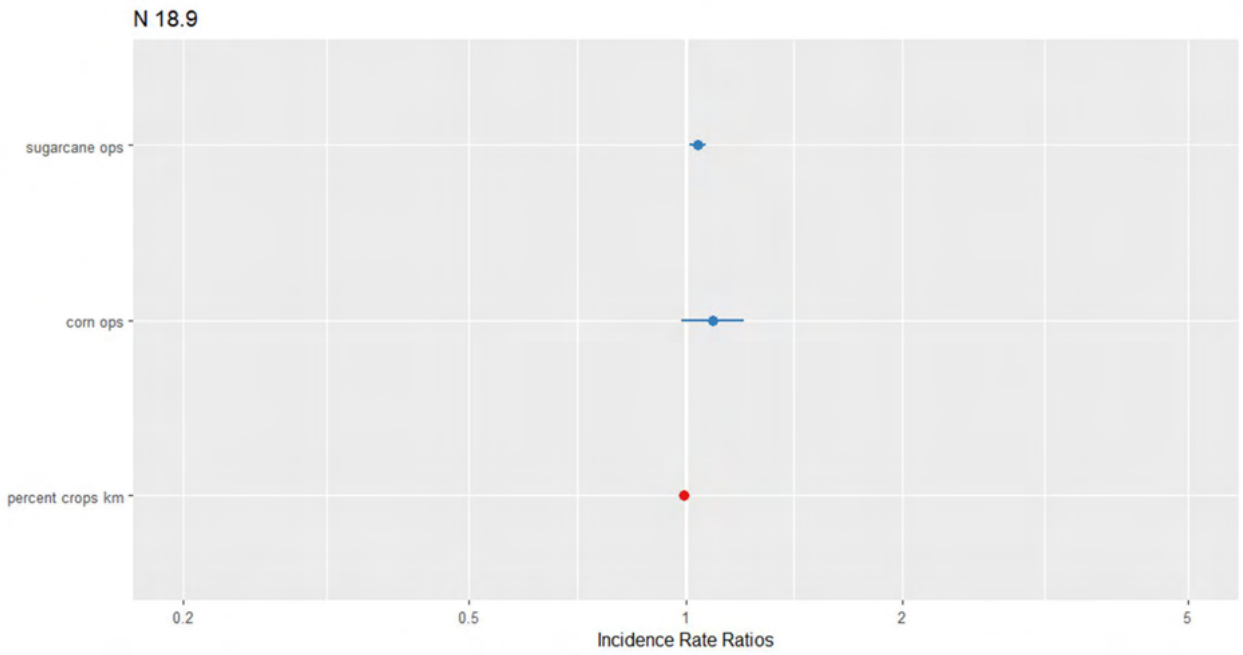


Figure 15. Forest plot of end-stage CKD Poisson regression model. Blue points denote variables with a positive association. Red points denote variables with negative association.

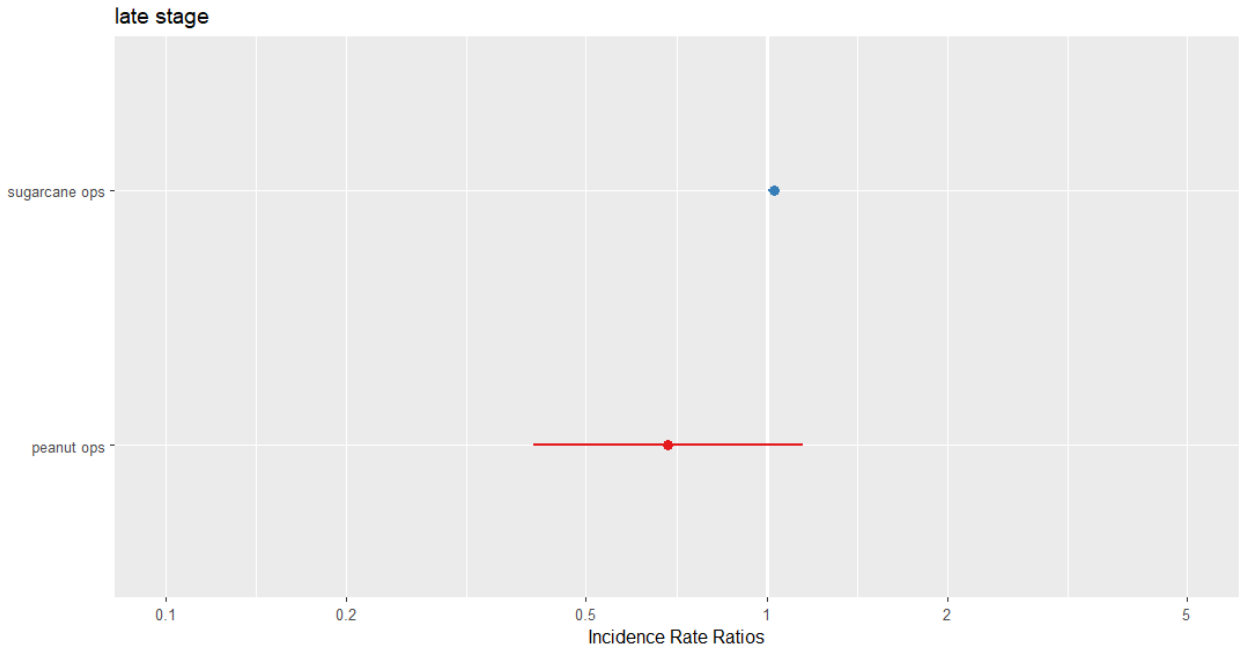


Figure 16. Forest plot of late=stage CKD Poisson regression model. Blue points denote variables with a positive association. Red points denote variables with negative association.

Progress Update: Exhaled Breath Condensate

Background and objectives: Little work has been done to advance biological surveillance tools that are efficient, relatively non-invasive and highly specific from a biomarker and pathogen identification perspective for the farmworker communities. The 'go-to' diagnostic tool for causative infectious agents is nasal swabs - an excellent method for identifying upper respiratory pathogens. However, this does not necessarily reflect the lower airways which requires bronchoscopy and sputum sampling - techniques that are invasive and are often contaminated with saliva. Furthermore, there are limited options to obtain true 'control' samples for comparison using these methods. Collection of exhaled breath condensate (**EBC**) has emerged as a non-invasive sample collection method that can be used to obtain information about a person's health status and *better reflects the lower respiratory environment that is typically associated with more severe ARIs compared to nasal swabs*[37].

EBC is produced by cooling the liquid phase of exhaled air. The majority of EBC is water but a small proportion is airway lining fluid which contains molecules which may serve as biomarkers of health status. Our goal of this pilot work was to:

1. Collect human EBC and determine whether pathogen identification, using the diagnostic Biofire platform (FDA approved test), is feasible in this sample type
2. Determine if we could detect lipids using a non-targeted lipidomics approach in EBC – which has not been shown in the literature to date.

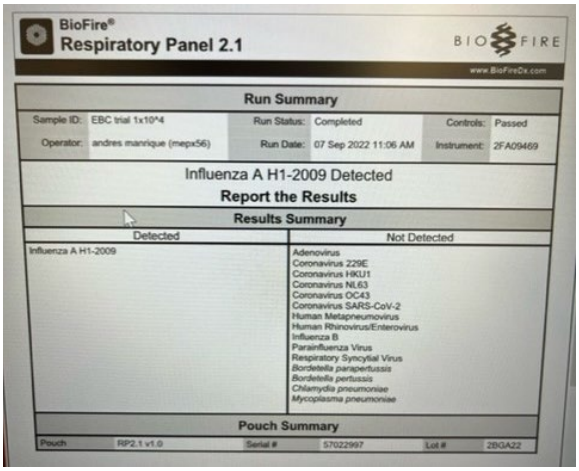
The focus on lipids is partially based on our recent publication showing an associate between lipid profiles and viral respiratory infections in human sputum samples (DOI: 10.1186/s12931-022-02091-w).

Methods and results:

EBC was collected from healthy volunteers using the RTube system. In brief, the individual breaths normally into the tube covered with a cold aluminum sleeve for 10 minutes. The condensate is collected and placed into a conical tube for processing. Typically we are able to collect ~ 1.5 mls from each individual.

Figure 1. Collection of exhaled breath condensate

The study team processed the condensate in 2 ways. First a series of experiments was performed to determine if we could detect a known virus – influenza (A/Mexico/4108/2009(pH1N1)). We spiked in several concentrations of this influenza virus into the EBC that ranged from 10^4 – 10^{-2} TCID50. We then extracted the RNA using a standard Qiagen kit for viruses and performed PCR using the HA and M2 gene primers. Using this method we were able to detect the virus for the 2 highest concentrations. We have now begun testing these same samples on the Biofire system, which does not require and RNA isolation or processing (this is all performed in the biofire system). To date we have been successful in detecting the influenza virus as shown in the output panel below. These data support that the matrix of the EBC does not interfere with the molecular reactions required for pathogen identification. We are currently working on defining the limit of detection of this assay.



For the lipid analysis, we collected an EBC samples as described above from a healthy volunteer. This sample was extracted with a series of solvents and injected into a mass spectrometer to see if any lipids could be identified. Results from this experiment support our ability to detect lipids as shown in the table below. Several lipid classes were identified that are known to play an important role in respiratory infections and disease. We also have more granular data on the specific lipid species from this data set that we are currently analyzing. These results support our ability to identify and semi-quantify lipids in EBC – this has not been performed to date as far as we know. These data also confirm our ability to employ EBC in the field to gain measurements that are critical to our larger R01 project that is under review.

Table 1. Initial lipid class identification and peak area identified in an EBC sample

Lipid	Peak Area
SM(20:1)+H	1.45E+06
DCER(14:0)+H	1.91E+05
DAG(14:0/18:1)+NH4	6.33E+04
MAG(22:5)+NH4	1.15E+04
PC(16:0/18:1)+AcO	1.78E+04
PE(16:0/20:3)-H	1.07E+05

Lynn Grattan, MD – Professor, Neuropsychology, University of Maryland

Pilot study of the acute psychological and health impacts of hurricane Irma in UFAS extension workers

Dr. Grattan examined 36 IFAS Extension Agents to explore Hurricane Irma's impact on health-related quality of life 6 to 8 weeks and at 1-year post disaster. Findings demonstrate that hurricane impact (exposure high versus low) predicted depression and PTSD. All participants obtained scores within the high average to very superior range on the Symbol Digits Modalities Test. Greater Hurricane Impact (home+work) was associated with elevated Depression, PTSD sx, Medical Symptoms 6- 10 weeks post hurricane (controlling for age and prior hurricane exposure).

	Beck Depression Inventory total score		Post Traumatic Checklist-5 Total Score		Total Number of Medical Symptoms	
	Coefficient (SE)	P value	Coefficient (SE)	P value	Coefficient (SE)	P value
Model 1:						
Exposure High vs. low	5.111111	0.036	11.22222	.01	5.111111	.002
Model 2:						
Exposure High vs. low	5.228696	.04	10.97848	.06	4.906668	.005
Past exposure	5.228696	.27	-.0248143	.97	.0126636	.57
Age	-.051819	.25	-.1153924	.47	.0126636	.83

TABLE 1. Depression, PTSD, No. of Medical Symptoms and Exposure (n=36).

John Luque, PhD – Associate Professor, Behavioral Sciences/Health Education, Florida A&M University

Aplicación Movil para Prevenir Agotamiento por Calor (AMPAC)

Pilot study of mobile app monitoring to prevent heat-related symptoms among Hispanic Farmworkers Farmworkers and supervisors or crew leaders showed enthusiasm for using the Heat Safety Tool. Since most farmworkers have smartphones, downloading the free app is feasible for them to download in most instances. Crew leaders using the heat safety app rated the app very highly on relevance, functionality, value and privacy. Farmworkers did not report being overly concerned about HRI based on their survey responses. Nevertheless, 19% of farmworkers had experienced nonspecific symptoms from working in the heat, such as headache, dizziness, and nausea. In the multivariate linear regression model, farmworkers had lower heat safety knowledge scores if they were H-2A visa holders, female, and only "a little bit concerned," compared to others who were "very concerned" about working in the heat. The results of this study indicate the need for continued heat safety training for both crew leaders and farmworkers to reduce the risk of HRI, especially among less experienced farmworkers.

Gülcan Önel, PhD – Assistant Professor, Food and Resource Economics, University of Florida

Uncovering patterns of mental, physical and occupational health issues among migrant farmworkers with different sociocultural networks: A pilot study among Haitian and Mexican farmworkers in Immokalee, FL

Dr. Önel completed the study data collection phase during Year 3 Quarter 4 to explore the extent to which migrant farmworkers with different ethnic backgrounds and social networks face higher risks of mental, physical and occupational health issues. The following marked key progress

1. Implementation of a three-module survey measuring mental and physical health status, social networks, and demographic and occupational background (in Spanish and Haitian Creole)
    - Sample: 30 Haitian male workers, 60 male and female Hispanic workers. Completed: interviews with Hispanic and Haitian workers.
    - Challenges:
        - Fear of deportation significantly higher, affecting recruitment. Each interview took ~3 hours → difficulties in recruitment and logistics → added cost (Pilot funding exhausted before completion)
        - Cultural barriers, and stigma associated with "mental health"
        - Difficulty finding skilled Haitian Creole-speaking interviewers living near Immokalee.

2. CBPR: Better understanding of underlying socio-economic and cultural differences between Hispanic and Haitian farmworkers as they relate to mental and occupational health.

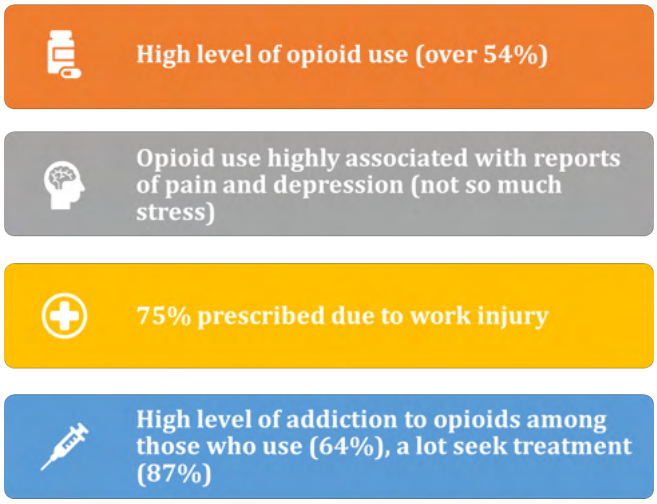
3. March 1st, 2019, 12 representatives from Haitian and Hispanic farmworker communities participated to help understand "*upstream" social and economic determinants* of mental health among farm workers.
   Themes of issues raised by Haitian farmworkers:
   Immigration – Fear of deportation, mixed-status families, family separations.
   Experiences of racism and discrimination – Specifically from Hispanics.
   Language barriers – Lack of English or Spanish. Difficult to engage with community.
   Feelings of social isolation and helplessness.
   Themes of issues raised by Hispanic farmworkers:
   Immigration – Fear of deportation, mixed-status families, family separations.
   Job displacement – Domestic workers are aging; growers are increasingly employing younger and stronger H-2A workers.
   Housing – Federally-mandated housing requirements for H-2A workers drive rental rates up for local workers. However, housing conditions continue to stay poor.

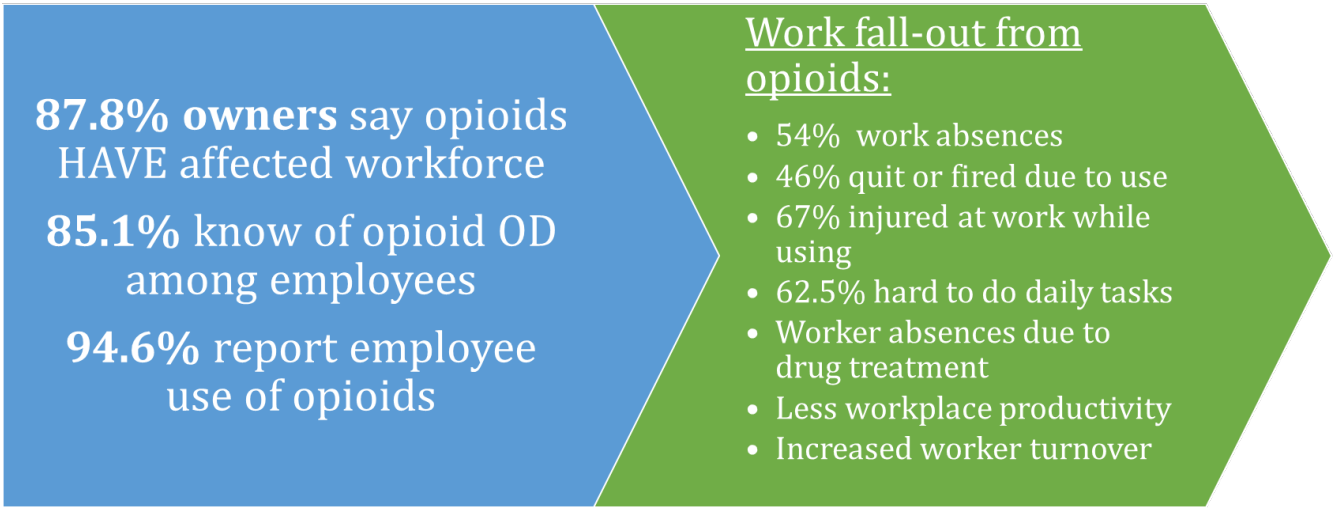
Antonio Tovar, PhD – Director, Farmworker Association of Florida
Agroecological practice in the face of climate change: Resilience, sustainability, and preparedness in Puerto Rico
Dr. Tovar surveyed the 5 geographical regions of Puerto Rico and compiled a list of 29 agroecology farmers, 15 conventional small-scale farmers, and additional 17 potential partners (i.e. extension officers, agricultural officials, and farmers associations). 50 surveys were completed by small farmers (<10 acreage): agroecology farmers, conventional farmers, and farmers using mix practices were interviewed.

Heidi Radunovich, PhD – Associate Professor, Family, Youth and Community Sciences, University of Florida

Understanding the scope of the opioid epidemic for agricultural industries

Data collection is in process and the total subjects to date are 132. Preliminary findings show that opioid use is strongly associated with pain among agricultural workers – of the people reporting opioid use, nearly 93% are reporting pain. However, pain is common for this population, with 86% of the total population reporting pain. Many who are experiencing pain do not take opioids (68%), so this begs the question: how are they managing their pain instead? The study team continues to observe a difference among the industries, with those in the nursery/landscape industry reporting much higher use of opiates (54%) than those in the livestock (7%) or crops (nearly 12%).





Gregg Stanwood, PhD – Associate Professor, Biomedical Sciences & Neuroscience

A novel approach to monitoring pesticide exposure in farmworkers

The goal of this study is to determine the feasibility of using sweat patches for biomonitoring pesticide exposure among immigrant Latino farmworkers. Laboratory experiments are underway to develop and assess the accuracy and precision of analytical techniques for assessing pesticide metabolites from sweat patches. Sweat and urine were monitored over a 1-week period (Sweat was sampled every 2 days and first void urines were collected every day. Only 1 sample each is being analyzed initially, but the PI will retain the ability to expand the analysis if warranted.

Atin Adhikari, PhD – Assistant Professor, Environmental Health Sciences, Georgia Southern University

Field evaluation of N95 filtering facepiece respirators against airborne dust and microorganisms during cotton harvesting

Dr. Adhikari has collected control air samples from three cotton farm locations and analyzed them for PM and culturable microorganisms. Respiratory deposition modeling data for particulate matter (PM) was presented in the inhaled aerosol dosimetry conference in Irvine, CA. Air sampling other field experiments at cotton farms continue during harvesting (by combine harvesters). Year 4 highlights include,

- The collection of air samples at three cotton farms have been completed. In addition to measuring the levels of PM_{10}, $PM_{2.5}$, PM_1, respirable, and total particle levels, the study team has measured total culturable bacteria, fungi, and abundance of airborne antibiotic resistance genes at all three farm locations.

- The respiratory deposition doses of PM_{10}, $PM_{2.5}$, PM_1 have been estimated by using the ICRP LUDEP computer-based respiratory deposition model. The study team has also used the Multiple Path Particle Dosimetry (MPPD) model. The new MPPD data is currently under analysis.

- The respiratory protection factors against airborne particles and total microorganisms during cotton harvesting have been determined by using a manikin fitted with N95 filtering facepiece respirators. We have also completed measuring the ATP levels (as a measure of total microbial activity) inside and outside of respirator surfaces.

Overall, all project tasks are now completed except for the additional analysis of respiratory deposition doses by using the MPPD model. This analysis part of the project is delayed because the student assistant was unavailable due to COVID-19 related university closure.

Results (March 2020 – September 2020)

Dr. Adihikari completed the analysis of airborne bacterial antibiotic resistance genes (ARGs) in air samples collected from cotton farms during this reporting period (March – September, 2020). Bacterial colonies were harvested from the agar plates, and the total genomic DNA (gDNA) was extracted using the PowerSoil® DNA Isolation Kit (QIAGEN-MO BIO) as described previously by our group (Adhikari et al., 2017). DNA was employed to perform real-time PCR to quantify targeted major bacterial ARGs. The ARG's include β-lactams resistance genes (bla_{tem-1} and bla_{pse-1}) (Chen et al., 2004), an aminoglycosides resistance gene (*aac*(3)-*Iva*) (Chen et al., 2004), a tetracycline resistance gene (*tet*A) (Chen et al., 2004), a trimethoprim resistance gene (*dhfrI*) (Chen et al., 2004), a sulfomamide resistance gene *(sulI*) (Chen et al., 2004), a chloramphenicol resistance gene (*flo*) (Chen et al., 2004), a phenicol resistance gene (*catIII*) (Maynard et al., 2003), a glycopeptide resistance gene (*van*C) (Clark et al., 1993), and a macrolide resistance gene (*erm*B) (Gevers et al., 2003). The positive control for detection used for ARG PCR was *Salmonella typhimurium*. A series of comparative critical threshold ($\Delta\Delta C_T$) real-time PCR was used to quantify targeted major ARGs with reference to bacterial 16S rRNA gene as described previously (Zhu et al., 2013).

The figure below is showing a heatmap displaying the relative abundance of selected antibiotic resistance genes (ARGs) in different air samples collected from cotton farms during harvesting related work activities.

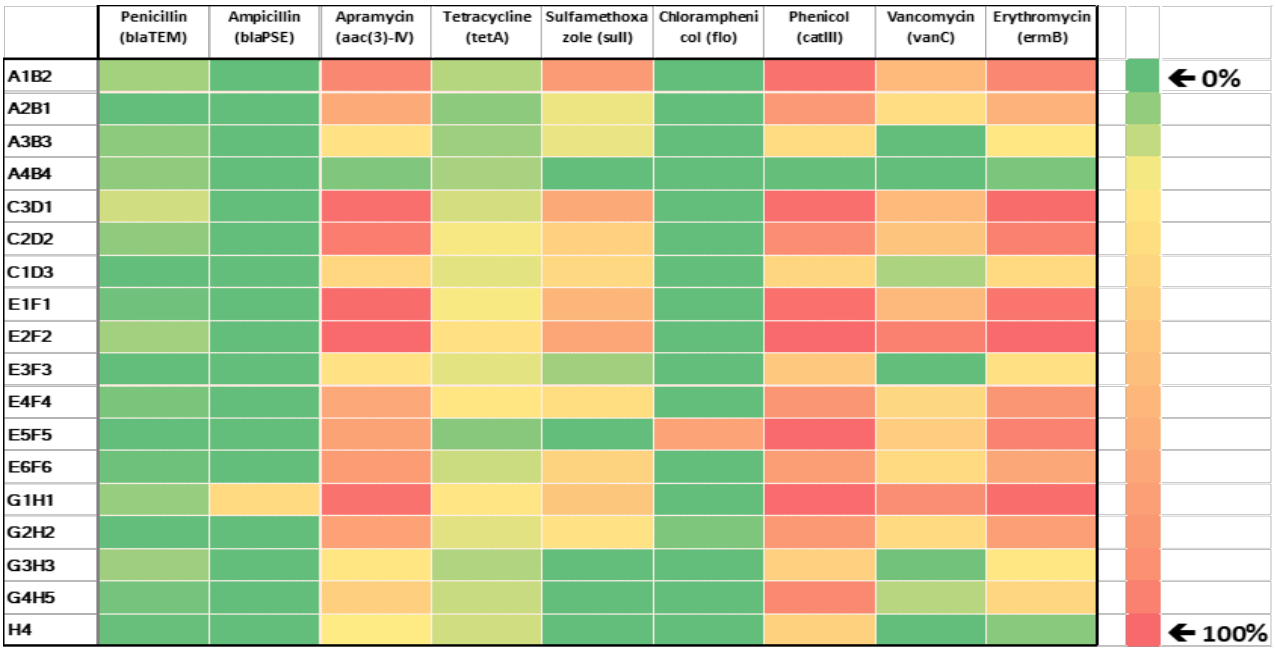


FIGURE 1. Heatmap: Relative abundance of selected ARGs across air samples from cotton farms during harvesting related work.

Conclusions

The abundance of antibiotic resistance genes (expressed in % with respect to 16S gene copies per unit sample volume) for phenicol, apramycin, and erythromycin were relatively higher (96.60±35.68%), (92.49±33.63%), and (85.98±26.49%) than other ARGs in the air during cotton harvesting works.

Outreach & Dissemination (conference presentations)

- Sherpa SD, Adeoye C, Thornton T, Adhikari A. Overall microbial activity on N95 respirator surfaces when used in an agricultural farm. "ICEM 2020: International Conference on Environmental Microbiology" April, 2020 in New York City, NY (virtual).
- Thornton T, Higgins D, Banerjee P, Adeoye C, Sherpa SD, Adhikari A. Exposure levels of bioaerosols and airborne antibiotic resistance genes in cotton farms during cotton harvesting. APHA 2020 Virtual Annual Meeting and Expo (Accepted).
- Thornton T, Adeoye C, Sherpa SD, Adhikari A. Airborne concentrations of $PM_{2.5}$ and PM_{10} at cotton farms during harvesting. Georgia Southern University Research Symposium, 2020, Statesboro, Georgia (accepted for presentation; the conference was canceled due to COVID-19).
- Adeoye C, Thornton T, Sherpa SD, Adhikari A. Respiratory protection against particles of 0.3 – 10 µm in cotton farms during harvesting. Georgia Southern University Research Symposium, 2020, Statesboro, Georgia (accepted for presentation; the conference was canceled due to COVID-19).

Highlights

Publications and Presentations

Önel, G., Simnitt, S., Stacciarini, JM and **Tovar-Aguilar, A.** (2020). Covid-19 Risk Factors Vary by Legal Status among Florida Crop Workers. *Agricultural & Applied Economics Association.* 25 (3), 1-10

Coker, E. S., Cavalli, L., Fabrizi, E., Guastella, G., Lippo, E., Parisi, M. L., Pontarollo, N., Rizzati, M., Varacca, A., & Vergalli, S. (2020). The Effects of Air Pollution on COVID-19 Related Mortality in Northern Italy. Environmental & resource economics, 1–24. doi: 10.1007/s10640-020-00486-1. Epub ahead of print. PMID: 32836855; PMCID: PMC7399615.

Campoverde, E.V. and Morera, M. (2020). Personal protective equipment: Respirators. Continuing education workshops to delivered online in English and Spanish at the UF/IFAS Extension Miami-Dade County office, October 22 and November 5, Homestead, Florida.

Adhikari, A. Contributions of pets to indoor environment exposome: hypothetical links with cancers and respiratory disorders. 2020 Mount Sinai Exposome Symposium (March 2020), New York, NY.

Tovar, A. Society for Applied Anthropology Annual Meeting. Agricultural Practices and Climate Change in Puerto Rico: Lessons from Maria. (March 2020) Albuquerque, NW.

Önel, Gülcan, 2020. "Comparative Assessment of Mental Wellbeing, Social Networks, and Earnings of Haitian and Hispanic Farm Workers in Florida," 2020 Annual Meeting, July 26-28, Kansas City, Missouri 304657, Agricultural and Applied Economics Association.

Simnitt, Skyler M. & **Önel, Gülcan** & Palacios Rivera, Jamille, 2020. "Revisiting Demand and Supply of Farm Labor in the United States: A Panel Data Approach," 2020 Annual Meeting, July 26-28, Kansas City, Missouri 304207, Agricultural and Applied Economics Association.

Simnitt, Skyler M. & **Önel, Gülcan** & Farnsworth, Derek, 2020. "Do Guest Workers Earn more than Domestic Workers? Evidence from Florida's Citrus Industry," 2020 Annual Meeting, July 26-28, Kansas City, Missouri 304205, Agricultural and Applied Economics Association.

Citrus Industry News: Florida Crop Workers at Risk. (2020, October 1). *Citrus Industry Magazine is a publication of AgNet Media, Inc.* Interview with **Dr. Gülcan Önel** retrieved from https://citrusindustry.net/2020/10/01/florida-crop-workers-at-risk/.

Luque, J, Becker, A, Bossak, B, Grzywacz, J, Tovar-Aguilar, A: Guo, Y. (2019) Knowledge and Practices to Avoid Heat-Related Illness among Hispanic Farmworkers along the Florida-Georgia Line. *Journal of Agromedicine*. DOI: 10.1080/1059924X.2019.1670312 PMID: 31544652

Luque, J, Becker, A, Bossak, B, Grzywacz, J, Tovar, A, Guo, Y. "Knowledge and Practices for Adapting to Working in the Heat among Latino Farmworkers in the Florida-Georgia Border Region," roundtable paper presented at the APHA Conference (November 2019), Philadelphia, PA. https://apha.confex.com/apha/2019/meetingapp.cgi/Paper/431357

Adhikari, A, Dotherow, JE. Respiratory deposition modeling for PM10, PM2.5, and PM1 exposure in cotton farms for standard and heavy workers. Third Aerosol Dosimetry Conference, Inhaled Aerosol Dosimetry: Models, Applications and Impact (October 2019), Irvine, CA.

Stacciarini, J.M., **Önel, Gülcan**, & **Tovar, A.** A Rural State of Mind: Addressing Mental, Physical, and Economic Health of Farm Communities in Florida. *East Coast Migrant Stream Forum.* (October 2019), San Juan, Puerto Rico.

Honors/Awards

Gregg Stanwood. CDC/NIOSH R21 OH012124-01A1 NIH/NIOSH Noninvasive Pesticide Biomonitoring Using Sweat Patches (09/01/21 – 08/31/23).

Maria Morera. Promotion to Assistant Research Scientist. (2020). Agricultural Education and Communication at the University of Florida, Institute of Food and Agricultural Sciences.

Heidi Radunovich. Co-Investigator. (2019). Agrisafe Network, Inc. (PI: Natalie Roy) *Southern region farm and ranch stress assistance network.* Develop a clearinghouse of farmer assistance programs in the region inclusive of programs providing professional agricultural behavioral health counseling and referral.

Heidi Radunovich. (2018). Research Enhancement Award. Florida Nursery, Growers and Landscape Association (FNGLA). Endowed Research Fund.

Gülcan Önel and **Antonio Tovar**. (2018). Robert Wood Johnson Foundation. Interdisciplinary Research Leaders Award. The broad goal of the Interdisciplinary Research Leaders (IRL) program is to produce diverse interdisciplinary leaders who conduct and apply high-quality, community-engaged, action-oriented, equity-focused health research in order to drive improvements in the health of communities.

Section III – Outreach Core

Project PI: Tracy Irani
Ricky Telg; Ashley McLeod-Morin; Lisa K. Lundy; Angela B. Lindsey; Heidi Radunovich; Martie Gillen

Overview

The Outreach Team leads a comprehensive Core, providing knowledge transfer support for the Research Core and Pilot/Feasibility Program, integration with all proposed educational and extension activities, and effective and culturally competent communication, and information dissemination to stakeholders across the six-state region. The Outreach Core activities consist of disseminating relevant risk reduction interventions and research findings and promoting adoption of best practices in the agricultural and fishery workplaces.

The goals of the Outreach Core for the supplemental year were to translate and disseminate research-to-practice (r2p) findings in the agricultural, fishery and forestry sectors, develop and implement inclusive communications, and grow the Center's network to foster valuable collaborations. These goals were accomplished through the use of traditional and innovative media efforts and effective collaborations with industry stakeholders.

Since its inception in 2016, the Center's audience growth has reached 2,370 email subscribers, 586 social media followers, and 44,000 website views with an annual average growth of 36% year over year. The Center's Outreach Core has hosted a series of ongoing training and development opportunities, including 27 webinars, seven Community Stakeholder Advisory Board Meetings, four State of the Science research events with over 35 unique presentations, and eight issue guides, white papers, and Extension documents. The Outreach Core has developed multiple education and training videos, including webinars, related to topics of agricultural health and safety, such as heat-related illness, pesticide exposure, mental health, workplace-related illnesses, injuries, and deaths and COVID-19. Videos have been produced in both English and Spanish and have received over a total of 1,403 views.

Many of the communication products developed by the SCCAHS Outreach Core received awards from the Association for Communication Excellence, including videos, crisis campaigns, and print materials. The Outreach Core also supported key issues in the agricultural, fishery, and forestry sectors, including mental health first-aid, opioid misuse, and the COVID-19 pandemic. To support these issues, the outreach team hosted specialized training and developed curated educational resources.

Accomplishments (10/2021 - 9/2022 only)

- What were the major goals and objectives of the project?
  The goals of the Outreach Core were to translate and disseminate research-to-practice (r2p) findings, develop and implement inclusive communications, and grow the Center's network to foster valuable collaborations.
- What was accomplished under these goals?
  - 105 new email subscribers
  - Monthly newsletter with an average email open rate of 45%
  - Monthly webinars
  - Restructured Community Stakeholder Advisory Board (CSAB) to be more regionally inclusive of our geographic region.
- What opportunities for training and professional development did the project provide?

  - **Eight** webinars related to health equity, injury surveillance, and emerging resources in agricultural health and safety.
  - The Outreach Core hosted two meetings for the Community Stakeholder Advisory Board. One meeting, hosted in March 2022, served as a final meeting for the grant cycle, delivered final research updates, provided plans for the future. The other meeting, hosted in September 2022, welcomed many returning CSAB members as well as many new members. The newly restructured CSAB is more geographically representative of the center's catchment area. Valuable feedback was received that will be applied as the team embarks on new outreach initiatives that will build on the foundation built in the previous grant cycle.
- How were the results disseminated to communities of interest?
  - Email listserv that includes nearly 400 regional stakeholders
  - CSAB members served as an intermediary audience that delivered information to secondary audiences of the center.
- What do you plan to do during the next reporting period to accomplish the goals and objectives?
  - Translate and disseminate research-to-practice (r2p) findings and promote adoption of health and safety strategies in agricultural workplaces among the Center's target populations, including underrepresented, vulnerable, and culturally diverse subpopulations.
  - Develop, test, and implement inclusive communications and education materials utilizing a wide range of traditional and digital media.
  - Grow the Center's network by partnering with health and AgFF industry leaders to foster cohesive collaborations with intermediaries, such as news media, educators, public health specialists, and opinion leaders, and to expand awareness of the Center and its resource materials targeted to end users, such as agricultural producers, seafood workers, farm crew leaders, and migrant workers.

State of the Science Meeting

Hosted by the Southeastern Coastal Center for Agricultural Health and Safety (SCCAHS) headquartered at the University of Florida in Gainesville, FL, the annual State of the Science Meetings combine esteemed speakers to present research relevant to occupational safety and health needs of people working in agriculture, fishing, and forestry in Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Puerto Rico, and the U.S. Virgin Islands. State of the Science 2021 featured researchers and scientists from various fields from across the United States, who presented their findings related to occupational, environmental and physical barriers in the agriculture, forestry and fishery industries. The Outreach Core has begun planning for the State of the Science 2023, including determining a meeting theme, potential speakers, and possible vendors.

Key Accomplishments 2021-2022

Community Stakeholder Advisory Board

The Southeastern Coastal Center for Agricultural Health and Safety (SCCAHS) is committed to stakeholder involvement. The Outreach Core prioritizes community-based participatory research, and has included representatives from Extension, industry, public agencies, regulatory agencies, academia, advocacy organizations, and medicine on our Center's Community Stakeholder Advisory Board. A high-functioning CSAB allows our Center to better engage stakeholders in receiving input on research findings, educational and communications materials and message testing to make our work accessible to the community at large.

The Outreach Core hosted two meetings for the Community Stakeholder Advisory Board. One meeting, hosted in March 2022, served as a final meeting for the grant cycle, delivered final research updates, provided plans for the future. The other meeting, hosted in September 2022, welcomed many returning CSAB members as well as many new members. The newly restructured CSAB is more geographically representative of the center's catchment area. Valuable feedback was received that will be applied as the team embarks on new outreach initiatives that will build on the foundation built in the previous grant cycle.

Communications

The Outreach Core prioritizes a connection with center leadership to develop messages for farm families, laborers, supervisors, and company owners (all the stakeholders) to communicate important points about workplace safety. These messages are developed with different frames to ascertain which frame will be most effective. SCCAHS seminars/webinars in agricultural safety and health/occupational health have proven reach to all stakeholders and academic partners. The seminar/webinar series adds to the library of outreach materials and is intended to draw on SCCAHS investigators as well as external speakers. Seminars are webcast and archived on the SCCAHS website to facilitate inclusion of investigators at collaborating institutions. The Outreach Core also welcomed Ashley McLeod-Morin, Ph.D. in October 2021 as the Associate Director of Strategic Communication. McLeod-Morin has been instrumental in building relationships with existing and new stakeholder partners in the agricultural community and applied research. McLeod-Morin has also led the planning of applied research projects focused on message testing and audience analysis that will guide the development of communication products related to agricultural health and safety.

Webinars hosted by SCCAHS Outreach Core (October 2021 – Present):

- **Serap Gorucu** November 17, 2021 Available Data Sources for Agricultural Injury Surveillance
- **Cindy Prins** October 28, 2021 What's Next? Understanding the current status of COVID-19 and future projections
- **Latoya O'Neal** January 20, 2022 Advancing Health Equity as a Core System Value
- **Dawn E. Burton** February 23, 2022 Practical Steps to Advancing Health Equity and Minimizing Bias in Health Related Programming Efforts
- **Erika Scott** March 9, 2022 Why Agriculture Remains Undercounted in Fatal and Non-Fatal Occupational Injury Surveillance Systems
- **Samantha Murray and Styliana Resvanis** April 27, 2022 Communicating with Vulnerable Populations about Pandemic Related Health Risks
- **David Buys** June 29, 2022 Film, Farmers, and Finding a New (Old) Tool for Education: On the Farm
- **Ashley McLeod-Morin** July 14, 2022 Emerging Topics and New Collaborations in the Southeastern Coastal Center for Agricultural Health and Safety

State of the Science Meeting

There has been an increased focus on moving beyond generating evidence to translating evidence into practice and policy actions to ensure that scientific discoveries actually reach the populations for whom they are intended and are implemented with fidelity. The State of the Science meetings were developed in response to this increased focus, and the dissemination approach is accomplishing its work by deepening multidisciplinary relationships, building capacity for public health professionals to collaborate effectively with other–related disciplines, and developing a research agenda on farmworker/fisher/forestry health translation, dissemination, and implementation through interdisciplinary collaboration. Although effort was dedicated to the planning/implementation of an in-person meeting, the event was moved to a virtual format. The State of the Science meetings have become a special, more regionally coveted space for the dissemination of new scientific knowledge across disciplines, as well as for the establishment and development of social networks among scientists across U.S. academic institutions and community partners. However, the virtual dimension of conferences, was a challenge in ensuring effectiveness and relied on a different framing of events, the teams' comfort navigating the multiple facets of technology and the chosen platform. To deliver content in a more interactive online space, the Outreach Core chose to deliver the 2021 SOS Meeting using Whova, an interactive virtual meeting platform.

The 2021 State of the Science Meeting focused on Pathways to Health Equity in Agriculture, Fishery and Forestry was delivered at the close of Year 5 via Whova on September 9, 2021. The annual meeting featured researchers and scientists from various fields from across the United States, who presented their findings related to occupational, environmental and physical barriers in the agriculture, forestry and fishery industries.

Pathways to Health Equity in Agriculture, Fishery and Forestry
September 9,2021
Keynote Speakers
Pathways to Health Equity in Agriculture, Fishery and Forestry presented by Glenn Morris and Linda Cottler

Equity as a Framework for Health presented by Michael Gutter, Roger Rennekamp, and Latoya O'Neal

Communicating with Vulnerable Populations about Pandemic-Related Health Risks presented by Ashley McLeod-Morin, Samantha Grenrock, Megan Macpherson, and Matt Surrency

Understanding Injury and Illness Disparities to Achieve Health Equity presented by Erika Scott, Risto Rautianen, and Marcy Harrington

Poster Presentations
Prevalence of Anaplasmosis in White-tailed Deer and Inherent Risks to Hunters

Social determinants of occupational health and safety among agricultural workers in the U.S. southeastern coastal states

Prevalence of Ehrlichiosis ewingii in White-tailed Deer and Possible Transmission to Humans
Agricultural Mental Health Literacy Programs

Dangers of Gossypol to Cotton Farmers and Gin Operators

Anaplasmosis and the Dangers of Tick-Borne Diseases to Handlers of White-tailed Deer Carcasses

Publications and Presentations

Irani, T., Pierre, B. & Nesbit, T. (2021). Agricultural Professionals' Perceptions of COVID-19 and Occupational Health and Safety. *Journal of International Agricultural and Extension Education.* https://doi.org/jiaee.2021.28106

Irani T, Pierre, B. F, Nesbit, T.S. (2021). Agricultural stakeholders' perceptions of occupational health and safety in the Southeastern U.S. Coastal States. *International Journal of Environmental Research and Public Health,* 18(12):6605. https://doi.org/10.3390/ijerph18126605

Lindsey, A., McLeod-Morin, A., Lundy, L., Irani, T., & Telg, R. (2022). *Using Communication Toolkits to Expand Extension Efforts Related to Agricultural Health and Safety Topics.* Abstract presented at the 2022 Extension Professional Associations of Florida Annual Meeting, Panama City, FL.

McLeod-Morin, A., Lundy, L., Lindsey, A. B., Kandzer, M., Telg, R., Irani, T., Stokes, P., Castano, V., & Santa Maria, N. (2022). *It All Goes Back to Trust: A Qualitative Exploration of Extension Professionals' Perceptions of COVID-19 Vaccines in Rural Florida.* Abstract presented at the 2022 National Agricultural Communications Symposium, New Orleans, LA.

McLeod-Morin, A., Irani, T., Telg, R., Lindsey, A., & Lundy, L. (2022). *Empowering Extension Empowers Everyone: Developing Agricultural Health and Safety Outreach Materials for Cooperative Extension.* Abstract presented at the 2022 International Society for Agricultural Safety and Health Annual Conference, Fort Collins, CO.

2022 Awards

- **Third place people's choice poster**, 2022 National Agricultural Communications Symposium
    - *It All Goes Back to Trust: A Qualitative Exploration of Extension Professionals' Perceptions of COVID-19 Vaccines in Rural Florida*
- **Silver Award: Issue Management, 2022 Association for Communication Excellence**
    - COVID-19 Vaccine Information Campaign
- **Bronze Award: Publications for Diverse Audiences, 2022 Association for Communication Excellence**
    - COVID-19 Vaccine Translated Info Sheets
- **Gold Award Winner: Digital-only Publications, 2022 Association for Communication Excellence**
    - Mental Health in Agriculture Impact Report

Section IV – Cumulative Years 1 – 5 Extended Publications/Presentations

Planning and Evaluation Core 2016 – 2022

1. Chicas R, Elon L, Houser M, Mutic A, Gallegos E, Smith D, Modly L, Xiuhtecutli N, Hertzberg V, Flocks J, Sands J, and McCauley L. "The Health Status of Hispanic Agricultural Workers in Georgia and Florida." *Journal of Immigrant and Minority Health* 24:1129-1136 (2022).

2. Flocks J and Espinoza M. "Historical and Current Insights on Environmental Health and Agricultural Guestworkers" Ecology Law Quarterly 48:1015-1049. (2021)

3. Lauzardo M, Kovacevich N, Dennis A, Myers P, Flocks J, Morris JG Jr. An Outbreak of COVID-19 Among H-2A Temporary Agricultural Workers. Am J Public Health. 2021 Apr;111(4):571-573. doi: 10.2105/AJPH.2020.306082. PMID: 33689435; PMCID: PMC7958039.

4. Israel, G. D., Diehl, D. C., Galindo, S., Ward, C., Ramos, A. K., Harrington, M., & Kasner, E. J. (2021). Extension Professionals' Information Use, Protective Behaviors, and Work-Life Stress During the COVID-19 Pandemic. *The Journal of Extension, 58*(6), Article 5. https://tigerprints.clemson.edu/joe/vol58/iss6/5

5. Israel, G. D., James, H. E., & Gariton, C. E. Anxiety disorders among Extension Professionals' during the COVID-19 Pandemic. Paper presented at the virtual annual meeting of the Southern Rural Sociological Association, February 2021.

6. Flocks J. The Potential Impact of COVID-19 on H-2A Agricultural Workers. J Agromedicine. 2020 Oct;25(4):367-369. doi: 10.1080/1059924X.2020.1814922. Epub 2020 Aug 28. PMID: 32856557.

7. Israel, G. D., James, H. E., & Gariton, C. E. Anxiety disorders among Extension Professionals' during the COVID-19 Pandemic. Paper presented at the virtual annual meeting of the Southern Rural Sociological Association, February 2021.

8. Mitchell, C., Israel, G. D., Galindo, S. & Diehl, D. C. (February, 2020). From Plan to Action: Adapting Evaluation to Serve the Developmental Needs of a Newly-Funded Multidisciplinary Research Center. Evaluation and Program Planning. 78. ISSN 0149-7189

9. Mitchell RC, Israel GD, Diehl DC, Galindo-Gonzalez S. From plan to action: Adapting evaluation to serve the developmental needs of a newly-funded multidisciplinary research center. Eval Program Plan. 2020 Feb;78:101729. doi: 10.1016/j.evalprogplan.2019.101729. Epub 2019 Oct 18. PMID: 31698318.

10. Flocks J, Tovar JA, Economos E, Thien Mac VV, Mutic A, Peterman K, McCauley L. Lessons Learned from Data Collection as Health Screening in Underserved Farmworker Communities. Prog Community Health Partnersh. 2018;12(1S):93-100. doi: 10.1353/cpr.2018.0024. PMID: 29755052.

Presentations

11. Arosemena, FA, Flocks, J, & Morris, JG. (2022, September 28-29). *Addressing the scarcity of Florida farmworker data: Using geographic information systems to assess vulnerability in H-2A and migrant labor camp housing* [Poster Presentation]. International Society of Exposure Science 2022 "From exposure to human health: New developments and challenges in a changing environment" Lisbon, Portugal. https://intlexposurescience.org/

12. "Farmworkers and Heat-Related Illness" (invited presenter). *Farmworker Justice – Environmental Justice Symposium,* Online, May 18, 2022.

13. "Agricultural Safety and Health" (invited presenter) with Serap Gorucu. *Florida Health Policy Leadership Academy*, Online, May 6, 2022.

14. "Centering Unheard Voices: Community-Driven Collaboration for Health and Safety with Farmworkers in the U.S." (panel) with Becca Berkey, Maria Carmona, Jeannie Economos, Joseph Grzywacz, and Benita Lozano. *Northeastern University's Myra Kraft Open Classroom,* Online, March 2, 2022.

15. Gators Going Green, Gainesville, FL, October 8, 2020. Presentation on farmworker health at University of California Davis law school panel, February 25, 2021.

16. Flocks J. "The Potential Impact of COVID-19 on H-2A Agricultural Workers." Journal of Agromedicine 25(4): 367-369, 2020. "Southeastern Coastal Center for Agricultural Health and Safety (SCCAHS)" (invited presentation)

17. Environmental Protection Agency's Virtual Farmworker Community Visit, October 28, 2020. Occupational Pesticide Exposure and Pregnancy Health in Vulnerable Workers" (invited speaker).

18. Florida Local Section of the American Industrial Hygiene Association, October 16, 2020. "Environmental Justice Panel" (panel) with C Zimring, T Thomas-Burton, and H Young.

19. Halverson, C. & S. Galindo. (2019, April). Creating an Organizational Culture Responsive to Emerging Public Health Threats. Presented at the 2019 National Conference of the American Association of Occupational Health Nurses (AAOHN), Jacksonville, Florida.

20. Galindo, S., Mitchell, C., Saqib, H., Israel, G. D., & Diehl, D. C. (2019). Assessing SCCAHS' economic impact: Return on investment thematic approach for heat-related illness. Poster presented at the annual conference of the International Society for Agricultural Safety and Health, Des Moines, Iowa, June, 2019.

21. Nelson, J. D., Galindo, S., Israel, G. D., & Diehl, D. C. (2019). Developing a Common Evaluation Framework for the Centers for Agricultural Safety and Health. Oral presentation at the annual conference of the International Society for Agricultural Safety and Health, Des Moines, Iowa, June, 2019.

22. Galindo-Gonzalez, S., Mitchell, R. C., Diehl, D., Israel, G. D., Williams, D. Saqib H, Galindo S, & Irani T. Surfacing Strategies: Organizational Learning for the Strategic Development of an Agriculture, Forestry, and Fishing Occupational Health and Safety Research and Outreach Center. Poster presented at: International Conference on Sustainable Development; September 23-24, 2019; Columbia University, New York.

23. Galindo, S., Mitchell, C., Saqib, H., Israel, G. D., & Diehl, D. C. (2019). Assessing SCCAHS' economic impact: Return on investment thematic approach for heat-related illness. Poster presented at SCCAHS State of the Science Meeting, Saint Petersburg, Florida, September, 2019.

24. Flocks J, Monaghan P, and Tovar-Aguilar A. "Southeastern Coastal Center for Agricultural Health and Safety (SCCAHS): Current Projects at the Newest NIOSH Center for Agricultural Disease and Injury Research, Education, and Prevention." 2018 North American Agricultural Safety Summit, Scottsdale, AZ, February 21-23, 2018.

25. Flocks J. "The Environmental and Social Injustice of Farmworker Pesticide Exposure," (online guest lecture) for Vanessa Casanova's Environmental Justice class at the University of Texas Health Science Center at Tyler, July 11, 2018.

26. Bronstein J, Economos E, Flocks J, and Grzywacz J."Pesticides and Health: What We Need to Know" (panel) 19th National Our Community, Our Health Town Hall, University of Florida Health Street, Gainesville, FL, August 29, 2018. https://mediasite.video.ufl.edu/Mediasite/Play/e7e8e15cc65c462b93bfb0c1d22da2371d

27. Galindo-Gonzalez, S., Mitchell, R. C., Diehl, D., Israel, G. D., Williams, D. F., Avalos, N., & McLoed, A. The agricultural safety and health innovation, information and knowledge system: Considerations for its evaluation. Poster presented at the annual conference of the International Society for Agricultural Safety and Health, Halifax, Nova Scotia, Canada, June, 2018.

28. Flocks J. "Immigration Policy and Agricultural Labor in Florida" University of Florida, Department of Agricultural Education and Communications Seminar Series, Gainesville, FL, October 27, 2017.

29. Mutic A, Mix J, Elon L, Tovar J, Flocks J, Economos E, and McCauley L. "Classification of Heat Related Illness Symptoms among Florida Farmworkers." American Public Health Association Annual Meeting, Atlanta, GA, November 7, 2017.

30. Flocks J. "Immigration, Farm Labor, and Food Justice" University of Florida, Center for the Study of Race and Race Relations, Race Matters in the News Seminar Series, Gainesville, FL, November 9, 2017.

31. Flocks J. "Immigration, Farm Labor, and Food Justice" University of Florida, Center for the Study of Race and Race Relations, Race Matters in the News Seminar Series, Gainesville, FL, November 9, 2017.

32. Tovar J, Economos E, and Flocks J. "Community Based Research on Heat-Related Illness in Florida Farmworkers." American Public Health Association Annual Meeting, Atlanta, GA, November 7, 2017.

33. Flocks J. "Immigration Policy and Agricultural Labor in Florida" University of Florida, Department of Agricultural Education and Communications Seminar Series, Gainesville, FL, October 27, 2017.

Outreach Core 2018 – 2022

34. Irani, T., Pierre, B. & Nesbit, T. (2021). Agricultural Professionals' Perceptions of COVID-19 and Occupational Health and Safety. *Journal of International Agricultural and Extension Education.* https://doi.org/jiaee.2021.28106

35. Irani T, Pierre, B. F, Nesbit, T.S. (2021). Agricultural stakeholders' perceptions of occupational health and safety in the Southeastern U.S. Coastal States. *International Journal of Environmental Research and Public Health,* 18(12):6605. https://doi.org/10.3390/ijerph18126605

36. Lindsey, A., McLeod-Morin, A., Lundy, L., Irani, T., & Telg, R. (2022). *Using Communication Toolkits to Expand Extension Efforts Related to Agricultural Health and Safety Topics.* Abstract presented at the 2022 Extension Professional Associations of Florida Annual Meeting, Panama City, FL.

37. McLeod-Morin, A., Lundy, L., Lindsey, A. B., Kandzer, M., Telg, R., Irani, T., Stokes, P., Castano, V., & Santa Maria, N. (2022). *It All Goes Back to Trust: A Qualitative Exploration of Extension Professionals' Perceptions of COVID-19 Vaccines in Rural Florida.* Abstract presented at the 2022 National Agricultural Communications Symposium, New Orleans, LA.

38. McLeod-Morin, A., Irani, T., Telg, R., Lindsey, A., & Lundy, L. (2022). *Empowering Extension Empowers Everyone: Developing Agricultural Health and Safety Outreach Materials for Cooperative Extension.* Abstract presented at the 2022 International Society for Agricultural Safety and Health Annual Conference, Fort Collins, CO.

39. Santa Maria, N., Irani, T., Telg, R., Lundy, L.K., Lindsey, A.B., McLeod-Morin, A., Stokes, P., Kandzer, M., Castano, V., Morris, G., McCue, L., Millerick-May, M., Zhong, Y., Halverson, C., Baker, L.M., Andrews, D., Abler, D., Court, C., Galindo, S., Ramos, A.K., & Sampson, S.; Rampold, S., Kelly-Begazo, C., Pierre, B.F. (2021). State of the Science: Global Pandemics and the Agricultural Workforce: Research and Policy Implications. SCCAHS2020/21-03. Gainesville, FL.: University of Florida/ Southeastern Coastal Center for Agricultural Health and Safety. Whitepaper-2020-FINAL.pdf (sccahs.org)

40. McLeod-Morin, A., Baker, L. M., Lindsey, A. B., Lundy, L. K., & Telg, R. (2021, February). A tale of two agencies: Comparing Americans' attitudes and behaviors toward the CDC and Local Health Departments During COVID-19. Emerging Pathogens Institute Research Day, Gainesville, FL.

41. McLeod-Morin, A., Baker, L. M., Lindsey, A. B., Lundy, L. K., & Telg, R. (2021, February). The dimensions of the organization-public relationship of the Centers for Disease Control and Prevention during the COVID-19 pandemic. National Agricultural Communications Symposium, virtual.

42. Baker, L. M., Rampold S. D., McLeod-Morin, A., Lindsey, A. B., Telg, R. W., & Oglesby, M. (2021, February). Spreading information instead of COVID-19: Examining public communication networks in the early stages of a zoonotic disease pandemic. Paper presented at the 2021 National Agricultural Communications Symposium, virtual.

43. Schaper, TA. (2021). Characterizing major crop change trends in Florida from multiple sources: a comparison of USDA Cropland Data Layer and statewide Random Forest Classifications of the top five crops. M.S. thesis University of Florida.

44. Sampson, S., Mazur, J., Israel, G., Galindo, S., & Ward, C. (2020). Competing Roles and Expectations: Preliminary Data from an Agricultural Extension Survey on COVID-19 Impacts. Journal of agromedicine, 25(4), 396–401. https://doi.org/10.1080/1059924X.2020.1815619. PMID: 32945240.

45. Baker, L., Kandzer, M. S., Rampold, S. D., Chiarelli, C., Peterson, H. H., McLeod-Morin, A. (2020). Agriculture and natural resources business owners economic and communication concerns early in the COVID-19 pandemic. Advancements in Agricultural Development, 1(3), 95-110. https://doi.org/10.37433/aad.v1i3.83

46. Mitchell, R. C., Kandzer, M. S., Irani, T., Lindsey, A. B., Lundy, L. K., Telg, R. W., McLeod-Morin, A., Stokes, P., Chasek, C., Scheyett, A., Leeman, R., Stacciarini, J. M., Wennerstrom, A., Smithwick, J., Grattan, L., Dunleavy, K., Radunovich, H. L., Kane, A., Arosemena, F., & Honeycutt, S. (2020). State of the Science: Mental Health Issues in Agricultural, Vulnerable and Rural Communities. SCCAHS2020/21-02. Gainesville, FL.: University of Florida/ Southeastern Coastal Center for Agricultural Health and Safety. whitepaper2020_final1.pdf (sccahs.org)

47. Mitchell, R.C., Irani, T, Arosemena, F. A., Pierre, B., Bernard, T.E., Grzywacz, J.G., McCauley, L.A., Vi Thien Mac, V., Lopez, R.M., Ashley, C.D., Sawka, M.N., Misra, V., Pierre, B., & Morris, J.G. SCCAHS2019-02. Gainesville, FL: University of Florida/Southeastern Coastal Center for Agricultural Health and Safety. SOS_WhitePaper.pdf (sccahs.org)

48. Lundy, L. K., Rogers-Randolph, T. M., Lindsey, A. B., Hurdle, C., Ryan, H., Telg, R. W., & Irani, T. (2018). Analyzing Media Coverage of Agricultural Health and Safety Issues. Journal of Applied Communications, 102(4), 5.

49. Rogers, T., Lundy, L.K., Lindsey, A.B., Irani, T., Telg, R.W., McLeod, A., Stokes, P., Mitchell, R.C. Identifying Influencers in Agricultural Health and Safety Twitter Conversations. Southern Association of Agricultural Scientists Conference. Tovar J.A., (September 10-12, 2018). Processes of Development and Implementation of Training Conducted by Community Health Workers. Midwest Migrant Stream Forum. New Orleans, LA.

50. Mitchell, R.C. (August 15-16, 2018). Southeastern Coastal Center for Agricultural Health and Safety. Citrus Expo. Ft. Meyers, FL. Available at: https://public.3.basecamp.com/p/5M5WdbGzHTWYoA3TTPw5zzsb

51. Monaghan, P., (July 10-13, 2018). The Role of Labor Supervisors in Florida Citrus and Vegetable Production and How that Shapes Safety Behaviors. University of Nebraska Medical Center Agricultural Health and Safety Course. Omaha, NE. Monaghan, P., (April 3-7, 2018). Preliminary findings. Society for Applied Anthropology Annual Meeting. Philadelphia, PA.

State of the Science Meetings

The SCCAHS Outreach Core has hosted annual State of the Science Meetings since Year 3 (2018). The meetings are convened to educate the Southeast regional academic community and frontline professionals on clinical and public health science driving new thinking in areas of heat related illness and stress and resilience among agricultural, fishery, and forestry workers.

Given our southern location, the work of SCCAHS has included a major focus on heat-related illness. Additionally, addressing mental health remains a public health concern. Those who work in agriculture face many stressors, including financial uncertainty, family and relationships issues, social isolation, disaster, accidental injury, and acute and chronic diseases, that can affect their mental health. While some mental health issues, such as the high rate of farmer suicides, have been discussed widely, other mental health stressors that affect agriculture workers in vulnerable rural communities have not been discussed as broadly. Multidisciplinary research, strategies, and policies are needed 1) to identify the mental health issues that farmworkers, farm operators, farm owners and others in these communities face; 2) address the social, environmental and built-environment associations with mental health in rural communities; and 3) understand the inequities in farmworker/fishery/ forestry community mental health (depressive or substance use disorder rates) and how we might close these gaps to encourage individual, family, and community-level resilience. A recap of the Southeastern Coastal Center for Agricultural Health and Safety 2018 and 2019 State of the Science Meetings can be found at the below websites:

52. September 9, 2021, Pathways to Health Equity in Agriculture, Fishery and Forestry
53. September 11/18, 2020, Global Pandemics and the Agricultural Workforce: Research and Policy Implications
54. September 26/27, 2019, Stress and Resilience Among Agricultural Workers in Vulnerable Rural Communities
55. October 25/26, 2018, Heat-related Illness State of the Science Meeting

Websites and Other Internet Sources

56. SCCAHS Website: http://www.sccahs.org/
57. COVID-19 resources webpage http://www.sccahs.org/index.php/covid-19/
    - Screening and testing video: https://www.youtube.com/watch?v=oAByapLmi0I&feature=youtu.be
    - Adapted CDC guidance video: https://www.youtube.com/watch?v=dZ-jn3V1C4U&feature=youtu.be
    - Narrated PPT video for CDC guidance: https://youtu.be/9FWHMFi9NQE
    - Narrated PPT video for CDC guidance (Spanish): https://www.youtube.com/watch?v=8z11u6fsyzE
    - Face coverings (English): https://www.youtube.com/watch?v=6QZQvUDYvus
    - Face coverings (Spanish): https://www.youtube.com/watch?v=VJEfF5SnScE
    - Social distancing (English): https://www.youtube.com/watch?v=o0dWBoXCOZg
    - Social distancing (Spanish): https://www.youtube.com/watch?v=kQAFBtTV-_c

58. COVID-19 training toolkit: http://www.sccahs.org/wp-content/uploads/2020/08/COVID-19_ExtentionToolkit.pdf
59. COVID-19 training toolkit for Florida Extension: https://extadmin.ifas.ufl.edu/resources/grower-and-worker-education/
60. COVID-19 vaccine webpage: http://www.sccahs.org/index.php/covid-19-vaccine/
61. SCCAHS webinars (archived): http://www.sccahs.org/index.php/media/webinars/

- **Dawn Burton** February 23, 2022 Practical Steps to Advancing Equity
- **LaToya O'Neal** January 20, 2022 Advancing Health Equity as a Core System Value
- **Serap Gorucu** November 17, 2021 Available Data Sources for Agricultural Injury Surveillance
- **Cindy Prins** October 28, 2021 What's Next? Understanding the current status of COVID-19 and future projections
- **David Abler** July 22, 2021 COVID-19 and Resilience in Food Supply
- **Charlotte Halverson** June 16, 2021 Protecting Agricultural Communities During the COVID-19 Pandemic: Respiratory Fit Testing and Personal Protective Equipment
- **Lauri Baker** May 19, 2021: Communicating Vaccine Adoption Based on U.S. Perceptions of COVID-19
- **Melissa Millerick-May** April 14, 2021: Facilitating Pandemic Preparedness in Agricultural Industry via COVID-19 Hazard Assessment and Mitigation Plan (CHAMP) e-tool
- **Sarah (Ying) Zhong** March 31, 2021 Fighting Coronavirus with Corona Discharge
- **Christa Court**, February 17, 2021: Assessing the Impact of COVID-19 on Florida's Agricultural and Marine Industries
- **Glenn Morris and Ira Longini** January 26, 2021 COVID-19 Vaccine Town Hall
- **Leigh McCue** December 15, 2020 Development and Deployment of a Farmworker Housing Simulator for COVID-19 Risk Mitigation
- **LeiAnna Tucker and Danielle Andrews** November 19, 2020 Adapting Agriculture in Florida during the COVID-19 Pandemic: COVID-19 testing for migrant workers in Florida and the Farm to You
- **Sebastian Galindo** August 20, 2020 Impacts of COVID-19 on Extension
- **Ricky Telg, Saqib Mukhtar, Cindy Prins** August 7, 2020 COVID-19 Training Toolkit for Extension in Agriculture
- **Jeffrey Lindsey** August 6, 2020 Preparing for the 2020 Hurricane Season in the Midst of a Pandemic
- **Jeanne-Marie Stacciarini** June 18, 2020 Rurality, Social Networks and Mental Well-being in Rural Latinos (no recording)

- **Robert Leeman** May 14, 2020 Stressors, Resilience Factors and Applicability of New Interventions for Substance Misuse
- **Gülcan Önel** March 10, 2020 Uncovering Patterns of Mental, Physical, and Occupational Health Issues Among Migrant Farmworkers with Different Socio-Cultural Networks (no recording)
- **Anna M. Scheyett** February 14, 2020 Death on the Farm: Characteristics and Contextual Factors in Farmer and Agricultural Worker Suicide in Georgia from 2008-2015
- **Christine Chasek** January 8, 2020 Investigating Opioid and Alcohol Risk and Misuse Among Agricultural Workers
- **Vasubandhu Misra** October 10, 2019 Heat-related Illness in a Changing Climate and Demography of Florida
- **Kim Dunleavy** September 13, 2019 Chronic Low Back Pain in Seafood Workers: A Pilot Intervention Study to Identify Modifiable Work and Movement Solutions
- **Heidi Radunovich** June 4, 2019 Understanding the Scope of the Opioid Epidemic for Agricultural Industries
- **Angela Lindsey** May 14, 2019 Preparing for the 2019 Hurricane Season: Applying Lessons from Hurricanes Irma and Michael
- **Paul Monaghan** April 17, 2019 Using Social Marketing to Prevent Heat-related Illness and Improve Productivity Among Farmworkers
- **Linda McCauley** February 12, 2019 Heat Stress and Biomarkers of Renal Disease
- **Joseph Grzywacz** January 22, 2019 Pesticide & Heat Stress Education for Latino Farmworkers that is Culturally Appropriate
- **Jose A. Perez** November 6, 2018 The Need for a Safety Focus in Agriculture
- **Andrew Kane** October 24, 2018 Occupational Health and Safety Surveillance of Gulf Seafood Workers.
- **Martie Gillen** September 18, 2018 Assessing Agriculture Liability

62. The training toolkit webinar: https://vimeo.com/447806944
63. 2020 SOS meeting website: http://www.sccahs.org/index.php/state-of-science/2020-global-pandemics-and-the-agricultural-workforce-research-and-policy-implications/
64. Podcast: https://piecenter.com/media/podcast/

Research Core 2016 – 2022

2021

65. Glass, G. E., Ganser, C., & Kessler, W. H. (2021). Validating Species Distribution Models With Standardized Surveys for Ixodid Ticks in Mainland Florida. *Journal of medical*

entomology, *58*(3), 1345–1351. https://doi.org/10.1093/jme/tjaa282 PMID: 33386731; PMCID: PMC8122235.

66. Dunleavy K, Bishop M, Coffman A, Reidy J, Kane A. Chronic lower back pain in aquaculture clam farmers: adoption and feasibility of self-management strategies introduced using a rapid prototype participatory ergonomic approach. Int J Occup Saf Ergon. 2021 Jul 7:1-11. doi: 10.1080/10803548.2021.1935543. Epub ahead of print. PMID: 34121632.

67. Dunleavy K, Kane A, Coffman A, Reidy J, Bishop MD. Outcomes of Participatory Ergonomics and Self-management in Commercial Clam Farmers with Chronic Low Back Pain: A Feasibility Study. J Agromedicine. 2021 Nov 23:1-15. doi: 10.1080/1059924X.2021.2004961. Epub ahead of print. PMID: 34772318.

68. Grzywacz JG, Gonzales-Backen M, Liebman A, Trejo M, Gudino CO, Trejo M, Economos J, Xiuhtecutli N, Tovar-Aguilar JA. Comparative Effectiveness of Training Alternatives for the EPA's Worker Protection Standard Regulation Among Immigrant Latino Farmworkers. J Occup Environ Med. 2021 Aug 27. doi: 10.1097/JOM.0000000000002368. Epub ahead of print. PMID: 34456324.

69. Mac V, Elon L, Mix J, Tovar-Aguilar A, Flocks J, Economos E, Hertzberg V, McCauley L. Risk Factors for Reaching Core Body Temperature Thresholds in Florida Agricultural Workers. J Occup Environ Med. 2021 May 1;63(5):395-402. doi: 10.1097/JOM.0000000000002150. PMID: 33560064.

70. Houser MC, Mac V, Smith DJ, Chicas RC, Xiuhtecutli N, Flocks JD, Elon L, Tansey MG, Sands JM, McCauley L, Hertzberg VS. Inflammation-Related Factors Identified as Biomarkers of Dehydration and Subsequent Acute Kidney Injury in Agricultural Workers. Biol Res Nurs. 2021 Oct;23(4):676-688. doi: 10.1177/1099800421101607O. Epub 2021 May 21. PMID: 34018403.

71. Chicas R, Xiuhtecutli N, Elon L, Scammell MK, Steenland K, Hertzberg V, McCauley L. Cooling Interventions Among Agricultural Workers: A Pilot Study. Workplace Health Saf. 2021 Jul;69(7):315-322. doi: 10.1177/2165079920976524. Epub 2020 Dec 24. PMID: 33357122.

72. Chicas R, Xiuhtecutli N, Dickman NE, Flocks J, Scammell MK, Steenland K, Hertzberg V, McCauley L. Cooling Interventions Among Agricultural Workers: Qualitative Field-Based Study. Hisp Health Care Int. 2021 Sep;19(3):174-181. doi: 10.1177/1540415321993429. Epub 2021 Feb 19. PMID: 33601922; PMCID: PMC8363586.

73. Mac VV, Elon L, Smith DJ, Tovar-Aguilar A, Economos E, Flocks J, Hertzberg V, McCauley L. A modified physiological strain index for workplace-based assessment of heat strain experienced by agricultural workers. Am J Ind Med. 2021 Apr;64(4):258-265. doi: 10.1002/ajim.23230. Epub 2021 Feb 4. PMID: 33543496.

74. Matthew OO, Monaghan PF, Luque JS. The Novel Coronavirus and Undocumented Farmworkers in the United States. New Solut. 2021 May;31(1):9-15. doi: 10.1177/1048291121989000. Epub 2021 Jan 31. PMID: 33517834; PMCID: PMC8193739.

Presentations

75. Morera, M.C., Tovar-Aguilar, J.A., Monaghan, P.F., Roka, F.M., & Perez-Orozco, J. (2021). Going the [social] distance: Safety and productivity in Florida agriculture during COVID-19. Presentation at the 2021 Virtual Meeting of the Society for Applied Anthropology, March 26, 2021.

76. Morera, M.C. & Campoverde, E.V. (2021). Developing a customized decision-support tool for respiratory protection in Florida agriculture: Preliminary findings of a pilot project [Poster session]. Agricultural Safety and Health Council of America 2021 North American Agricultural Safely Summit, March 22-24.

77. Rash, R. and Kane, A.S. (2021). Environmental and Human Behavioral Risk Factors for Traumatic Stingray Puncture Injuries in Cedar Key Clam Harvesters. Presented at the 4th Southeast Regional Research Symposium (SERRS), February 17-18, 2021.

2020

78. Grattan LM, Lindsay A, Liang Y, Kilmon KA, Cohen S, Irani T, Morris JG. The Short- and Long-Term Impacts of Hurricane Irma on Florida Agricultural Leaders as Early Emergency Responders: The Importance of Workplace Stability. Int J Environ Res Public Health. 2020 Feb 7;17(3):1050. doi: 10.3390/ijerph17031050. PMID: 32046012; PMCID: PMC7038044.

79. Monaghan P, Raskin K, Morera M, Tovar Aguilar JA, Mac V, Flocks J. "What the Agricultural Sector in Florida Needs to Know about Heat-Related Illness (HRI)." EDIS (5). https://doi.org/10.32473/edis-wc359-2020.

2019

80. Mix JM, Elon L, Thein Mac VV, Flocks J, Economos J, Tovar-Aguilar AJ, Hertzberg VS, McCauley LA. Physical activity and work activities in Florida agricultural workers. Am J Ind Med. 2019 Dec;62(12):1058-1067. doi: 10.1002/ajim.23035. Epub 2019 Aug 16. PMID: 31418883.

81. Luque JS, Becker A, Bossak BH, Grzywacz JG, Tovar-Aguilar JA, Guo Y. Knowledge and Practices to Avoid Heat-Related Illness among Hispanic Farmworkers along the Florida-Georgia Line. J Agromedicine. 2020 Apr;25(2):190-200. doi: 10.1080/1059924X.2019.1670312. Epub 2019 Sep 23. PMID: 31544652; PMCID: PMC7075471.

82. Chicas R, Mix J, Mac V, Flocks J, Dickman NE, Hertzberg V, McCauley L. Chronic Kidney Disease Among Workers: A Review of the Literature. Workplace Health Saf. 2019 Sep;67(9):481-490. doi: 10.1177/2165079919843308. Epub 2019 Jun 10. PMID: 31179873.

83. Grzywacz JG, Gonzales-Backen M, Liebman A, Marín AJ, Trejo M, Gudino CO, Economos J, Tovar-Aguilar JA. Attending to Pesticide Exposure and Heat Illness Among Farmworkers: Results From an Attention Placebo-Controlled Evaluation Design. J Occup Environ Med. 2019 Sep;61(9):735-742. doi: 10.1097/JOM.0000000000001650. PMID: 31205205.

84. Mac VVT, Hertzberg V, McCauley LA. Examining Agricultural Workplace Micro and Macroclimate Data Using Decision Tree Analysis to Determine Heat Illness Risk. J Occup Environ Med. 2019 Feb;61(2):107-114. doi: 10.1097/JOM.0000000000001484. PMID: 30335678; PMCID: PMC6367045.

Presentations

85. Luque, J, Becker, A, Bossak, B, Grzywacz, J, Tovar, A, Guo, Y. "Knowledge and Practices for Adapting to Working in the Heat among Latino Farmworkers in the Florida-Georgia Border Region," roundtable paper presented at the APHA Conference (November 2019), Philadelphia, PA.

86. Adhikari, A, Dotherow, JE. Respiratory deposition modeling for PM10, PM2.5, and PM1 exposure in cotton farms for standard and heavy workers. Third Aerosol Dosimetry Conference, Inhaled Aerosol Dosimetry: Models, Applications and Impact (October 2019), Irvine, CA.

87. Stacciarini, J.M., Onel, Gulcan, & Tovar, A. A Rural State of Mind: Addressing Mental, Physical, and Economic Health of Farm Communities in Florida. East Coast Migrant Stream Forum. (October 2019), San Juan, Puerto Rico.

88. Flocks, J. "Prevention of Heat Stress among Farmworkers" (roundtable discussion moderator) Western Agriculture Safety & Health Conference, Seattle, WA, August 7-9, 2019.

89. Flocks, J., Saville, A., & Economos, J. "Differing Reponses and Perspective to Environmental Justice, Lessons from Lake Apopka, FL" (panel) with A Saville and J Economos. Association for Environmental Studies and Sciences Annual Conference, Orlando, FL, June 27, 2019.

2018

90. Mix J, Elon L, Vi Thien Mac V, Flocks J, Economos E, Tovar-Aguilar AJ, Stover Hertzberg V, McCauley LA. Hydration Status, Kidney Function, and Kidney Injury in Florida Agricultural Workers. J Occup Environ Med. 2018 May;60(5):e253-e260. doi: 10.1097/JOM.0000000000001261. PMID: 29271837.

91. Alterman T, Grzywacz JJ, Muntaner C, Shen R, Gabbard S, Georges A, Nakamoto J, Carroll DJ. Elevated Depressive Symptoms Among Hired Crop Workers in the United States: Variation by Sociodemographic and Employment Characteristics. Rural Ment Health. 2018 Apr;42(2):67-68. doi: 10.1037/rmh0000090. PMID: 31777642; PMCID: PMC6880944.

92. Myers ML, Kane AS and Durborow RM. 2018. Gulf of Mexico Seafood Harvesters: Part 1. Occupational Injury and Fatigue Risk Factors. Safety doi:10.3390/safety4030031.

93. Myers ML, Durborow RM, Kane AS. 2018. Gulf of Mexico Seafood Harvesters, Part 2: Occupational Health-Related Risk Factors. Safety doi: 10.3390/safety4030027.

94. Myers ML, Durborow RM and Kane AS. 2018. Gulf of Mexico Seafood Harvesters: Part 3. Potential Occupational Risk Reduction Measures. Safety doi:10.3390/safety4030033.

Presentations

95. Tovar-Aguilar A and Flocks J. "A Web of Immigration and Labor Regulation and How it Binds Farmworkers." American Association of Geographers Annual Meeting, New Orleans, LA, April 10-14, 2018.

96. Flocks J, Grzywacz J, Tovar-Aguilar A, McCauley L, Mac V, Chicas R, Vulpe C, Roberts S, and Denslow N. "Current Occupational Heat and Pesticide Research in Southeastern Coastal States," (poster) NIDDK-NIEHS Workshop on Chronic Kidney Diseases in Agricultural Communities, Bethesda, MD, June 25-26, 2018. http://www.sccahs.org/index.php/2018/07/11/joan-flocks-presents-on-behalf-of-sccahs-at-national-conference/

2017

97. Mutic AD, Mix JM, Elon L, Mutic NJ, Economos J, Flocks J, Tovar-Aguilar AJ, McCauley LA. Classification of Heat-Related Illness Symptoms Among Florida Farmworkers. J Nurs Scholarsh. 2018 Jan;50(1):74-82. doi: 10.1111/jnu.12355. Epub 2017 Oct 12. PMID: 29024370.

98. Mathews AE, Al-Rajhi A, Kane AS. Validation of a photographic seafood portion guide to assess fish and shrimp intakes. Public Health Nutr. 2018 Apr;21(5):896-901. doi: 10.1017/S1368980017000945. Epub 2017 Dec 29. PMID: 29284548; PMCID: PMC5848755.

Presentations

99. Flocks J. "Immigration Policy and Agricultural Labor in Florida" University of Florida, Department of Agricultural Education and Communications Seminar Series, Gainesville, FL, October 27, 2017.

100. Mutic A, Mix J, Elon L, Tovar J, Flocks J, Economos E, and McCauley L. "Classification of Heat Related Illness Symptoms among Florida Farmworkers." American Public Health Association Annual Meeting, Atlanta, GA, November 7, 2017.

101. Tovar J, Economos E, and Flocks J. "Community Based Research on Heat-Related Illness in Florida Farmworkers." American Public Health Association Annual Meeting, Atlanta, GA, November 7, 2017.

102. Flocks J. "Immigration, Farm Labor, and Food Justice" University of Florida, Center for the Study of Race and Race Relations, Race Matters in the News Seminar Series, Gainesville, FL, November 9, 2017.

103. Flocks J. "Immigration, Farm Labor, and Food Justice" University of Florida, Center for the Study of Race and Race Relations, Race Matters in the News Seminar Series, Gainesville, FL, November 9, 2017.

104. Mutic A, Mix J, Elon L, Tovar J, Flocks J, Economos E, and McCauley L. "Classification of Heat Related Illness Symptoms among Florida Farmworkers." American Public Health Association Annual Meeting, Atlanta, GA, November 7, 2017.

105. Tovar J, Economos E, and Flocks J. "Community Based Research on Heat-Related Illness in Florida Farmworkers." American Public Health Association Annual Meeting, Atlanta, GA, November 7, 2017.

106. Flocks J. "Immigration Policy and Agricultural Labor in Florida" University of Florida, Department of Agricultural Education and Communications Seminar Series, Gainesville, FL, October 27, 2017.

2016

107. Runkle J, Flocks J, Economos J, Dunlop AL. A systematic review of Mancozeb as a reproductive and developmental hazard. Environ Int. 2017 Feb;99:29-42. doi: 10.1016/j.envint.2016.11.006. Epub 2016 Nov 23. PMID: 27887783.

108. Mac VV, Tovar-Aguilar JA, Flocks J, Economos E, Hertzberg VS, McCauley LA. Heat Exposure in Central Florida Fernery Workers: Results of a Feasibility Study. J Agromedicine. 2017;22(2):89-99. doi: 10.1080/1059924X.2017.1282906. PMID: 28118110; PMCID: PMC5682629.

109. Hertzberg V, Mac V, Elon L, Mutic N, Mutic A, Peterman K, Tovar-Aguilar JA, Economos E, Flocks J, McCauley L. Novel Analytic Methods Needed for Real-Time Continuous Core Body Temperature Data. West J Nurs Res. 2017 Jan;39(1):95-111. doi: 10.1177/0193945916673058. Epub 2016 Oct 22. PMID: 27756853; PMCID: PMC5797491.

Awards 2016 – 2022

Outreach Core
Association for Communication Excellence in Agriculture, Natural Resources, and Life and Human Sciences

Crisis and Issues Management
Silver Award Winner: COVID-19 Crisis Communication for Extension and Agricultural Workers, COVID-19 Toolkit for Extension and agricultural workers

Diversity
Bronze Award Winner: State of the Science: Mental Health Issues in Agricultural, Vulnerable and Rural Communities White Paper, 2019 State of the Science White Paper

Publishing
Bronze Award Winner: Screening and Testing of Agriculture Farm Workers and Employers for COVID-19,
Electronic Media and Audio for Targeted Audiences, video with Dr. Glenn Morris on COVID-19 testing and screening for agricultural workers

Heidi Radunovich. Co-Investigator. (2019). Agrisafe Network, Inc. (PI: Natalie Roy) Southern region farm and ranch stress assistance network. Develop a clearinghouse of farmer assistance programs in the region inclusive of programs providing professional agricultural behavioral health counseling and referral.

Heidi Radunovich. (2018). Florida Nursery, Growers and Landscape Association (FNGLA). Endowed Research Fund. Research Enhancement Award. During August 2017, FNGLA leadership identified opioid misuse as a problem within their industries and contacted the Southeastern Coastal Center for Agricultural Health and Safety (SCCAHS) to gain assistance with addressing the issue of opioid misuse. SCCAHS created a resource section dedicated to opioids in order to help support FNGLA. However, it is unclear the extent to which opioids are a problem for FNGLA, what the economic impact might be, how individuals and families are affected, and what resources or programs might be useful for these industries. This project seeks to document the impact that opioid abuse has had on Florida's nursery, grower and landscaper industries, as well as their families, and determine how best to help them. In order to do this, information will be obtained from relevant stakeholders, and stakeholders will be informed of findings. This project will involve both assessment and information dissemination, which will be outlined below.

Gülcan Önel and Antonio Tovar. (2018). Robert Wood Johnson Foundation. Interdisciplinary Research Leaders Award. The broad goal of the Interdisciplinary Research Leaders (IRL) program is to produce diverse interdisciplinary leaders who conduct and apply high-quality, community-engaged, action-oriented, equity-focused health research in order to drive improvements in the health of communities.