

# Southwest Center for Agricultural Health, Injury Prevention and Education

**Summary Annual Report**

**September 30, 2015-September 29, 2016**

**CDC/NIOSH Cooperative Agreement 5U54OH007541-15**

**Center Director:  
Jeffrey L. Levin, M.D., M.S.P.H.  
The University of Texas Health Northeast  
11937 US Hwy 271  
Tyler, TX 75708**

**September 2016**

## SECTION 1

### **Center Summary**

The Southwest Center for Agricultural Health, Injury Prevention and Education (SW Ag Center) is a well-established center based at the University of Texas Health Northeast in Tyler, Texas. The SW Ag Center serves Public Health Region 6 which includes Arkansas, Louisiana, New Mexico, Oklahoma and Texas. The mission of the SW Ag Center is to *improve the safety and health of agricultural, forestry and fishing (AFF) workers*. This is accomplished through an integrated program of research, intervention, education and outreach activities that engage and leverage a network of strategic partners who represent the interests of a diverse worker population and a wide range of agricultural production in the region. Similarly, the Center's scope of work is organized around the theme "Building Strategic Partnerships to Improve Agricultural, Forestry and Fishing Worker Safety and Health". Four research projects are funded through the Center. Projects address (1) organic dust induced inflammatory responses in the lung; (2) neuromotor function and acute injury among adolescent Hispanic farmworkers; (3) social marketing to promote adoption of safe work practices among Vietnamese commercial fishermen in the Gulf of Mexico; and (4) respirator use among poultry house workers. The Center's feasibility program augments the research projects, supports mentorship relationships between senior and junior researchers and is responsive to emerging issues within AFF in the region. Five diverse, regionally representative feasibility studies were active in year five of this funding cycle. Outreach activities for year five include support for three agricultural safety and health interns, an agricultural medicine workshop, presentations and exhibits at regional and national conferences. The Center evaluation program uses logic models to assess goal attainment. Within the last twelve months, a Stakeholder Satisfaction Survey was distributed to collaborators to better understand their relationship to the Center and the value of the services and products provided by the Center.

### **Relevance**

The SW Ag Center is uniquely positioned to address farming, ranching, commercial fishing, forestry and logging occupational safety and health within its service region through research projects, feasibility studies and outreach activities. The SW Ag Center has two funded projects related to poultry production, a substantial operation within the region. One project will help us understand how the lungs respond to organic dust and the other will educate poultry workers on use of appropriate personal protective equipment. The latter project has experienced significant challenges due to industry culture and management structure. In light of these barriers, the PI partnered with an anthropologist to describe barriers and resistance to research among broiler chicken workers so that other scientists can benefit from his experience. Research projects specifically address diverse regional worker groups, including Vietnamese fishermen and adolescent Hispanic farmworkers. The Center has a record of success working with special populations and producing culturally appropriate interventions in the

language of the audience. Read more about the currently funded projects at <http://www.swagcenter.org/projectscurrent.asp>.

Feasibility studies allow the Center to investigate emerging issues or gaps in research or data, while also fostering mentoring relationships with scientists new to the field. Studies active in year five address a wide variety of topics including: surveillance of AFF occupational injuries; development of an enumeration profiles study guidebook; investigation of a novel diagnostic approach for traumatic brain injuries; development of heat and health indicators; and assessment of sun safety perceptions and behaviors among farmworkers. Principal investigators (PI) from these studies are located in Arkansas, Washington and Texas. One PI is an occupational medicine resident. Information about past and current feasibility studies is available at <http://www.swagcenter.org/projectsfeasibility.asp>.

Outreach activities address occupational safety and health across the broad industry through monthly safety messages delivered to 1200-2000 producers, educators and scientists; <http://www.swagcenter.org/resourcesmonthlyblasts.asp>. A on-line safety blast post-test has been created to measure audience engagement with the information being disseminated. Monthly safety blasts are regularly reprinted in trade publications like the Texas Logger, sent to industry list serves (Arkansas Ag Science Teachers, Louisiana Extension) and shared on Facebook. The SW Ag Center builds the capacity for future professionals in agricultural safety and health through a collaborative internship with the Noble Foundation (Oklahoma). Moreover, the SW Ag Center has partnered with the Association of Occupational and Environmental Clinics (AOEC) to sponsor interns through the Occupational Health Internship Program (OHIP), working with agricultural worker populations. Educational resources are adapted and created to address current occupational issues. Agromedicine, logging/forestry, tractor safety, and bites and stings were specifically addressed in year five. Additionally, the SW Ag Center collaborated with the other nine Ag Centers to maintain a joint YouTube channel in order to respond to the growing popularity of social media among AFF producers and educators (<http://www.youtube.com/user/USagCenters>). Outreach staff also actively participates with other Ag Centers to promote National Farm Safety and Health Week and National Agriculture Day through social media campaigns, presentations, and email blasts.

Evaluation data for research projects, feasibility studies and outreach initiatives are collected to record current work and lead future action. A new, time-efficient method for gathering data is currently in use by PIs and Core staff. The web-based database is mobile friendly and allows PIs and staff to capture the details of their research or outreach activities while on the go.

## Key Personnel

Name	Role	Phone	Email
Jeffrey Levin, MD, MSPH	Center Director	903-877-5900	<a href="mailto:jeffrey.levin@uthct.edu">jeffrey.levin@uthct.edu</a>
Dave Douphrate, PhD, MPT, MBA, CPE, CSP	Deputy Director	210-276-9005	<a href="mailto:David.I.Douphrate@uth.tmc.edu">David.I.Douphrate@uth.tmc.edu</a>
Vanessa Casanova, PhD	Applied Research Manager	903-877-5896	<a href="mailto:vanessa.casanova@uthct.edu">vanessa.casanova@uthct.edu</a>
Amanda Wickman, MBA	Program Manager	903-877-5998	<a href="mailto:amanda.wickman@uthct.edu">amanda.wickman@uthct.edu</a>
Nykole Vance, MS, CEP, CHES	Outreach Education Coordinator	903-877-7935	<a href="mailto:nykole.vance@uthct.edu">nykole.vance@uthct.edu</a>
Nickie Warren, BBA	Special Projects Coordinator	903-877-5621	<a href="mailto:nickie.warren@uthct.edu">nickie.warren@uthct.edu</a>
Teresa Walker	Grants & Contracts Specialist II	903-877-5884	<a href="mailto:teresa.walker@uthct.edu">teresa.walker@uthct.edu</a>
Ann Carruth, DNS, RN	PI-Intervention Project, Co-PI Outreach Core	985-549-3772	<a href="mailto:acarruth@selu.edu">acarruth@selu.edu</a>
Vijay Boggaram, PhD	PI-Research Project	903-877-7780	<a href="mailto:vijay.boggaram@uthct.edu">vijay.boggaram@uthct.edu</a>
Deborah Helitzer, ScD	Co-PI-Evaluation Core	505-272-1887	<a href="mailto:helitzer@salud.unm.edu">helitzer@salud.unm.edu</a>
Matthew Nonnenmann, PhD, CIH	PI-Education Project	319-335-4207	<a href="mailto:matthew-nonnenmann@uiowa.edu">matthew-nonnenmann@uiowa.edu</a>
Eva Shipp, PhD	PI-Research Project	979-458-2151	<a href="mailto:eshipp@tamhsc.edu">eshipp@tamhsc.edu</a>

Learn more about the SW Ag Center faculty, staff, principal investigators and advisors at <http://www.swagcenter.org/aboutpeople.asp>.

**Ag Center web link:** [www.swagcenter.org](http://www.swagcenter.org)

- Facebook: [www.facebook.com/swagcenter](http://www.facebook.com/swagcenter)
- Twitter: <https://twitter.com/SouthwestAg95>
- SW Ag Center YouTube Channel: <https://www.youtube.com/channel/UCpjY-4XqieAKHwSioeBH-nQ>
- Ag Centers' Joint YouTube Channel: [https://www.youtube.com/channel/UCRgk3ryTcY8Wcvvv\\_ulZgmA](https://www.youtube.com/channel/UCRgk3ryTcY8Wcvvv_ulZgmA)

## SECTION II

### Center Cores

#### **Administrative and Planning Core**

Center staff, principal investigators (PIs) and advisors convened for their annual in-person Board Meeting in Tyler, Texas on March 7-9, 2016. The SW Ag Center welcomed four new External Advisory Committee Members: Janelle Rios, PhD; Jennifer Conner, DrPH, MPH; Kevin Moore, ChE, MBA; and James Wright, DVM. The group discussed progress on research projects and cores and considered emerging issues in agricultural occupational safety and health. Preliminary progress for four feasibility studies was presented. The Center engaged in two field trips in order to learn more about Texas agriculture. The group visited a locally owned and operated ranch and toured the state of the art cancer treatment facility at UT Health Northeast. Worker safety and health issues were explored at the ranch and hospital leadership described how they serve a largely rural community through an extensive clinic network and on-site



Board meeting attendees observe artificial insemination at a beef cattle operation in East Texas.

patient-centered services. The in-person meeting wrapped up with a presentation from Paul McGaha, DO, MPH, Deputy Director for the Northeast Texas

Center for Rural Community Health and Associate Professor for Community Health and Preventive Medicine. Dr. McGaha addressed the evolution of the Zika virus and the potential implications for outdoor workers in the United States. Additional discussion time was dedicated to current and future evaluation strategies.

#### **Feasibility/Pilot Studies Program and Emerging Issues Core**

Five projects were in process over the last year. Six applications were submitted for the 2015-2016 feasibility studies announcement. Four projects received favorable scores from reviewers. A fifth project (Dr. Khademi) was submitted, reviewed and funded in the spring of 2016.

- Victor Cardenas, MD, MPH, PhD, FACE, from the University of Arkansas is investigating methods for improving public health surveillance of occupational injuries in agriculture, particularly in Arkansas.
- Alice Larson, PhD, is developing a guidelines document for future investigators to use to conduct migrant and seasonal farmworker enumeration profiles studies.

- Joseph Neary, PhD, VetMB, from Texas Tech University is investigating a novel diagnostic approach to traumatic brain injuries among agricultural workers.
- Kai Zhang, PhD, from the University of Texas School of Public Health is looking at heat and health and the development of vulnerability indicators for agricultural workers along the Texas-Mexico border using secondary environmental data.
- Shaadi Khademi, MD, occupational medicine resident from UT Health Northeast, is collecting data that will assess the farmworker population in the Rio Grande Valley (TX) with respect to their perceptions of sun safety, sun-protective behaviors and their use of protective measures.



Amy Gulick, graduate student for Joseph Neary, fits Tim Struttman (IAC) with an eye tracking device. Dr. Neary is testing the feasibility of using such a device to identify head injuries.

For more information, visit

<http://www.swagcenter.org/opportunitiesfeasibilities.asp> or contact Vanessa Casanova, PhD at 903-877-5896 or by email to [Vanessa.Casanova@uthct.edu](mailto:Vanessa.Casanova@uthct.edu) .

Read more about past and current feasibility studies at

<http://www.swagcenter.org/projectsfeasibility.asp>.

## Outreach Program Core

The SW Ag Center supported three young professionals through internships in 2016. Larimey Curtis was selected as the SW Ag Center-Noble Foundation Ag Safety and Health Intern. He is a student at Southeastern Oklahoma State University and plans to graduate in May 2017 with a Bachelor's degree in Occupational Safety and Health. Over the summer, Larimey delivered a safety presentation on small engine safety, performed outreach at the National Association of Ag Extension Agents conference, organized and secured hazardous chemicals and became familiar with OSHA reporting. Larimey also networked at the Emerging Issues Conference with guest speaker, John Howard, and a special occupational safety and health exhibit by renowned photojournalist, Earl Dotter. The SW Ag Center provided funding to the Occupational Health Internship Program to support two additional individuals. Leigha Vilen and Rebecca Leibowitz worked with Center PI, Michael Merten, PhD, at the Oklahoma State University-Tulsa campus to explore safety and health perceptions and work satisfaction among Latino nursery workers. Rebecca attends Yale University and plans to graduate with a bachelor's degree in Molecular, Cellular and Developmental Biology. Her long term career goals include earning a MD/MPH degree. Leigha is an undergraduate

student at the University of North Carolina in the department of Health Policy and Management. When asked how the internship impacted her career goals, Leigha commented that she discovered a passion for performing public health outreach.

In collaboration with the University of North Texas Health Science Center, Texas Rural Health Association (TRHA) and UT Health Northeast (through a NIOSH-funded TPG), the SW Ag Center conducted the second half of the Texas Agromedicine Workshop. The event was held in conjunction with the annual TRHA conference in October 2015. Forty-nine people participated including occupational medicine residents, medical students and registered nurses. Topics included environmental hazards in agriculture, acute injuries, musculoskeletal diseases and ergonomics, physical factors affecting health, prevention of illness and injury, colorectal cancer, occupational skin diseases and ATV safety.

Other resources available through the Center include:

- Educational Materials, <http://www.swagcenter.org/resourcesvideos.asp>
- Monthly Safety Blasts, <http://www.swagcenter.org/resourcesmonthlyblasts.asp>
- Cultivation Newsletters, <http://www.swagcenter.org/resourcesnewsletters.asp>

Contact Nykole Vance at 903-877-7935 or by email to [Nykole.Vance@uthct.edu](mailto:Nykole.Vance@uthct.edu) for more information on outreach activities and resources.

## Evaluation Program Core

At the Advisory Board meeting in 2014 (Yr 4), the evaluation team requested guidance from the External Advisory Committee to ensure that the desired data for the summative year was collected. The common thread in the responses was for the summative evaluation to better identify the impact of the SW Ag Center in the region and by stakeholder groups. To accomplish this aim, a widely distributed and comprehensive (excluding social network analysis) survey was launched to evaluate perceptions of the SW Ag Center stakeholders. The intent was to identify differences between members of a diverse stakeholder group by affiliation (e.g., AFF, Extension Agent, Government, etc.) and commodity area (e.g., farm, fishing, dairy, etc.). To determine impact, a quantitative analysis of differences within each stakeholder group was conducted. In January, 2016, an on-line survey (Survey Monkey) was deployed to all stakeholders via email to the SW Ag Center listserv; it was closed in early March. Unfortunately the response rate was extremely low (8%) allowing only preliminary conclusions that may inform future survey strategies (see Lessons Learned).

To enable the SW Ag Center leadership, IAC and EAC to glean as much as possible from results, despite the low response rate, descriptive statistics were presented in the final report through a series of tables by (1) the overall (aggregate) responses, (2) primary affiliation and (3) primary commodity area for these inquires:

- Level of involvement
- Effectiveness of the SW Center
- SW Center alignment with respondent organization
- SW Center relevance and influence to organization and the region

- SW Center support and commitment to respondent organization
- SW Center accomplishments
- SW Center Outreach activities – types of service and usefulness of materials

### **Lessons Learned**

The year 5 survey offered an opportunity to learn how best to move forward into the next cycle. These lessons learned essentially examine the question, *Who needs to be asked What and How?*

1. An all-inclusive, one-shot survey is not the most effective approach. The tables presented in the summative report disaggregated by affiliation and by commodity areas can be culled to get some evidence-based idea of 'WHO' is most satisfied with 'WHAT' (both SW Ag Center capacity and specifically outreach materials). However, for the future, another consideration is to send a few smaller surveys to targeted groups, which may result in more definitive information and more confidence in our ability to use the information for decision making purposes.
2. 'HOW' is more challenging to evaluate. Surveys are ideal for large samples, securing measurable perceptions quickly and affordably. 'How' to administer, 'when', and 'where' are questions the SW Ag Center leadership, IAC and EAC will deliberate and provide guidance to the evaluation team for the next funding cycle.
3. Impact is another challenge to the evaluation since credible assessments require data that can be differentiated – either by time and data across time or stakeholder attributes.

Lastly, the manuscript, "Hierarchical Logic Models as a Tool to Evaluate Programmatic Initiatives: Practical Solutions to Identified Problems," has been submitted to the Journal of Evaluation and Program Planning, and is under review.

## **Research Projects**

### **Poultry Dust Exposure and Lung Inflammation**

PI: Vijay Boggaram, PhD

Host Institution: University of Texas Health Northeast

Persistent inflammatory responses to infectious agents and other components in organic dust underlie lung injury and development of respiratory diseases. The components in organic dust responsible for eliciting inflammation, and the mechanisms by which they cause lung inflammation are not fully understood. We studied the mechanisms by which protease activities in poultry dust extracts and intracellular oxidant stress induce interleukin-8 (IL-8) gene expression in A549 and Beas2B lung epithelial cells. We found that poultry dust extracts contained trypsin- and elastase-like activities, and activated protease activated receptor (PAR)-1 and -2. Serine protease inhibitors and PAR-1 or PAR-2 knockdown suppressed the induction of IL-8 gene expression. The induction of IL-8 gene expression was associated with increased DHEfluorescence and 4-HNE staining indicative of generation of reactive oxygen species (ROS), and antioxidants such as n-acetylcysteine, dimethylthiourea, and 1-(2-Cyano-3,12,28-trioxooleana-1,9(11)-dien-28-yl)-1*H*-imidazole (CDDOIm) suppressed the induction of IL-8 gene expression. Protease inhibitors and antioxidants suppressed protein kinase C activation and the induction of IL-8 promoter activity by dust extract. In summary, our studies have indicated that protease activities and oxidant stress are important players in the induction of IL-8 gene expression by poultry dust extracts in lung epithelial cells.

## **Neuromotor Function and Work Injury Risk Among Hispanic Adolescent Farmworkers**

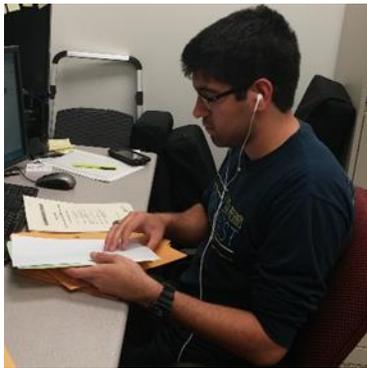
PI: Eva Shipp, PhD

Host Institution: Texas A&M School of Rural Public Health

Participants in this three year cross-sectional/cohort hybrid study are adolescents from the Texas-Mexico border who participate in migrant farm work in the United States and a comparison group of their peers. All eligible participants were enrolled in the Migrant Education Program in their respective school. The data collection schedule covered three migration seasons with pre- and post-migration assessments occurring during each season (project year 2-5). During the current reporting period (project year 5), data collection was finished successfully in Fall 2015 as planned with community support. The post-migration data for season 3 was collected during Fall 2015. Assessments involved questionnaires to solicit information on demographics, migration and agricultural work patterns, work safety including a focus on pesticides/chemicals, injury, general health status, and health behaviors. Nurses measured height, weight, foot size, and blood pressure. Trained staff and nurses measured motor control primarily using postural sway assessment. Collaborators at the University of Cincinnati continued to monitor the postural sway assessment protocol (including an on-site visit-Fall 2015) and to verify the accuracy of data processing.

Preliminary data analysis was conducted during the year 5. For the season 3 post-migration, 90 adolescents in grades 9-12 participated (response proportion=84%). To date, 562 adolescents have been enrolled in the study (58 during pilot assessments, 197 during season 1, 186 during season 2, and 121 during season 3. In total, there were 517 adolescents that participated in the study during the three migration seasons (project year 2-5). Of these, approximately half of participants were female (50.5%) and 99.4% were Hispanic/Latino. Preliminary data analysis of post-migration data found that those with high exposure history and who reported pesticide (e.g., mix or loading pesticides into sprayers and home pesticide use) use had higher mean Area F and Length F sway parameters. For middle school students, those with a high exposure history had a mean sway length and area that were 11.3% and 14.6% higher than those with low exposure history. For high school students, males with a high exposure history had a mean sway length and area that were 4.3% and 1.0% higher than those with a low exposure history. While, female high school students with a high exposure history had a mean sway length and area that were 6.5% and 15.5% higher than those with a low exposure history. In addition, those who reported mixing or loading pesticide into sprayers had a mean sway length and area that were 14.4% and 6.5% higher than those who did not report mixing or loading pesticide into sprayers. Those who reported home pesticide use had a sway length and areas that were 10.9% and 17.6% higher than participants who did not report home pesticide use. To review and based on prior research, increased sway parameters may be indicative of decrements in gross motor performance and potential exposure to neurotoxicants. An additional analysis assessed if participants with artificial fingernails had impaired performance compared to female participants with natural fingernails on the 25-hole grooved peg board test, a measure of fine motor control. We found that both middle and high school females with artificial fingernails performed slower compared to those with natural fingernails. Middle school

students that were right hand dominant with artificial nails had a higher mean place and remove tasks time during the pre-assessment for right hand tasks by 20.3 seconds and 5.6 seconds, respectively. This group also had a higher mean time for left hand tasks for place and remove tasks times by 26.5 and 8.4 seconds, respectively. Next, left hand dominant middle school females with artificial fingernails also had a higher mean place and remove tasks time for both right (22.8 and 6.9 seconds) and left hand tasks (8.2 and 4.4 seconds). For high school students, right hand dominant females with artificial nails had a higher mean time for place and remove tasks times for pre-assessments compared to those with natural nails for both right (10.7 and 2.4 seconds) and left hand tasks (7.6 and 0.7 seconds). This was also true for post-assessments for right (15.3 and 4.4 seconds) and left hand tasks (18.9 and 3.5 seconds). These findings are the focus of a brief report that is being submitted for consideration in a peer-reviewed journal. Final analysis of questionnaire and postural sway data is underway, as well as dissemination of findings (year 5).



Sean Castillo working on data entry (March 2016)



Project staff take a break from data entry and analysis to take a team picture (May 2016). Left to Right: Katrina Korenek, Amber Brooke Trueblood, Brendan Mueller

## **Intervention Project**

### **Marketing Safety and Health Among Vietnamese Commercial Fishermen**

PI: Ann Carruth, DSN, RN

Host Institution: Southeastern Louisiana University

During July and August 2016, the Louisiana Public Health Institute (LPHI) in collaboration with the project team developed a social marketing campaign to increase personal flotation device (PFD) usage among Vietnamese shrimpers to address the issue of high mortality rates of Gulf Coast fishermen due to lack of use of PFDs. The creative campaign was based on prior formative research to better understand the target population (Vietnamese captains and deckhands). The goals of the initiative are to increase Vietnamese shrimpers' awareness of the importance of wearing PFDs and to increase the actual use of PFDs by Vietnamese shrimpers while on the water shrimp fishing.

Three captain focus groups and three deckhand focus groups were conducted to test the visual campaign message and content. The campaign's concepts were tested to ensure the message and visual aspects of the campaign are relevant and impactful. Key topics of discussion included: (1) immediate reactions to the creative campaign, (2) perceptions of the intended message of the campaign, and (3) considerations for implementing the campaign. The captains reported that the poster suggests that the captain's responsibility is to take care of the crew by enforcing the use of PFDs. They noted that "safety is a must" and that it "motivates everyone" to wear the PFD for "their own safety." The captains stated that the poster is clear, the image of the individual in the poster tossing the PFD into the water as a life-saving device is memorable, and that the poster evokes positive feelings about safety. They expressed that the poster is realistic and personable, and reminds the men that they are held accountable for their crews' safety by maintaining safety regulations. The deckhands said that the poster evokes positive feelings of family and reminds them of their commitment to the livelihoods of their families; one respondent said that if he could not work, his "family will suffer because they depend on me for their eating and shelter." They perceived that the poster not only spoke to the physical safety of the crew member, but also to the family's feelings of safety as the boat departs from the dock. They said that they appreciated the colors, choice of words, and images of family. The deckhands also reported that the posters made them feel motivated to wear the PFD for safety.

Key project members are evaluating audience reaction and need for further art redesign and evaluation.

## Education Project

### **Education Approach to Increase Respirator Use Among Broiler Chicken Workers**

PI: Matt Nonnenmann, PhD, CIH

Host Institution: The University of Iowa

Data collection has concluded for the project and analyses are nearing completion. The project team plans to publish two additional papers. To date, three papers have been published from this project. The first paper is a characterization of worker bioaerosols exposure to broiler chicken dust during tasks in the broiler chicken building. (1) This paper used state-of-the art DNA sequencing technology to characterize bacteria in poultry dust. The second paper evaluated the effectiveness of an engineering control to reduce dust and ammonia concentrations in broiler chicken production. (2) The engineering control was a sprinkling system that is used to reduce heat stress among chickens and was promoted to reduce dust by the manufacturer. We found no difference in dust or ammonia concentrations between a house using the sprinkling system and a control house. A third paper is an anthropological analysis of broiler chicken growers perceptions of agricultural health and safety research. These data are very interesting and suggest some important barriers that need to be overcome to perform health and safety research among workers in the broiler chicken industry. The fourth and fifth papers planned will complete this project. The fourth paper is an additional analysis of the DNA data from the fungal components of the broiler chicken dust exposure samples that were collected. These analyses are ongoing and will be completed by December 2016. The last paper is an in-depth analysis of perceptions to reveal themes among broiler chicken growers. Areas of focus include perceptions of research, funding agencies and agricultural safety and health. The project used Computer Assisted Telephone Interviewing to collect these data.

1. O'Brien K, Chimenti M, Farnell M, Tabler T, Bair T, Bray J, **Nonnenmann MW\*** (2016) High Throughput Genomic Sequencing of Bioaerosols in Broiler Chicken Production Facilities. *Microbial Biotechnology*. (DOI: 10.1111/1751-7915.12380)
2. Ischer S, Farnell M, Tabler T, O'Shaughnessy P, **Nonnenmann MW\*** (2016) Evaluation of a Sprinkler Cooling System on Inhalable Dust and Ammonia Concentrations in Broiler Chicken Production. *Journal of Occupational and Environmental Hygiene*. (In-Press)
3. Janssen B\*, **Nonnenmann, M.** (2016) New Institutional Theory and a Culture of Safety in Agriculture. *Journal of Agromedicine*. (Accepted)
4. **Nonnenmann MW\***, Chimenti M, O'Brien K, Farnell M, Tabler T, Bray J, Bair T. (2017) High Throughput Genomic Sequencing of Fungal Bioaerosols in Broiler Chicken Production Facilities. *Mycology*. (Submission 9-1-16)
5. Janssen B\*, **Nonnenmann, M.** (2017) Title is not identified.