A tractor rollover demonstration at the UMASH Farm Safety Pavillion at Minnesota Farmfest 2021

Summary Annual Report

2020-2021

NIOSH Center of Excellence in Agricultural Disease and Injury Research, Education, and Prevention
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UMASH Upper Midwest Agricultural Safety and Health Center

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Section I: Center Overview

The Upper Midwest Agricultural Safety and Health Center

Background

In our 10th year of serving producers, agricultural workers, and farm families, there are many things we are thankful for at UMASH. Enclosed in this annual report is a summation of our research, community engagement, and outreach efforts. I hope you will enjoy reading about the collective work of the Center and how we humbly seek to support the health and safety of our agricultural community. During another difficult pandemic year, we say thanks to our farmers, farm families, and farm workers for their tireless work in providing food for our tables.

Our research efforts have continued despite the ongoing pandemic. Many of our partners (Marshfield Research Foundation, Migrant Clinicians Network, Minnesota Department of Health, College of Veterinary Medicine, and the School of Public Health) are on the frontlines supporting our local communities. As such, it has been challenging to do our regular surveillance work and in-person engagement. Yet, disease and injury prevention research continues. This includes understanding better ways to detect airborne viruses, responding to infectious disease threats to workers and visitors to farms (i.e. agritourism), and preparing first responders how to respond to on-farm emergencies (e.g. see inside on RF-DASH). Our team supported our dairy producers and workers in trying to provide access to COVID-19 testing sites, vaccinations, and Spanish educational materials.

In addition, we developed new collaborations. One way that this was done was through our emerging issues funds and partnership building. To support our aging farmers, we provided funds for four partner projects to develop materials for rural farmers with Parkinson's Disease, create educational programs with occupational health professionals, and partner with local community groups to prevent injuries in our agricultural producers living with dementia. As part of these efforts, we continue to expand our network in the context of the One Health model (i.e. engaging multiple disciplines to address complex challenges). Varied health professionals are needed to create a holistic approach to supporting rural health. Further, we have engaged diversified farm groups including producers who support our farmers markets and underserved communities.

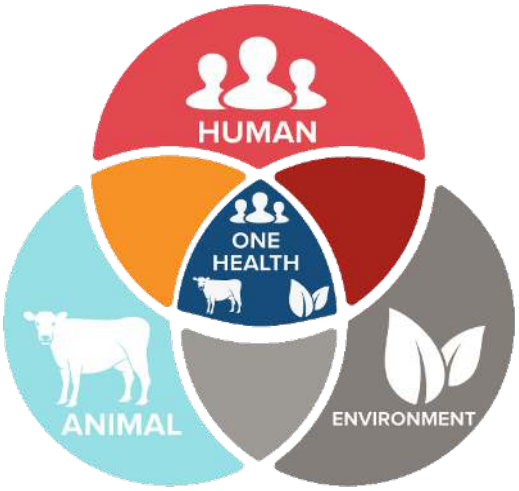
Our communications and outreach team again has been tireless in developing new materials to address timely topics including drought, grain bin safety, aging, antimicrobial resistance, and zoonotic disease prevention to list a few. These include materials with culturally appropriate, accessible language, such as new videos and relevant spotlight stories.

The success of our efforts depends on listening to our agricultural partners. We thank our key partners, advisory board, and collaborators and look forward to a brighter New Year.

About the Center

UMASH is a Center of Excellence in Agricultural Disease and Injury Research, Education, and Prevention funded by the National Institute for Occupational Safety and Health (NIOSH). The Center is a collaboration of the **University of Minnesota School of Public Health** and **College of Veterinary Medicine**, the **National Farm Medicine Center of the Marshfield Clinic** with the **Migrant Clinicians Network**, and the **Minnesota Department of Health**. This collaboration brings together unique and complementary expertise to address existing and emerging occupational health and safety issues in agriculture.

UMASH focuses on the interrelationship between agricultural production practices, farm workplace health and safety conditions, and the interdisciplinary connections needed to address agricultural worker health and safety. Agricultural production practices are primarily driven by social, economic, and animal health and productivity considerations. These agricultural production practices, in turn, strongly influence workplace health and safety conditions.



UMASH emphasizes the concept of One Health which engages multiple disciplines and sectors to understand the interdependence between animal health, human health, and the health of the environment. UMASH also emphasizes how the ever-changing nature of agriculture can influence the health and well-being of agricultural workers.

The current grant cycle includes six funded research projects in support of agricultural worker health and safety:

1. Optimizing Assessment and Control of Virus-Containing Particles in Animal Agriculture Operations
2. Rural Firefighters Delivering Agricultural Safety and Health (RF-DASH)
3. Promoting Safety and Worker Health for Immigrant Dairy Workers
4. Longitudinal Study of Infectious Disease Risks at the Human-Swine Interface
5. Surveillance and Control of Zoonotic Diseases in Agricultural Workers in the Upper Midwest
6. Assessing and Preventing Work Related Injuries in Animal Agriculture

UMASH emphasizes the concept of One Health which engages multiple disciplines and sectors to understand the interdependence between animal, human, and environmental health.

The Center also has an outreach component to disseminate and collect information from stakeholders; an emerging issues program to explore new opportunities and address emerging issues in agricultural safety and health; and an evaluation program to monitor and assess the performance and outcomes of the Center.

UMASH Key Personnel	Role
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Section II: UMASH Research Project Updates

Monitoring Zoonotic Diseases in Minnesota Agricultural Workers, Their Families and Those Who Engage in Agritourism

Background

Agriculture is the foundation of the economy in the Upper Midwest. Minnesota, in particular, ranks 5th in the United States in overall agriculture production and generates over $112 billion annually in total economic impact while supporting more than 430,000 jobs. Minnesota is the largest producer of turkeys in the U.S. and the 3rd largest producer of hogs.

Agriculture is not only integral to Minnesota's economy, but it is also a big part of Minnesota culture. More than 90 county fairs and the Minnesota State Fair attract more than 2.1 million visitors each year. Food production animals naturally carry several zoonotic pathogens (germs that can be passed between animals and people) that can cause illness in agricultural workers, their families, and visitors to farms and fairs. Since 2012, this UMASH project has focused on documenting the scope of zoonotic diseases in agricultural populations and visitors to agricultural venues. This information will inform prevention measures and guide educational efforts around zoonotic enteric diseases.

Project update

Illnesses caused by *Cryptosporidium*, *E. coli* O157:H7 and other Shiga toxin-producing *E. coli* (STEC), *Campylobacter*, and *Salmonella* infections are reportable to MDH. All ill people are interviewed with a routine questionnaire that includes questions about agricultural exposures (i.e., living on, working on, or visiting a farm, petting zoo, fair, or another venue with animals). Since 2012, patients who report a food animal agriculture exposure have been re-interviewed with a more detailed questionnaire about their interactions with the animals.

From 2012-2019, there were 12,999 laboratory-confirmed illnesses among Minnesotans that were eligible for our study. Of these, 3,019 (23%) reported an animal agriculture exposure in Minnesota right before they got sick. Sixty-two percent of ill people with an animal agriculture exposure reported living and/or working on a farm, 28% reported visiting a private farm, and 10% reported visiting a public animal agriculture venue. During this reporting period (October 2020-September 2021), there were 1,662 laboratory-confirmed illnesses among Minnesotans that were eligible for our study. Of

Of the confirmed zoonotic illnesses in Minnesota this year, **18% reported an animal agriculture exposure** before their illness and **62% reported living and/or working on a farm.**

these, 304 (18%) reported an animal agriculture exposure in Minnesota before their illness and 62% reported living and/or working on a farm.

MDH also investigates animal-contact-related outbreaks. A 2021 outbreak of *E. coli* O157:H7 infections associated with a private farm illustrates the importance of zoonotic diseases acquired via food animal agriculture exposures. Three children were affected, and two developed hemolytic uremic syndrome (HUS); one child was hospitalized for 13 days and the other for 35 days. Samples collected from calves and sheep on the farm yielded *E. coli* O157:H7 that were identical to the *E. coli* O157:H7 from human patients. No direct exposures to the animals were identified, highlighting the importance of indirect exposures to animal environments on farms as a potential source of illness. MDH epidemiologists provided education to the farm owners and families of ill children. Providing these tailored, one-on-one consultations has become a larger part of the work we do to help prevent these outbreaks from occurring. Additional outreach activities are described in the Outreach section of this report.

For the sixth year in a row, Minnesota was part of a large, nationwide outbreak of *Salmonella* infections associated with live young poultry contact. The 2020 outbreak consisted of 1,722 people from all 50 states (including 43 from Minnesota) that became ill with salmonellosis, resulting in 333 hospitalizations and 1 death. Currently, the 2021 outbreak consists of 994 people from 47 states (including 54 from Minnesota) that have become ill with salmonellosis, resulting in 219 hospitalizations and 2 deaths. We also investigated a *Campylobacter jejuni* outbreak associated with contact with live poultry purchased at a feedstore. A total of 21 people became infected. Fourteen environmental samples were taken at the feedstore, and four (19%) were positive for the outbreak strain of *Campylobacter jejuni*. MDH, in conjunction with the Minnesota Board of Animal Health (BAH), recommended the following mitigation measures: physically separate poultry from the public in such a way that the public cannot have contact with the birds or their housing, only allow feedstore staff members to handle poultry, and provide

the MDH *Campylobacter* informational flier at point of sale to anyone buying live poultry.

The COVID-19 pandemic has created a major disruption in this work, which is conducted solely by staff at the Minnesota Department of Health (MDH), the lead state agency in the pandemic response. Since March 2020, all MDH staff who work on this UMASH project have been redeployed to work full-time on the pandemic response. Consequently, we have been able to maintain only a minimal level of traditional UMASH activities since March 2020, primarily interviewing as many cases as possible, as well as outbreak detection and response. MDH UMASH staff were heavily involved in COVID-19 prevention activities in the agriculture sector. MDH developed COVID prevention guidance for animal agriculture workers and veterinary personnel with BAH and the Minnesota Department of Agriculture (MDA) and has met virtually with 17 swine, dairy, and poultry producers and 53 veterinary clinics to go over these best practices and answer questions. Outreach to additional facilities is ongoing and COVID vaccination presentations for employees are being offered. Dr. Scheftel worked with the Minnesota State Fair on COVID prevention and safety measures for the animal barns and 4-H dormitories, and with 4-H administration on COVID mitigation for the "Livestock Encampment" involving 1,400 4-H participants at the fair. MDH and BAH have contacted 40 Minnesota county fairs and cattle, sheep, swine, and poultry exhibitions and events about COVID prevention best practices.

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

Background

The importance of the human-animal interface as a source of emerging infectious diseases is universally recognized. People having regular animal contact are at the front line for exposure to known and emerging pathogens, and veterinarians provide a unique window into occupational risks for emerging zoonotic diseases. A 5-year longitudinal cohort study of U.S. swine veterinarians will be conducted to understand the exposure and health risks attributable to pig exposure for three important emerging zoonotic pathogens that are endemic in the U.S. swine industry: 1) Livestock associated *S. aureus* (including MRSA and multidrug-resistant *S. aureus*); 2) Influenza A viruses; 3) Hepatitis E virus. A control group of companion animal veterinarians without contact with swine will be included for comparison of exposure and health risks, and to enable calculation of risks attributable to swine exposure.

Project update

The final sampling and survey collection for the project were conducted in June 2021, and laboratory work on *S. aureus* typing is in the final stages. Throughout the study, the compliance rate for swab submission overall was 98.3% and for survey submission was 94.6%. Final data are not yet available

Preliminary data suggest higher prevalence of S. aureus and MRSA in swine veterinarians compared to companion animal veterinarians.

from June 2021, but the data consistently show the expected higher prevalence of *S. aureus* (approximately two-fold) and MRSA (approximately 4 fold) in the swine veterinarians compared to the companion animal veterinarians. Furthermore, the isolates from swine veterinarians were dominated by livestock associated variants, with the distribution of spa types very similar to those found in our previous study.

Only 3 individuals (2 swine vets and 1 companion animal) reported clinical *S. aureus* infections that were medically confirmed. None were MRSA, and all were minor localized infections. Table 1 compares the incidence of self-reported work-related injuries (WRI), WRI receiving medical attention, skin and soft tissue infections, and *S. aureus* infections. Similarly, there was no indication of elevated risk of influenza-like illnesses or hepatic disease.

Table 1. Incidence of self-reported health events per 100 person-months in swine veterinarians and companion animal veterinarians

	Swine Veterinarians	Companion Animal Veterinarians
Work related injuries (WRI)	2.4	4.0
Medical attention for WRI	0.28	0.40
Skin and soft tissue infections	5.9	9.8
S. aureus infection	0.07	0.04

Note: incident rates are based on incomplete data

Optimizing Assessment of Virus-Containing Particles in Animal Agriculture

Background

Viruses have the potential to be transmitted through the air among animals and between animals and people, posing risks to swine and poultry workers, and veterinary workers. Animals in agricultural facilities generate virus-containing particles from their respiratory tracts or their fecal matter. Many of these particles are small enough to be transported substantial distances. Few measurements have been made of the airborne concentrations, sizes, and viability of these virus-containing particles. Particle size is especially important because it helps to determine how far virus-containing particles can travel through the air, where virus-containing particles deposit in the human respiratory tract, and technologies that can remove the particles from the air. The objective of this research is to identify or develop a high-volume, field-portable, size-differentiating viral aerosol sampler and use it to measure worker exposures to infectious airborne influenza viruses in animal agriculture facilities.

In the first step toward this objective, we assembled an array of existing samplers that collect airborne particles by a variety of principles. In three groups, we tested samplers side-by-side in an isolation

room by allowing them to collect artificially generated aerosols containing one of three different viruses: swine influenza virus, avian influenza virus, and MS2 bacteriophage virus. Samples were analyzed to determine quantities of viable virus using isolation techniques and viral RNA using RT-PCR. These tests allowed us to determine that higher virus titers and more RNA copies were recovered from high flow rate samplers. On the other hand, these highest flow samplers yielded lower airborne concentration measurements. This suggested that sample consolidation in the higher flow rate samplers may contribute to inactivation of the virus and damage to viral RNA.

Project update

During the past year, results from the first group of these samplers were published in a paper in *PLoS ONE*. Two additional manuscripts are in preparation using the results from the second two groups of samplers. We expect to submit these manuscripts in the next few months.

In early March 2020, field measurements were taken to detect and measure airborne viruses in a swine production facility using a small subset of the most promising samplers. Analyses of these field samples indicated that the lower flow rate samplers used in the study, the AGI-30 impinger and the Andersen Non-viable Cascade Impactor, measured higher airborne virus concentrations compared to the high-volume cyclonic sampler despite the cyclonic sampler's high recovery of infectious and total virus. The viral particles were observed in particles larger than 3.3 µm in aerodynamic diameter. Taken together, the isolation room and field data indicate that to successfully quantify airborne virus, a two-sampler strategy may be needed. A high flow sampler will be needed to provide low limits of detection, while a lower flow sampler will offer benefits for concentration measurements.

To detect viral load in animal facilities, a two-sampler strategy may be needed: A high flow sampler to provide low limits of detection, and a lower flow sampler to provide concentration measurements.

In the past year, we designed a novel size-separating impingement sampler. Our approach is to develop a multi-stage virtual impactor system that concentrates particles in different size intervals and collects them in impingement samplers. Inertia is the most practical way to separate particles for analysis by size. A virtual impactor consists of an acceleration inlet nozzle and two outlets: a collection probe which draws away a minor portion of the incoming flow – in our case about 5% – and a bypass outlet which draws away the remaining major portion of the incoming flow, which turns 90° from its original direction. Airborne particles are accelerated through the inlet nozzle with the incoming air and directed towards the collection probe. Larger particles with enough inertia are separated in the probe, concentrated, and carried away with the minor flow while most of the smaller particles follow the turning air and are carried away with the major flow. With an inlet flow rate of 300 L/min, the sampler will contain a series of stages with progressively smaller nozzles placed in series to process the same aerosol flow, with the particles separated by size into several samples that can be collected and analyzed individually. We plan to separate particles into at least four aerodynamic size intervals (>10 µm, 4-10 µm, 1-4 µm, and <1 µm) using a series of virtual impactors. We will collect particles concentrated in the minor flows using

aerosol impingers such as an AGI-30. Particles passing through the final stage will be collected using a gelatin filter.

The multi-stage virtual impaction sampler has been designed using Ansys computational fluid dynamics (CFD) modeling software. This modeling involved establishing the geometry of each stage in three dimensions, laying out a three-dimensional computational mesh within the geometry of each section, modeling the airflow throughout the mesh, and superimposing particle motion into the airflow. Using the geometry from the models, engineering drawings are currently being developed. The drawings will allow a sampler to be fabricated by the University of Minnesota College of Science and Engineering Machine Shop. In the coming year, the performance of the multi-stage virtual impaction sampler will be verified in laboratory tests. After the performance of the new sampler has been validated, it will be compared to existing samplers in laboratory and field tests.

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

Background

The Rural Firefighters Delivering Agriculture Safety and Health (RF-DASH) project is a train-the-trainer program designed to increase rural fire/EMS knowledge and promotion of injury prevention on farms in our local communities. The program expanded beyond the Midwest and has trained over 70 firefighters/EMS in 10 states and in turn, they have begun to train dozens more.

Project update

The RF-DASH team has been working on the development of a training manual and dedicated website to assist emergency responders in scaling up agricultural health and safety practices throughout their communities. Entering the final years of the grant, the program has taken a greater focus on creating various resources as part of the sustainability of the program and thinking beyond the life of the grant.

A dedicated website was requested by the trainers of the program as a method to be able to increase their networking and collaboration amongst emergency responders and safety professionals in other regions, as well as have the capabilities to share updates, successes, and

challenges to help others continue to build and train others within RF-DASH. The website will also house important information and resources to help the RF-DASH core team communicate and share information more readily with its target audiences. The creation of a detailed training manual was a result of requests by trainers to have materials and information that would assist in organizing trainings, providing a thorough review of the materials and information contained within the five modules, and a multitude of supporting materials to help continue their own personal training within the program. The extensive training guide will serve both existing and new trainers with the information they need to help build confidence in training others effectively.

The RF-DASH team has been collaborating with the Canadian Agricultural Safety Association (CASA) which expressed interest in establishing RF-DASH in Canada. After the RF-DASH team presented the program with both CASA and a multitude of fire chiefs from various Canadian provinces, the team received tremendous feedback and increased interest from Canadian rural fire departments to incorporate the program into their departments' trainings. Discussions are ongoing with CASA on how the RF-DASH core team can provide technical assistance in starting up their version of the program. The team has also initiated conversations with a USDA representative, who first became interested after attending a virtual RF-DASH presentation at the National Alliance of State Animal and Agricultural Emergency Programs (NASAAEP), discussing the integration of RF-DASH into existing response structures such as FEMA and the Regional Response Teams in various regions of the country.

Lastly, data analysis of the Social Network Analysis (SNA) and national training interviews that have been collected over the past three years has continued. As the analysis begins to conclude, the RF-DASH team has also begun writing manuscripts on the data and information collected, ramping up as the program enters its final year.

Promoting Safety and Worker Health for Immigrant Dairy Workers

Background

Immigrant workers are important to the economic sustainability of dairy production in the United States. Yet, this population often lacks adequate training due to cultural and language barriers. Our project goal is to improve the occupational health and safety of Minnesota's growing immigrant dairy workforce. This will involve the incorporation of a One Health approach, employing a multidisciplinary team of clinicians, veterinarians, producers, workers, and community health centers. It will build on previous efforts that successfully implemented a train-the-trainer safety and health curriculum for immigrant workers and applied a community health worker (CHW) model *(See Seguridad en Las Lecherías: Immigrant Dairy Worker Health and Safety)*.

Project update

As COVID-19 continued to restrict on-farm access to dairy farms in Minnesota, the project team focused efforts to support dairy producers, workers, and farm families with information and access to

COVID-19 testing and vaccinations through our University and State partners. We continued regular communication and engagement with dairies, including:

- Providing dairies with information about free COVID-19 testing and facilitated access to COVID-19 vaccines for immigrant dairy workers in dairies.
- Collaborating with UMN Medical School researchers with a survey of dairy farmers regarding their response, prevention and biosecurity practices. The results of the survey were published in the Journal of Agromedicine, July 2021.
- Conducting a query to consult with dairy farmers on the best way to provide the COVID-19 vaccine for dairy workers.

During this interim time, we collaborated with county health departments and Community Health Services Inc, (CHSI) to encourage free COVID-19 vaccinations for dairy workers and to make use of telehealth opportunities through CHSI. We continued regular communication and engagement on related health issues (i.e. mental health resources) which we were able to support by performing Spanish interpretation.

With no farm contact during COVID-19, the project team participated in a number of relevant conferences. A project overview focusing on immigrant workers was provided at two agricultural health and safety conferences through a workshop, a lightning talk, and a poster.

A Sunrise Plan with safety protocols on COVID-19 was required by the University of Minnesota Research Office/School of Public Health to resume health and safety trainings on dairy farms. This plan was submitted and approved to resume on-site training in June 2021. A one-page summary of our plan was shared with producers and our training staff was required to be vaccinated. With approval, we were able to resume health and safety trainings in Spanish for immigrant dairy workers in Minnesota and we have expanded the project to dairies in Wisconsin and South Dakota. The Seguridad curriculum was updated, printed and assembled for the implementation of the Community Health Workers Program on dairy farms. This will be a helpful resource as we continue to add additional dairy farms and promote the Community Health Worker program.

Our focus for the upcoming year includes continued recruitment of dairy farms for immigrant dairy workers health and safety training and implementing the Community Health Worker Program. As COVID-19 continues to circulate we will continue to listen, adjust, and respond to the changing epidemiology of COVID-19, assess barriers and concerns to worker health, safety, and the overall impact on dairy farmers and their workers' needs. We will test the newly developed External Safety Audit tool developed in collaboration with the School of Public Health Industrial Hygiene faculty/graduate students and Veterinary Public Health and Preventive Medicine Residents.

Assessing and Preventing Work Related Injuries in Animal Agriculture

Background

Occupational injury in animal agriculture affects not only the health and well-being of workers but is a significant burden to the agriculture industry due to lost productivity and compensation costs. There is significant interest in reducing the burden of injury, however, the tools available for specific injury prevention activities are limited. People working in the animal agriculture industry may encounter many health and safety risks on a daily basis. Contact with animals, working on uneven and slippery surfaces, repetitive motions in ergonomically compromised positions, and using powered machinery are examples of routine hazards. In addition to the potential injury risks, the amount of lost work time, lost productivity, and increased medical and operational costs present a significant burden to the industry.

Project update

To properly characterize the burden of injury, identify opportunities for prevention, and evaluate progress in controlling injury requires systematically collected data that can link injury events to information characterizing risk. Identifying the most common and severe injuries is the first task in an injury prevention program. Developing specific strategies to prevent injuries requires an understanding of the underlying determinants of the injury. To accomplish this goal, we are engaging our industry partners and experts in animal agriculture to identify strategies to:

- prevent specific injuries in animal agricultural settings

- disseminate high-impact recommendations to stakeholders, and
- implement interventions in at-risk populations

Data from companies and worker compensation insurance carriers that characterize injuries can provide insights into the overall burden of injuries, the major types of injuries, and potential opportunities for intervention. These data are particularly useful for understanding the risks of injury of larger producer operations. These operations are characterized by more intensive production methods and an employed workforce. These data have some limitations and are often difficult to combine, but offer a more comprehensive picture of injury risks to workers and burden to employers.

We have identified several areas of focus in swine operations, including animal interactions, needlestick injuries, knee injuries, animal interaction injuries, and injuries related to power-washing. We are in the process of acquiring additional worker compensation claims data from the Minnesota Department of Labor and Industry to characterize the distribution of injury type and risk for compensable injuries by type of agriculture. Data acquisition has been slowed due to the coronavirus pandemic as the producers, worker compensation insurance carriers, and state agencies have limited time to pursue these activities.

Company and worker compensation data may not provide adequate insight into the risks faced by smaller producers. While many of the same risks are shared between small and large producers, it is not clear if the impacts are similar. We have identified options to ascertain primary injury concerns and potential impacts of injuries among smaller producers, where the majority of the work will be done by the owner/operator and family with few, if any, hired employees. We have identified several venues in the region where the smaller producers gather and will visit these to collect some summary information on injury burden and prevention measures. Attendance at these venues has been hindered by the coronavirus pandemic.

Section III: Other Program & Activity Highlights

Emerging Issues Program

The challenges faced by the agricultural workforce are dynamic. The goal of the UMASH Emerging Issues Program enables UMASH to be nimble enough to identify and respond to emerging or re-emerging issues that may impact the health and well-being of the agricultural workforce and their families. To support these activities, the UMASH advisory board is key in identifying emerging issues across the region and providing suggestions to address the topic(s).

Manure Hazards

Animal agriculture is significant in the Upper Midwest: dairy, cattle, poultry, and swine are ubiquitous to the landscape, creating a need for moving manure. The potential hazards from manure have been known for decades. UMASH is cooperating with the University of Minnesota (UMN) Extension to take a closer look at the emerging occupational hazards in the industry.

Manure Management. UMASH and UMN Extension surveyed 162 manure applicators at training workshops throughout Minnesota in early 2020. This project aimed to understand work practices and characterize potential hazards involved with manure application work. Findings highlighted that manure applicators work long hours during the busy season, resulting in fatigue and the risk of injury and gas exposure. A summary and manuscript have been developed with the intention of publication. Additional safety and health resources are being considered to include as a component of the spring and fall workshops with Extension.

Manure Solids. The increased use of recycled manure solids (RMS) as bedding in Midwest dairy herds has occurred over the past 10 to 15 years. Our research evaluated the costs and benefits of a number of technologies addressing bedding bacteria counts (BBC) and increased mastitis risk in herds using RMS as compared to inorganic or organic non-manure materials. At this time all of the lab work has been completed and the research team is preparing a manuscript for the mastitis-related objective. Additional data on antimicrobial resistance (AMR) is currently being compiled and reviewed. With respect to air quality data, a master's student has defended presenting data on air quality in dairy barns.

Antimicrobial Resistance (AMR)

In 2020, two groups completed their partner projects, following funding and support from UMASH and the 2019 Annual Forum: *Antimicrobial Resistance: Is it a worker health issue?*:

North Dakota State University faculty and students received funding to understand if large-animal veterinarians are at an increased risk of antimicrobial-resistant bacterial carriage. This study identified a high prevalence of both MRSA and MRSP carriage among veterinary professionals, with further data analysis ongoing and a manuscript being prepared for publication.

Ag Health and Safety Alliance received funding to:

1. Review existing **college-level** AMR resources
2. Develop new content for agriculture and veterinary courses
3. Evaluate the effectiveness of the AMR curriculum
4. Analyze survey data to understand the safety behaviors and the risk of AMR infections and prevention methods

299 students were pilot tested and self-reported agricultural tasks with potential exposures were identified. Many found value in receiving PPE and a need for educational outreach around AMR and zoonotic exposures among young adults working with livestock. Ag Health and Safety Alliance is seeking additional funding to support the training of veterinary technicians.

Aging on the Farm

As the average age of the farmer in the United States approaches 60, and as many continue to live and work on the farm, support and resources are needed. In 2020, UMASH hosted two *Aging on the Farm* community forums with a focus in Minnesota. To build on the work of these Forums, UMASH funded four partner projects. These innovative projects sought to better understand the needs and available resources for older farmers and farm families, and trial interventions for improving their health and ability to work.

Active @ Home: The American Parkinson's Disease (PD) Association of Wisconsin and the University of Wisconsin partnered with UMASH to create a toolkit that supports in-home physical exercise and meaningful client-centered experiences for agricultural populations experiencing PD in Wisconsin.

Aging in Place & Occupational Therapy Telehealth: University of Minnesota Occupational Therapy: Agricultural communities may have limited access to aging-in-place resources. This project sought to understand the aging-in-place needs of the agricultural community and create and deliver a series of telehealth programming and webinars about strategies for successful aging in place.

Rural Minnesota Memory Loss Connection: Big Stone Area Memory Connections: A non-profit volunteer group in rural Minnesota is working with UMASH to assist older farmers remain in the community and on the farmstead for as long and as safely as possible by providing dementia training in the community and creating resources.

Healthy Aging on the Farm with the United Church of Christ- Zumbrota and the Normandale Center for Healing and Wholeness: A better understanding of what barriers exist to healthy aging on

Goodhue county farms inspired this project. Through community engagement, this project seeks to facilitate activity that connects the community back to the existing resources and to reduce barriers.

Outreach and Engagement

Background

The UMASH outreach team is composed of staff at the University of Minnesota (UMN), the National Farm Medicine Center (NFMC) in Marshfield, WI, and the Minnesota Department of Health (MDH). Our collective purpose is to promote agricultural safety and health in our five-state area, particularly with farmers, farmworkers, and their families. We accomplish our goals by working closely with the other ten National Institute for Occupational Safety and Health (NIOSH) funded U.S. Agricultural Health and Safety Centers, agriculture partners, researchers, educators, and agricultural organizations via farm shows, meetings, conferences, and other stakeholder events. Many of these events are described in our In the Field posts and Spotlight Stories featured on our website.

Outreach Update

COVID-19 continued to push UMASH into new and innovative outreach and engagement tactics while keeping existing relationships and community work in place. UMASH regularly connects with our stakeholders and audiences through online and in-person outreach activities, sharing new resources, research findings, and more. This past year, nearly 80 email communications reached the UMASH subscribers, keeping the agricultural community connected to the latest COVID-19, health, and safety information and resources. Telling stories and having our boots on the ground increased the salience and reach of UMASH, and this year over 40 Spotlight Stories and 30 In the Field posts were shared. Many of the email communications highlight these stories and posts about UMASH activities. We leverage partners in agricultural and rural podcasts and radio along with print and social media to amplify safety reminders and awareness campaigns while promoting upcoming events.

We know the agricultural audience gets their information from a plethora of platforms, and paid advertisements in print and online trade and commodity publications are among those used to reach farmers/producers who may rely on those as a primary source of information for their farm operations. By working with agricultural associations and media, UMASH continues to provide expert interviews across the Upper Midwest.

UMASH Safety Demonstration Pavilion: Farmfest 2021

COVID-19 canceled many outreach events in 2020 and into 2021. As COVID-19 vaccines were distributed, more options for events became realistic to offer safely. Minnesota Farmfest 2021 was back in person, and the UMASH team set out on the road to Redwood County to provide up-to-date safety and health information to over 28,000 regional farmers, farmworkers, and their families.

The UMASH team partnered with colleagues to offer the UMASH Safety Demonstration Pavilion, where four live demonstrations took place daily, and subject matter experts exhibited on-site to supplement the demonstrations with prevention resources.

Demonstrations included:

- Grain bin safety with fire chief and South Central College instructor, Jim Zwaschka
- ATVs and UTVs for adults and youth with Progressive Ag Safety Days
- Power Takeoff (PTO) safety demonstration with UMN Extension and a Minnesota Farm Bureau member and farmer
- Tractor rollover rescue with Max Radil of the Forada Fire Department

Twelve live demonstrations took place, with attendees interacting with exhibits and experts all three days of Farmfest. Minnesota Department of Agriculture Commissioner Thom Petersen and Deputy Commissioner Andrea Vaubel joined the Pavilion to kick off demonstrations and highlight the importance of farm safety, and champion their programs that cover costs for improving safety on farms. Additional visitors included Patrice Bailey, MDA's Assistant Commissioner, Roslyn Robertson, Minnesota Department of Labor and Industries Commissioner, Joan TA Gabel, President of the University of Minnesota, Bev Durgan, Dean of UMN Extension, and Laura Molgaard, Dean of UMN's College of Veterinary Medicine.

With additional support from the Minnesota Farm Bureau and the Minnesota Department of Agriculture, UMASH provided up-to-date safety and health information for farmers, farmworkers, and their families to prevent and/or reduce injuries and illness on farms. Over 1,000 bags with sunscreen, prescription deactivation kits, gun locks, stress and mental health resources, and more were taken home by attendees. The showgrounds attracted more attendees than previous years throughout the three-day event from August 3-5 exhibiting the latest ag products, services, and technologies. The Minnesota Department of Health was able to host an on-site COVID-19 vaccine clinic through support from IdeaAg, UMASH, and additional partners.

In the Field:

Juneteenth with Forty Acre Cooperative

40 Acre Cooperative is the nation's first national Black farmer's co-op, and they joined with partners in celebrating Juneteenth and Black and otherwise marginalized farmers. UMASH was fortunate to facilitate the event by supporting the health and safety planning for the event, which included time and space to celebrate Juneteenth, hear from 40 Acres' leadership, other leadership, and a meal shared by the community.

***Being Cooperative* with MN Agricultural Coop Safety Directors**

Agricultural cooperatives are integral to agricultural communities and work closely with farmers. Minnesota's unique group, the Agricultural Coop Safety Directors, meets quarterly to synergize on how to facilitate safe and healthy work environments, which reaches onto farms. UMASH partnered with this group to talk about how to stimulate safety culture, understand what is effective at agricultural cooperatives, and use tools to implement the hierarchy of controls.

Public Service Announcement: Video contest with college students a success

UMASH worked with the University of Minnesota's Department of Agricultural Education, Communication, and Marketing to make farm safety a student project. Students in Dr. Troy McKay's Agricultural Communications Advanced Video class created short videos or Public Service Announcements (PSA's) on grain bin safety, roadway safety, and silage safety defining the risks and prevention strategies. In addition to class credit, students had the option to enter their videos into a UMASH-sponsored contest to add a bit of friendly competition. Dr. McKay noted that the students were excited about the project and developed new skills in the process. Some of the students plan to use their video as a capstone project and also to enter the project in other national competitions. UMASH will offer the project again in 2022 with additional options for a print layout/graphic design course.

The **Midwest Regional Agricultural Safety and Health Conference** was held November 17-20. The 2020 theme was "Rising to New Challenges," and the conference agenda included presentations, speaker panels, roundtable discussions, posters, and virtual networking opportunities. UMASH staff were busy with five presentations. Topics included zoonotic diseases, outreach and social media, and mental health.

The **Agricultural Safety and Health Council of America's** (ASHCA) North American Agricultural Safety Summit, Raising Safety: Cultivate a Culture of Safety was held March 22 - 24. The goal of this year's event was to align evidence-based safety interventions with production practices and emerging safety issues. UMASH presenters included:

- Chela Vázquez, Jeff Bender, Amy Liebman, and Jonathan Kirsch detailed the importance of protecting the health of immigrant dairy workers.
- Megan Schossow promoted our dairy worker training guides in Tools of the Trade, learning labs with live demonstrations of safety resources and training programs, now available in both English and Spanish.
- Research assistant Devon Charlier highlighted the research results and occupational risks of manure applicators, an emerging issue that UMASH has identified in ag communities.

- Shared an engaging video about aging on the farm, another emerging issue, and the topic of our 2020 annual forum.

The International Society of Agricultural Safety and Health (ISASH) was held the week of June 21, 2021, via Zoom. This international conference provides an excellent opportunity for staff development and the chance to network with other professionals to share ideas, resources, and research for the betterment of occupational safety and health for the agricultural community.

UMASH attended and presented in several areas:

- Devon Charlier et al. – Assessing occupational risks of manure applicators in the Upper Midwest
- Devon Charlier, Megan Schossow, Maria Bertrand, Diane Kampa – Strategies for Social Media Evaluation
- Megan Schossow, Jeffrey Bender, Averi Olson, Carol Peterson – Aging on the Farm
- Devon Charlier, Megan Schossow – Partnering in Mental Health Support

Stress and Mental Health

Many factors in the agricultural system continue to strain agriculturalists. UMASH continues to build on past stress and mental health work partner projects and networks. 2021 brought significant weather and climate events to nearly every region. Much of the Upper Midwest navigated extensive drought conditions and even wildfires that impacted crop growth, animal health, economic stability, air quality, and more. UMASH responded to the unique needs of the agricultural community in a number of ways:

- In partnership with University of Minnesota staff and faculty, developed a drought toolkit that is a one-stop resource for health, economic, and community resources during drought, which was shared through the Minnesota Farm Safety Working Group among many other avenues
- Staff engaged in stakeholder calls with the Minnesota Department of Agriculture's Commissioner to amplify the health and safety risks associated with drought
- Partnered with the Washington County Water District to share expertise and interventions on *Drought and Agricultural Health*

Telling the Story Project

Telling the Story Project, a collaboration with UMASH, the Great Plains Center for Agricultural Health (GPCAH), and the Central States Center for Agricultural Safety and Health (CS-CASH), turns farmers' first-hand stories about close calls and fatalities into teachable moments. The project website hosts multi-media stories and prevention resources aimed at farmers, agricultural workers, communicators, educators, and policymakers.

The staff interviewed a farmer in western Wisconsin who survived a tractor rollover, thanks to a recently installed roll-over protection system (ROPS). This story is slated for publication in early October 2021. The second story features a farmer in southwest Minnesota, who volunteers his time and conducts a meaningful presentation on the hazards of power take-offs (PTO's) He lost a good friend to a PTO entanglement and wants to share his message to help others understand how tragedies can and do occur as well as prevention methods.

Agritourism and Zoonoses

Public Health Veterinary Residency with UMASH:
UMASH is fortunate to partner with the University of Minnesota College of Veterinary Medicine and the Public Health Residency program. These residents are DVM's and are adding public health coursework for an additional MPH degree. UMASH has utilized their expertise in several areas including on-site outreach activities, developing surveys, and researching material for farmer-friendly fact sheets. Three highlights of their work this past year include 1) Positive Animal Handling for fourth-grade students, 2) Antimicrobial fact sheet, and 3) Script preparation for a zoonotic disease video with dairy calves. In all cases, the residents were technical experts and were an asset to UMASH by translating research and science-based content for use by the agricultural community.

Healthy Harvest: Farming Safely with Livestock and Produce:
Farms are unique in many aspects - size, crops, animals, organic and more. UMASH partnered with UMN Extension, Minnesota Department of Agriculture, Minnesota Farmers Union, and the Sustainable Farmers Association – Greater Mille Lacs Chapter to provide a half-day workshop for fruit and vegetable producers in central Minnesota. The event was hosted by Maple Ridge Produce. Megan Schossow, Carol Peterson, and Jeff Bender attended with resources and Dr. Bender was a featured speaker. He discussed Zoonotic Disease & Food Safety on the Farm which drew attention to the potential risks of infectious disease particularly with visitors to the farm. Jeff answered many questions from the participants and everyone learned from one another's experiences as well as the experts.

Minnesota Department of Health: Keeping visitors safe on agritourism farms remains a priority, and UMASH supports this through training and outreach. MDH's ongoing response to the COVID-19 pandemic and the pandemic itself made it impossible to offer in-person workshops this past year. However, MDH outreach staff were able to provide some virtual learning opportunities, outreach, and guidance. The self-paced, voluntary certification program called Safer Farm Animal Contact Exhibits (FACES) has been maintained throughout the pandemic. This training program is based on national best practices and is offered at no charge. Over 300 people have registered for the course and 28 registered during the last reporting year even though we were unable to do any promotion of the program due to COVID-19.

The 5th Annual Emerging Issues Breakfast was held virtually in 2020, again hosted by MDH. Over 30 people attended the virtual get-together from agencies and industries across the human-animal intersection in Minnesota like Minnesota Milk, MN Pork Board, Minnesota Turkey Growers Association, and FFA. This event gave people a chance to reconnect during this very difficult year and share successes as well as struggles. It also gave people the opportunity to look for areas of collaboration in the COVID-19 response and beyond.

NIOSH Ag Centers Evaluators, Coordinators, and Outreach (ECO) Group

As a part of the larger US Ag Center collective, UMASH participates in regular Evaluator, Coordinator, Outreach (ECO) meetings. UMASH outreach staff is currently leading the planning for the US Ag Center collective participation in two national campaigns: Ag Safety Awareness Program (ASAP) Week (March) and National Farm Safety and Health (NFSHW) Week (September). UMASH created

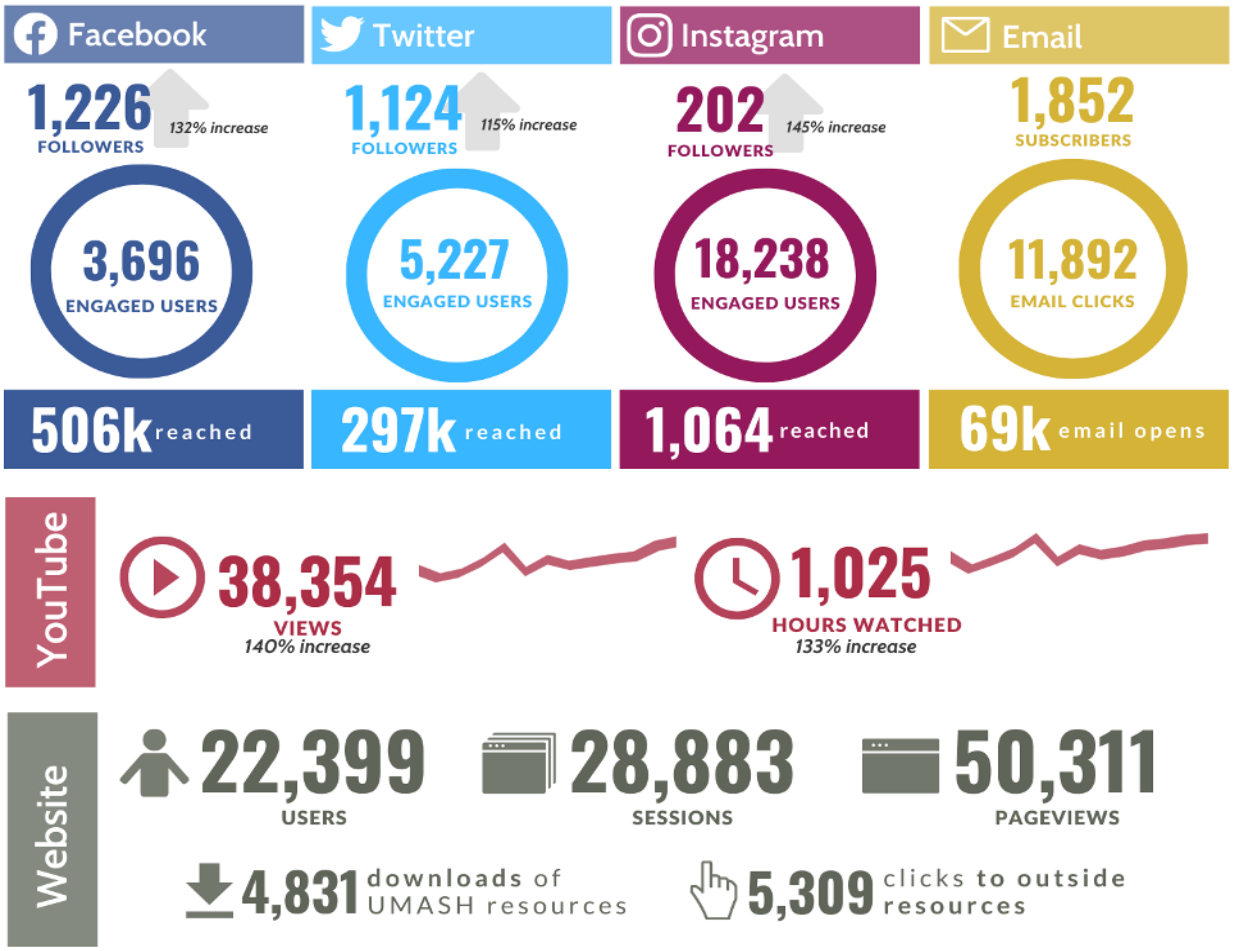
and disseminated the national social media toolkit for the 2020 National Farm Safety and Health Week campaign. The toolkit equipped partners, including NIOSH and all US Ag Centers, with social media content, photo resources, social media guides, and an evaluation worksheet that will inform the impact of the campaign.

Digital Presence and Engagement

UMASH continues to leverage new technology and digital platforms to grow our reach and engagement with agricultural health workers and those that serve them. Digital outreach platforms include:

- UMASH website
- UMASH YouTube
- US Ag Centers YouTube
- UMASH Facebook
- UMASH Twitter
- UMASH Instagram
- UMASH LinkedIn
- Weekly emails
- UMASH Connector (quarterly newsletter)

The graphic below displays the digital presence and engagement metrics on social media, platforms, YouTube, and the UMASH website for this year (October 2020-September 2021) compared to last.



Featured Outreach Resources

UMASH continues to create new and updated resources to meet the safety and health needs of farmers, families, and workers. Following is a sample of resources developed in the past year.

Repetitive motion injuries are caused by performing the same motion over and over. These conditions are due to overuse without adequate recovery. A newly created poster describes the causes, commonly affected body parts, and prevention methods.

COVID - Vaccine resources - As the COVID-19 pandemic continues, information changes quickly. Most information is currently focused on vaccines. The UMASH website stays up to date by sharing the latest information from trusted sources.

Manure Toolkit: Many farmers in the Upper Midwest utilize manure as fertilizer for their fields. The Manure toolkit was developed to provide farmers and their family members, manure haulers, and agricultural workers with specific resources to have on hand during manure agitation and land application.

National Resource Center for Refugees, Immigrants and Migrants has co-branded a vaccination guide with UMASH. The purpose of this resource is to inform health professionals, public health departments, and community organizations, in coordination with dairy farmers, about the advantages of bringing a vaccination mobile clinic to their area to assist with vaccinating immigrant dairy workers. A step-by-step method is included to encourage implementation.

Six Reasons You Should Get the Flu Shot This Year is an updated resource to promote the flu shot in addition to your COVID vaccine. COVID-19 has strained the healthcare system, making it more difficult to get necessary care when you're sick. The webpage includes additional information including common questions and answers about the flu shot.

A **Stopping the Spread of Zoonotic Disease** video is being developed to address the spread of zoonotic disease with calves on dairy farms. Video is available in English and Spanish.

Evaluation

Background

UMASH Center leadership prioritizes evaluation and strategic planning activities that promote thoughtful decision-making, targeted use of resources, and continuous improvement. The evaluation team utilizes a systems approach to assess Center activities.

Evaluation update

This year, Dr. John LaVelle has provided important expertise in evaluation theory and practice, as well as valuable mentorship for student workers. The evaluation team participates in cross-center evaluation opportunities, supports outreach activities and emerging issues projects, and facilitates organizational development and future planning.

Cross-Center Evaluation

Throughout the year, UMASH participated in NIOSH's contribution analysis process, collaborating with other U.S. Agricultural Safety and Health Centers to build and update a logic model to understand the potential cumulative impact of our work to improve the health and safety outcomes of livestock workers. The UMASH evaluation team also facilitated a process for assessing and reporting on the collective impact of the Centers' coordinated social media efforts during the National Farm Safety and Health Week campaign. Additionally, a research assistant on our team has also collaborated with evaluators from three other Centers to analyze the viewership of the Centers' collaborative YouTube Channel over time.

Outreach, Research, and Emerging Issues Support

The evaluation team continues to provide monitoring and evaluation support for UMASH outreach activities, including events and online engagement. This year, the team has focused on building capacity and refining protocols, intending to shift social media and online analytics reporting responsibilities to the communications team in late 2021. Additionally, the team has supported the work of outreach and research project teams as they develop and update logic models and evaluation plans. Finally, the evaluation team assists with the Emerging Issues program in several ways. We use a 3-Step Model (Scan-Prioritize-Select) to choose emerging issues to pursue annually. The team is building a framework for holistically evaluating the Emerging Issues program to better understand associated outcomes.

Organizational Development & Future Planning

The evaluation team has focused on a needs assessment project identifying opportunities for capacity building and strategic planning at UMASH. The team conducted one-on-one semi-structured interviews with UMASH personnel, gathering participants' experiences with the Center, perspectives about various indicators of organizational capacity and development, and visions for future work. A preliminary analysis revealed a variety of Center strengths and opportunities, as well as insights around relationships and stakeholder engagement, diversity, equity, and inclusion, and the changing contextual factors that influence our work.

Looking forward

In the coming year, the evaluation team will continue to support collaboration, learning, and adaptation throughout the Center. We will develop an updated strategic plan, incorporating the findings gathered throughout this year's needs assessment and last year's strengths, opportunities,

aspirations, and results (SOAR) analysis. We will focus on refining Center evaluation tools, such as the UMASH Outreach Reporting Tool (used to gather and report outreach information to inform planning and reporting) and the UMASH Outcome Tracking Tool (used to document the outcomes and results of UMASH activities). Finally, we will establish a sustainable framework for conducting Center-wide evaluation. This framework will utilize approaches such as contribution analysis and participatory and utilization-focused evaluation to assess the degree to which UMASH activities are delivered with fidelity and are effective at building institutional capacity and promoting the health and safety of agricultural workers and their families.

Other Center Activities

Occupational Health Teams

National Occupational Research Agenda (NORA): As the COVID-19 pandemic strained the workforce and brought up novel questions, UMASH once again partnered with the Midwest Center for Occupational Safety and Health (MCOSH) to host the 2021 NORA Symposium, keynoted by **Dr. Mike Osterholm**. Dr. Osterholm addressed work concerns, like emerging variants, before a panel representing agriculture and other essential workers which targeted addressing health inequities. Over **450** attendees joined live, a record for this Symposium, and also were able to take home Continuing Education Units (CEUs).

Annual Forum: The Upper Midwest Agricultural Safety and Health Center (UMASH) Annual Forum "Creating Occupational Health Teams in Agriculture" convened a multidisciplinary group of clinicians and health and safety professionals to discuss strategies to best support the occupational health of people in rural and agricultural communities. Many attendees were healthcare providers with an occupational, agricultural, and/or rural focus.

Small group discussions offered the opportunity to brainstorm for solutions on the hazards associated with agricultural work. Conversations centered on the tools and models already available to address the challenges in occupational health care including telehealth and virtual education. All attendees agreed that a multidisciplinary, One Health approach is necessary. Ultimately, being successful in this work would mean that rural healthcare systems are efficient and ready to respond to occupational needs in a culturally appropriate manner.

Occupational Health Teams: Occupational Therapy utilizes the Person-Environment-Occupation (PEO), a model that emphasizes occupational performance shaped by the interaction between person, environment, and occupation. Through a partnership with the University of Mary Doctorate in Occupational Therapy, UMASH served as a doctoral capstone host to then-doctoral student, Averi Olson. By leveraging the background work of UMASH's Aging on the Farm Community Forums with occupational therapy and occupational health, we were able to deliver national webinars, create resources to facilitate healthy, pain-free work, and further a conversation around Parkinson's Disease and agricultural work.

- *Parkinson's Disease and Aging in Agriculture* served as a continuing education avenue for attendees, and it highlighted the expertise of occupational therapy
- Repetitive motion fact sheet and poster

- Partnered with Dr. David Douphrate to develop requested materials from dairy producers
- Translated into a poster format in English and Spanish to highlight in employee break rooms
- Worked to create resources targeted at reducing long-term injuries

Minnesota Farm Safety Working Group

UMASH participates in the Minnesota-based farm safety working group with state agencies, professional farm organizations, Extension, agribusiness, and others. This initiative led to the MN State Legislature funding the Minnesota Rollover Protection System (ROPS) Rebate Program. The group continues to meet quarterly to discuss current issues and opportunities for collaboration. In 2020, this led to a newly funded safety initiative: the grain storage facility cost share. UMASH supported this initiative and continued to partner with the Minnesota Department of Agriculture in their implementation of this program. The full allocation of funds was put into practice on Minnesota farms, and the funding was renewed in the 2021 Legislature.

U.S. Agricultural Safety and Health Center Collaborations

UMASH collaborates with the other ten NIOSH-funded Ag Centers throughout the year and participates in bi-monthly calls with the Evaluation, Outreach, and Coordinators (ECO) group to discuss, plan and implement multi-center collaborations on evaluation and outreach initiatives. This working group has resulted in stronger connections and collaboration across the US Ag Centers over the past **two** years. UMASH has provided leadership, social media content, and evaluation strategies to support collaborative Ag Center participation in two major national campaigns - Agriculture Safety Awareness Program (ASAP) Week in March and National Farm Safety and Health Week (NFSHW) in September. We continue to collaborate and partner with other US Ag Centers and participate in the ECO group to plan, implement, and assess collective outreach initiatives, including campaigns and content on the US Ag Centers YouTube channel. We also contribute to the NIOSH Extramural Communication Community of Practice by attending and presenting at meetings and co-branding materials.

Collaboration with fellow US Ag Centers has enabled UMASH to better support farmers, farmworkers, and their families, by leaning on the resources and expertise of each Center. This year, four US Ag Centers participated in the UMASH Online Expo by hosting live, engaging safety talks and exhibit booths. Building off of these activities, UMASH, CS-CASH, HICAHS, National Children's Center for Rural and Agricultural Health and Safety (NCCRAHS), and others joined agriculture educators in New Jersey. Educators are influential to school-aged children, and this group discussed how to incorporate health and safety into the classroom, in person, or online.

UMASH continues to actively participate in the US Ag Centers Awareness and YouTube workgroups that develop and implement these collaborative agricultural safety awareness campaigns. The US Ag Center YouTube, which UMASH is a partner on, has more than 2,330 subscribers and 163 education and training videos (27 from UMASH) on a wide range of agricultural safety and health topics (many in Spanish).