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Assessment of Hearing Exposures and Personal Protective Equipment use in Agricultural Workers

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COMMITTEE

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Abstract

Agriculture continues to rank as one of the most hazardous industries in the United States. This is in part due to the high number of hazardous exposures that farmers face, including respiratory and hearing exposures. The danger to workers can be reduced by properly wearing personal protective equipment (PPE). However, it has been shown that agricultural workers wear PPE at a low rate, in part due to inconvenience and poor accessibility of the equipment. There is little knowledge currently about how PPE are stored, maintained, and if they are used in a correct manner in specific exposure conditions by the operators. To gain a better understanding of PPE usage an on-farm exposure assessment was conducted using a questionnaire. A survey conducted by CS-CASH added to this data by covering potential sources of noise exposures and frequency of PPE use. Findings indicate that farmers do not always know what PPE is appropriate to wear and they only wear PPE on 30% of the time in high exposure situations. Many farmers noted that not having PPE readily available and inconvenience of wearing PPE were reasons for low frequency of PPE use. Reported noise exposures (tractor, combine, air seeder, chainsaw, compressor, grinder, and other) were significantly associated with hearing loss. Education of proper PPE use needs to increase among farmers and ranchers to emphasize the importance of PPE use and damage to hearing if not worn. This can be done through surveillance, education, and outreach programs.

Introduction

Agriculture has been the most hazardous major industry sector in the US for more than a decade, based upon occupational fatality rates. The rate of occupational

fatalities in agriculture, forestry, and fishing was 25.6 fatalities per 100,000 workers in 2014, compared to 3.4/100,000 in all industries combined (BLS CFOI, 2016). The Bureau of Labor Statistics (BLS) further reported that the rate of recordable injuries and illnesses was 5.7 cases per 100 full-time workers in agriculture compared to 3.0/100 in all industries combined (BLS, 2016). These data only represent hired workers on farms with 11 or more employees and exclude self-employed farmers, which represent around 2/3 of the agricultural working population (BLS, 2016). To supplement this information the Central States Center for Agricultural Safety and Health (CS-CASH) implemented an annual injury surveillance survey in their seven-state region (Missouri, Kansas, Nebraska, Iowa, South Dakota, North Dakota, and Minnesota). During 2011-2014 farm and ranch operators reported 7.2 injuries per 100 operators per year on average from the seven-state region (CS-CASH, 2016). Besides injuries agricultural workers have an increased prevalence of several chronic diseases including respiratory diseases, noise-induced hearing loss, musculoskeletal conditions, and certain cancers (Rautiainen & Reynolds, 2002).

There has been a high rate of respiratory dysfunction documented in agricultural workers in several studies (Baur et al., 2003; Reynolds et al., 2012; Rodriguez et al., 2014; Schenker 2000; Schenker 2010; Schenker et al., 2005; Zejda & Dosman, 1993). The common respiratory conditions in farmers include organic dust toxic syndrome, rhinitis, asthma, and hypersensitivity pneumonitis (Donham & Thelin, 2016). High exposures occur during animal production, tillage and harvest activities (Schenker 2000; Vanderstraeten 2008). Yet, most farmers do not perceive themselves to be at risk for respiratory exposures and do not wear the proper personal protective equipment (PPE)

(Farrar et al., 1995; Schenker 2004; Schenker et al., 2002). Identified barriers for respiratory PPE use include discomfort, inconvenience, unawareness of proper use, and lack of social support (Donham et al., 2013; Schenker et al., 2002; Harber et al., 2010; Petrea 2001). Similar barriers can impact the usage of other PPE devices.

Farmers experience noise-induced hearing loss (NIHL) at higher rates than non-farmers. Nearly half of all workers have experienced exposure to hazardous workplace noise (Rabinowitz et al., 2005; Tak & Calvert, 2008). Prevention of hazardous noise is best done through elimination of noise sources, although this is not always possible due to economic and feasibility reasons. Wearing hearing protective devices (HPDs) helps prevent NIHL in an economically feasible way, however, use among farmers can be as low as 7% (Carruth et al., 2007).

Currently farmers' PPE purchase, maintenance and use practices are relatively unknown. It is also not well-known whether farmers understand when it is necessary to use PPE and what types of PPE are required when exposed to specific hazardous conditions. Information on these critically important questions has not been adequately assessed. This proposed study offers to provide insight on PPE use practices in the agricultural field. This will be done by a questionnaire and on farm walk through. Where we hypothesize that participants have all necessary PPE to complete their daily work tasks and that survey participants with severe hearing loss will wear hearing protection less often than individuals with no hearing loss. The participants' baseline PPE usage and current exposures that could serve as potential targets for an intervention will be assessed. Analyze hearing and PPE questions from an agricultural safety and health survey implemented by CS-CASH.

Research Methods

Recruitment

Potential farmers were recruited through mail and phone contacts. Addresses were purchased through Farm Market iD, which is a private company that has detailed information on farms in the region. There were two separate mailings, one carried out in the Eastern and one in the Central part of the state. The mailings contained a cover letter that provided detailed information about the project along with contact information on how to participate in the study. Phone numbers had been received through personal contact and referrals. Individuals were contacted, and the study was described informing participants of the requirements and benefits.

Farm Exposures and PPE Assessment

All participants filled out an initial form that covers their agricultural work tasks, different exposure sources, and PPE usage. Then an initial on-farm walk-through was conducted using a modified Certified Safe Farm checklist. This checklist allowed information to be systematically collected on each farm over the type of PPE used during high exposures. A short questionnaire was also given to assess the base knowledge of each participants use and current issues they have with wearing of PPE.

CS-CASH Survey

Survey population was randomly selected from Farm Market iD database. Inclusion criteria consisted of having an email address, and gross farm income greater than $2500. The surveys were sent first electronically by email (one repeat to non-respondents) and then by mail using a paper form (one repeat to non-respondents). The surveys were addressed to the primary operators, and the survey data were requested

also for second and third operators on the farm/ranch. Online surveys were administered through UNMC RedCap, covering the seven-state region of CS-CASH (Missouri, Kansas, Nebraska, Iowa, South Dakota, North Dakota, and Minnesota); approximately 2500 operations in each state.

Analysis

Farm exposure and PPE Assessment. Descriptive analysis of farm participant demographics, farming/ranching practices, and PPE use situation were conducted. The questions from the questionnaire were tabulated with additional graphs showing where participants buy their PPE and their knowledge of when it is necessary to wear PPE.

CS-CASH Survey data analysis. Descriptive analysis of the survey data will include a flowchart of administration (numbers of respondents included and excluded in electronic and mail survey process), and counts of farms, ranches, and operators of respondents in the CS-CASH survey. The hearing categories were analyzed against the amount of time the individual wore PPE and against each exposure. Percentages of PPE usage for hearing protection will be compared with a NPAR1WAYtest between severity of hearing loss. Chi Squared test will be used to compare the severity of hearing loss to the different noise sources of exposures. Each exposure and severity of hearing loss was also individually analyzed for descriptive statistics.

Results

Recruitment

Thirteen farmers from eight farms consented to participate. These farms were located across Nebraska, as shown in Figure 1. The designation of intervention or control was determined by the order of when farms agreed to participate.

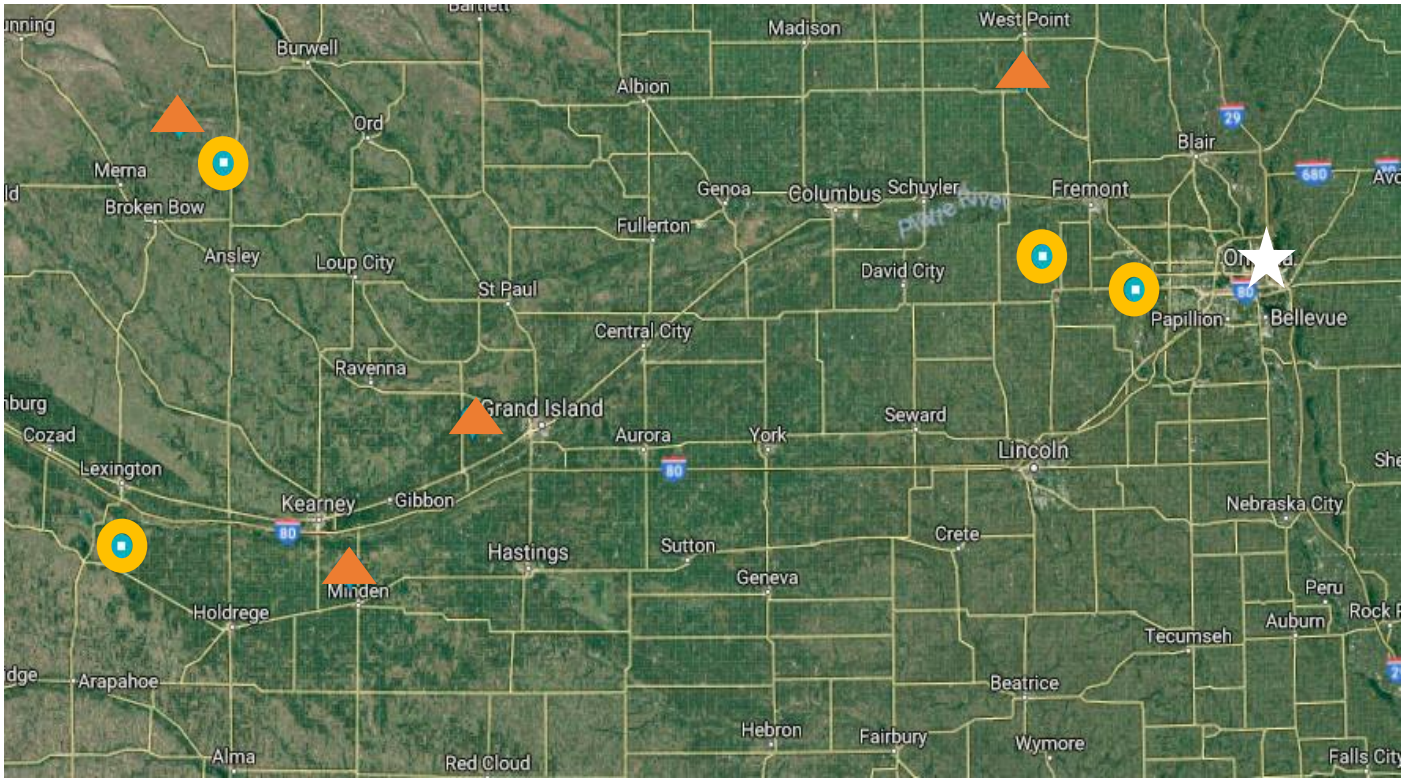

Figure 1. Geographical representation of the participants, where the intervention groups are designated by the yellow circles and the control groups are designated by the orange triangles. The University of Nebraska Medical Center designated by the white star.

Farm Exposure and PPE Assessment

All of the farms were row crop farmers (corn/soybean), where a few farmers had rotations of peas or wheat as a cover crop. One farm had a greenhouse where they grew vegetables, this farm was also completely organic their production. The distribution of types of crops grown by participants can be seen in Figure 2.

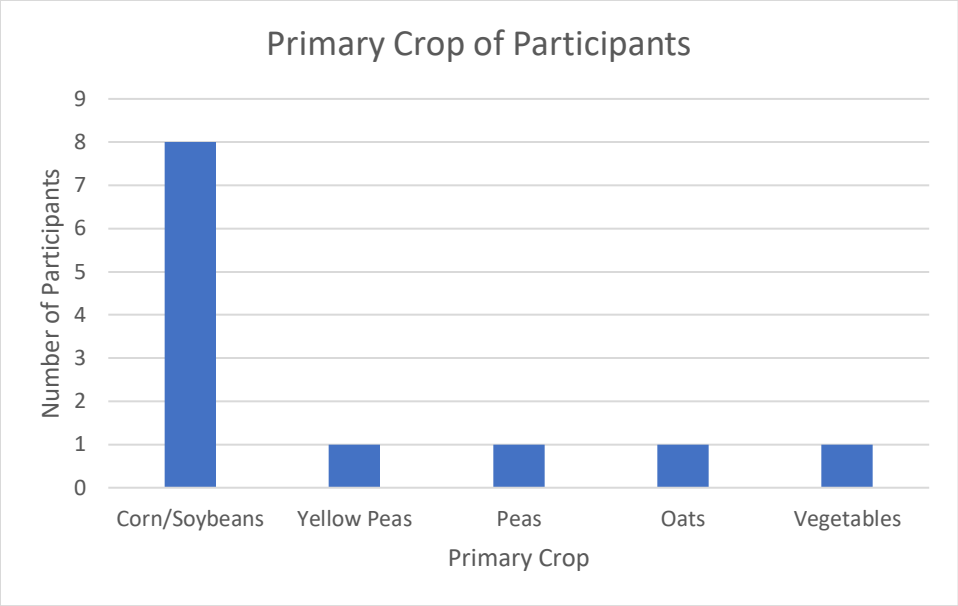

Figure 2. Distribution of types of crop grown on participants farms.

From the short questionnaire, participants baseline usage of PPE was obtained. Gloves were the most frequent type of PPE that was worn by participants and many preferred the foam ear plugs over ear muffs (Figure 3). The participants also mainly bought PPE at hardware stores or Menards (Figure 4). Other common places that supplied PPE were farm shows (Husker Harvest Days) or their employer. Many of the participants knew what type of PPE to wear when cleaning out a grain bin at the end of the season, however, it was close to 50% that did not know what was required while standing next to an auger (Figure 5). Many of the participants gave reasons as to why they do not commonly wear or think about wearing PPE while they are doing hazardous tasks. The most common between all participants was that the PPE was not readily available where or when they needed it (Figure 6).

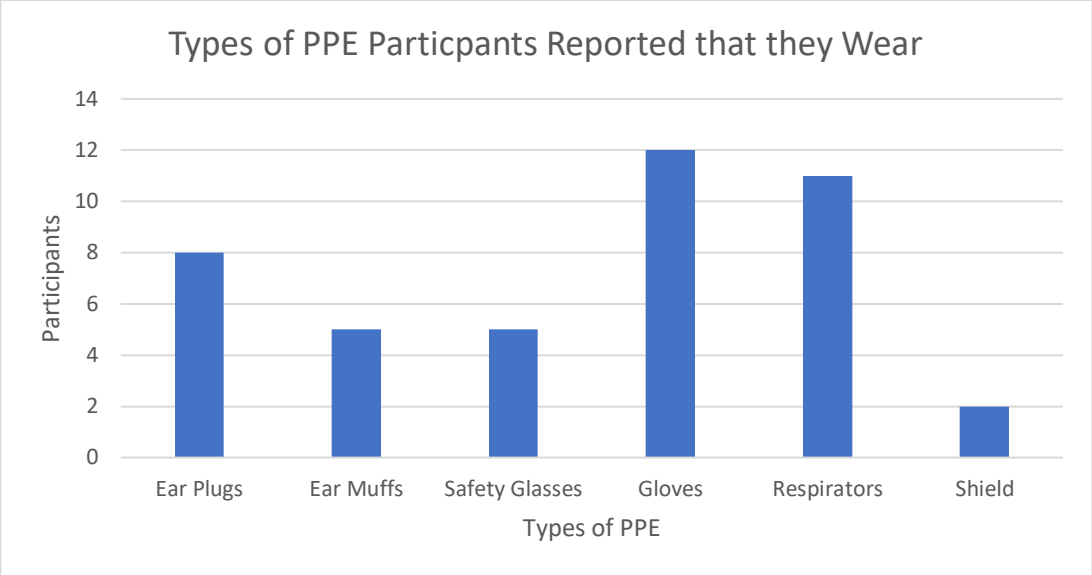

Figure 3. Baseline usage of personal protective equipment (PPE) of all participants.

Figure 4. Common places where participants purchase or acquire personal protective equipment (PPE).

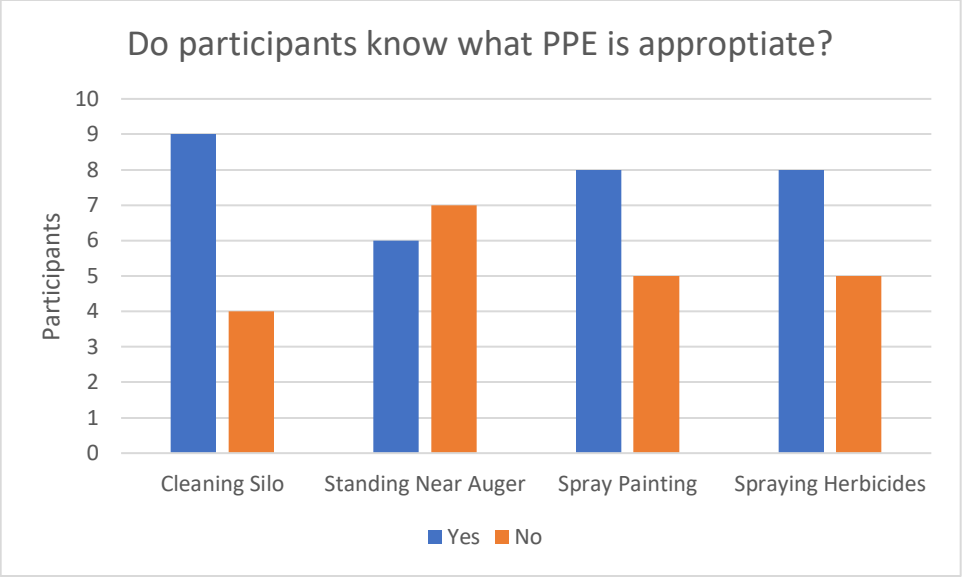

Figure 5. Question number 6 on questionnaire asking participants if they knew what personal protective equipment (PPE) is required for different tasks.

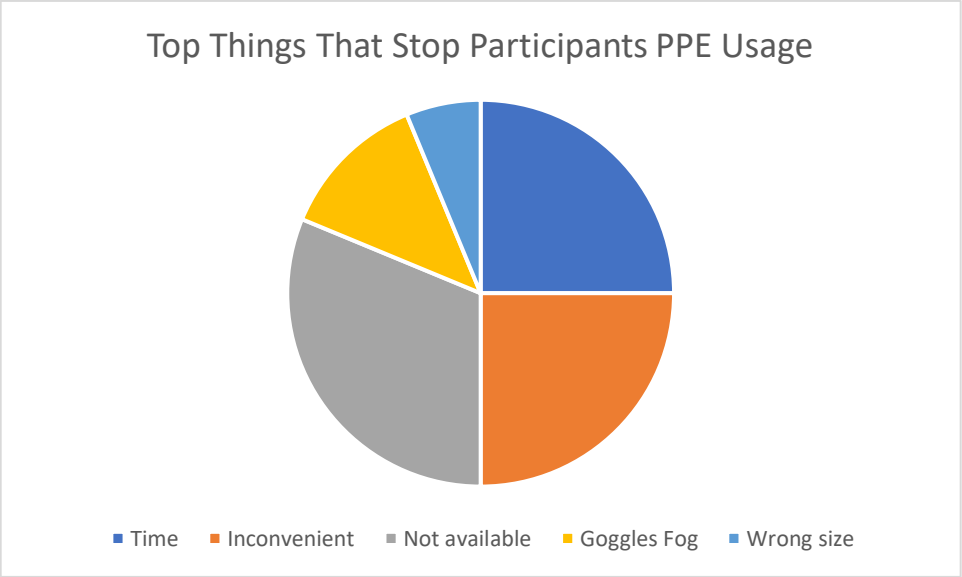

Figure 6. Top things that discourage use of personal protective equipment (PPE) in participants.

CS-CASH Survey

This survey was sent out to over 20,000 farms in the seven-state region of CS-CASH through email and was then sent to over 16,000 farms for the mailed portion. In

total, 3259 surveys were collected. How the surveys were distributed in the region can be seen in further detail in Figure 7.

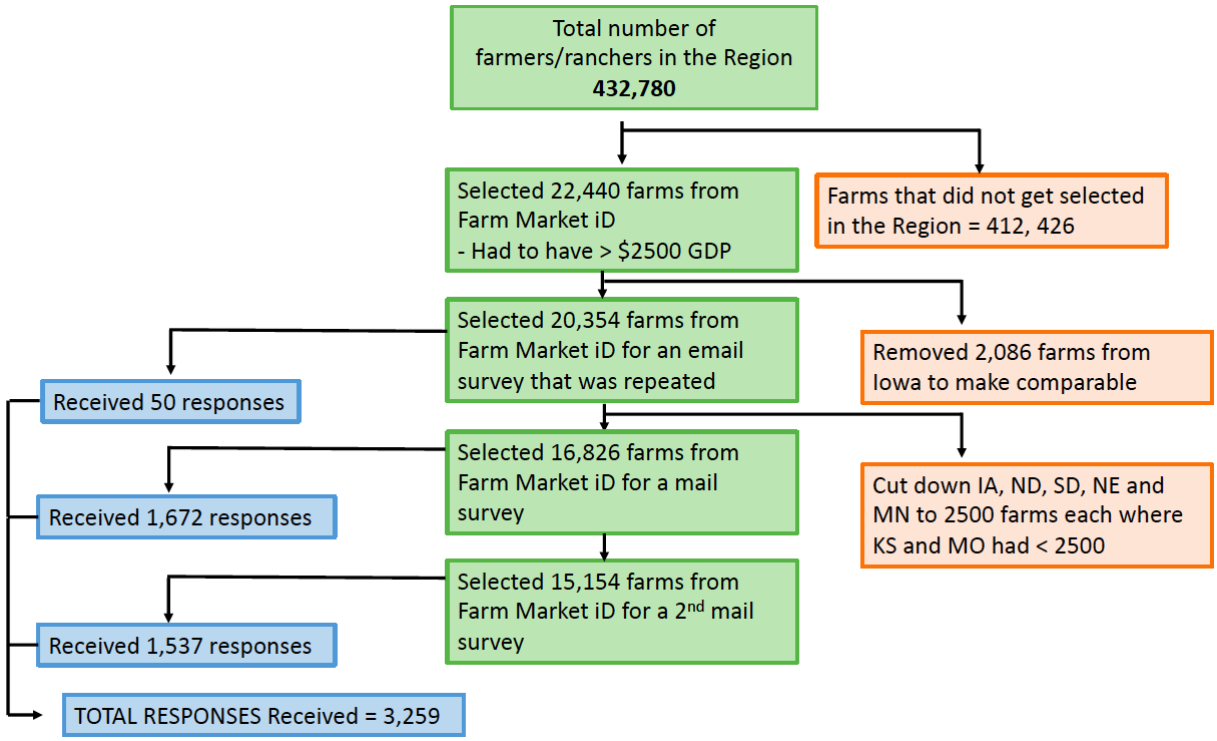

Figure 7. Breakdown of how the surveys were distributed to the seven-state region and how many total responses were received.

From those responses, there were a total of 2800 farms (299 ranches, 2420 farms, 81 farm/ranches). There were 8710 total respondents, including the primary, secondary, and tertiary operator on each farm/ranch. The survey response was predominately male (85%) for all operators with an average age of 56, where 84% of them worked on their farms/ranch more than 50% of the time.

For all operators: 46% had no hearing loss, 35% had mild hearing loss, 16% had moderate hearing loss, and 3% had severe hearing loss. Of these operators the average amount of time one wore PPE was 30% (SD=35.9) when they were around high noise exposures. The severity of hearing loss and the amount of time one wore

hearing protection was not found to be significant (p=0.12). Exposures to high noise sources that were statistically significantly associated with hearing loss included: tractor (p <0.0001), combine (p <0.0001) air seeder(p=0.04) chainsaw (p <0.0001), compressor (p <0.0001), grinder (p <0.0001) and other p=(0.0036). A few of the other sources included: grain vacuum, lawn mower, irrigation engine, farm animals (hogs, cattle), and skid steer.

Conclusion

Low PPE usage among farmers is consistent with previous studies (Carruth et al., 2007). Our participants gave similar known reasons as to why they choose to not wear PPE at high rates, which is due to mainly inconvenience (Donham et al., 2013; Schenker et al., 2002; Harber et al., 2010; Petrea 2001). Not wearing any PPE during high noise exposures, however, comes at a price as there is a statistically significant relationship between high noise exposures and hearing loss. This could be due to the fact that individuals do not always know when to wear the correct PPE around high noise exposures.

With a variety of hazards potentially being a daily threat to agricultural workers, properly educating them on what is necessary under hazardous conditions is a high priority. These demonstrations of proper PPE usage will give the user more confidence of when they should be wearing the equipment and knowledge of how and where to store the PPE. The demonstrations would be most effective if done in person or through video, but a flyer explaining the appropriate way to wear equipment would work as well. Here demonstrations could be done on the on-farm-walk throughs explaining to farmers the correct way to use PPE while handing it out to them. For the CS-CASH survey a

flyer could be made available either electronically or as a hand-out in the survey to inform them the proper way to wear PPE.

Increasing awareness and safety around farm equipment is a necessary task as individuals who work in the field suffer injuries and debilitating health consequences, including respiratory dysfunction and hearing loss. From our survey's respondents do not know when to properly wear PPE or wear it even 50% of the time around high noise exposures. These surveys will continue to inform outreach educators why farmers are not wearing PPE and formulate new ideas to encourage agricultural workers wear PPE more often. Both the surveys will continue in the future to gather more information on how to better serve the agricultural community.

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Service Learning/Capstone Experience Reflection

Experience with placement site

Working with the members at CS-CASH was an amazing experience. Every individual was willing to take the time to explain information that was necessary to complete my project. This included being available for meetings and at times when questions arose. These individuals also created collaborations with contacts that they knew for me to reach out to so that my project could be completed. From conversations with previous students, I knew that working with this organization would not only allow me to grow as an individual, but through my research knowledge as well.

Activities performed

Throughout my project I performed a variety of different daily tasks. There were three main projects that I was working: CS-CASH annual survey, CS-CASH Google alert database system, and PPE on-farm walk through (capstone experience). For the CS-CASH annual survey, I was involved with helped reorganize the questions, creating the survey in RedCap, helping disseminate the survey, analyze the data, and communicate the data conferences. These conferences were for ISASH and I was able to give an oral presentation demonstrating our results. My help with the database included managing the system, which involved receiving daily alerts and recording any farm death or injury that had occurred into the database. This was also a collaboration with other facilities that discussed whether events were actually injuries or deaths. This was a great learning experience on how to collaborate with other universities and on how to make decisions based upon evidence and not upon feeling. The on-farm walk throughs were designed to gather the knowledge the amount PPE that farmers wore

and if they kept their farms safe. These were baseline data gatherings and were there to make the farmer to feel at ease with sharing information with new individuals. If unsafe farming conditions were observed, they were pointed out to the farmer and explained on how they could be improved, and information was provided to the individual on how they could fix it. On went to eight different farms on these walk throughs over the state of Nebraska.

Greatest Contributions to the Project

Some of my greatest contributions to the project were helping build and learn how survey distribution works along with the management of the online database system. The online database system has shown me how severe farm injuries are and how many occur throughout the year. It is a very deadly industry to be in, but a necessary one that we must keep trying to make a safer place.

Greatest Challenges of the Project

By far the greatest challenge of the project was recruitment of individuals to the PPE project for the ongoing on-farm walk through. I was only able to recruit eight participants, when I was hoping to get 20 or more for the project. I was able to get a good baseline information for the project started, however, and now there is a new student working on the project and they have been able to get a few more people to participate.