Too Late Smart

Farmers' Adoption of Self-Protective Behaviors in Response to Exposure to Hazardous Noise

by Marjorie McCullagh, PhD, and Cheryl Robertson, PhD

RESEARCH ABSTRACT

Farmers are exposed to hazardous noise from equipment and livestock and experience high rates of noise-induced hearing loss (NIHL); however, their use of hearing protection devices (HPDs) is low. The purpose of this study was to describe farmers' personal experiences using HPDs, influencing others' use of HPDs, and overcoming barriers to the use of HPDs. A purposive sample of farmers who reported a high frequency of HPD use was selected for face-to-face interviews. Findings indicated that farmers have frequent exposure to hazardous noise. They described their motivation to adopt protective behaviors to avoid hearing loss, noise annoyance, or tinnitus. Many tried to influence others' use of HPD, particularly family members. These farmers have developed a variety of methods to ensure convenient access to HPDs when needed, and have developed effective techniques for overcoming common barriers to protection. Findings from this study will be used to form the foundation for future studies aimed at developing and testing an intervention to increase HPD use and decrease rates of NIHL among farmers.

The farm work environment is characterized by multiple work hazards, including frequent exposure to hazardous noise (e.g., farm machinery, power tools, and livestock) (Beckett et al., 2000; Guul-Simonsen & Madsen, 2000). Although farmers experience a high prevalence of noise-induced hearing loss (NIHL), they often neglect to use hearing protection. Addressing NIHL has been identified as a priority by federal agencies, including *Healthy People 2010* (U.S. Department of Health and Human Services, 2000) and the *National Occupational Research Agenda* (National Institute for Occupational Safety and Health, 1996).

REVIEW OF THE LITERATURE

NIHL is irreversible and progresses with continued exposure to noise. It often results in impaired communication, reduced self-esteem, impaired ability to interact with one's environment, disruption of intimacy (Suter, 2000), and tinnitus. Agriculture has the third largest number of potential noise-exposed employees among American industries (Rivera, 1998). Several authors have noted a high prevalence of hearing loss in this worker population (Beckett et al., 2000; Hwang et al., 2001; Stewart, Scherer, & Lehman, 2003), although estimates have varied widely due to the lack of large population-based studies.

Although hearing protection devices (HPDs) are effective in preventing NIHL (Hong, Chen, & Conrad, 1998; Sataloff & Sataloff, 1993; Savelle & Toothman, 1987), their use among farmers is low (Carruth, Robert, Hurley, & Currie, 2007; Gates & Jones, 2007; Jenkins, Stack, Earle-Richardson, Scofield, & May, 2007; McCullagh, Lusk, & Ronis, 2002; Stewart et al., 2003). Reasons cited for this low rate of HPD use have included farmers' fear of not hearing equipment noises, difficulty communicating while wearing HPDs, inconvenience of use, and interpersonal influences (Gates & Jones; McCullagh et al.).

Unlike general industry, most farms are not regulated and farmers are not protected by the Occupational Safety

ABOUT THE AUTHORS

Dr. McCullagh is Associate Professor, Department of Nursing, North Dakota State University, Fargo, ND. Dr. Robertson is Associate Professor, University of Minnesota, Minneapolis, MN.

Interview Guide

1. What is your name?
2. Where do you farm?
3. What products do you produce?
4. Are you exposed to noise in your work on the farm? What sources of farm noise are you exposed to?
5. Do you do anything to protect yourself from this noise?
6. When did you become a hearing protection user? What made you decide to do this?
7. Are there some obstacles to using hearing protection on the farm? What do you do to overcome them?
8. Who has encouraged or supported your use of hearing protection?
9. Have you influenced the use of hearing protectors by other farmers? How?

and Health Administration or the Hearing Conservation Amendment (Occupational Safety and Health Administration, 1981). In addition, few farmers have access to safety specialists, industrial hygienists, or occupational health nurses. Most farms in the United States are small, independently run operations, and many owner-operators resist outside interference in their operations (Murphy, 1997).

The Pender Health Promotion Model posits that health-promoting behaviors are influenced by a variety of cognitive and attitudinal factors, including perceived barriers, perceived benefits, situational factors, self-efficacy, and interpersonal factors such as norms, modeling, and support (Pender, Murdaugh, & Parsons, 2006). This model was successfully used to develop the Predictors of Farmers' Use of Hearing Protection Model (McCullagh et al., 2002), which correctly predicted 78% of 139 farmers' propensity to use HPDs.

Although rates of HPD use are low overall, some farmers have successfully used hearing protection in their work environments. The motivations and mechanisms for this success, from the perspective of the user, are currently unexplored and have important implications for the development of interventions to increase HPD use. This article reports on a study of farmers who consistently use HPDs. The purpose of this study was to describe farmers' personal experiences in becoming HPD users, influencing others' use of HPDs, and overcoming barriers to using HPDs.

METHODS

Interviews were conducted with a purposive sample of farmers who attended trade shows and reported they consistently used hearing protection. Procedures for the study were approved by the Institutional Review Boards of the universities of the investigators and research consultant team.

Instrument Development

The semi-structured, open-ended interview guide (Sidebar) was developed based on factors identified in the Predictors of Farmers' Use of Hearing Protection Model. Topics of items (and their associated model concepts) included actions that participants take to protect themselves from farm noise (HPD use), who encouraged or supported their use of hearing protection, how they might have influenced other farmers' use of hearing protection (interpersonal factors), and how they overcome obstacles to using hearing protection on the farm (barriers to use and access to use). Farmers were also asked to describe their personal motivations for becoming consistent HPD users.

With input from a panel of experienced hearing health researchers, the questions were critiqued and revised for relevance, comprehension, and appropriateness. The items were piloted with several farmers, slightly revised to be less formal, and found effective in eliciting the desired information from farmers. One resulting item asked, "Are there some obstacles to using hearing protection on the farm? What do you do to overcome them?"

Sample

Several farm trade shows and commodity meetings in the upper Midwest were selected as venues to recruit participants, and consent was secured in advance from program sponsors. Participants were screened and recruited during one-on-one interactions at these meetings. A purposive sample of adult, English-speaking farmers who were active in production and reported consistent HPD use (i.e., at least 90% of the time when exposed to high-level noise) was sought. If potential participants stated that their HPD use was rare or inconsistent, they were excluded from participating. Sampling continued until informants revealed no new information.

Data Collection Procedures

After informed consent was obtained, each participant was individually interviewed once for approximately 10 to 25 minutes. Interviews were conducted by the investigator for future use in an intervention. Interviews took place on exhibit floors of farm shows or other common areas (e.g., trade group meeting). Participants were offered $20 for their time.

Data Analysis and Interpretation

Audiotapes were transcribed and read by two experienced hearing loss prevention researchers. The transcriptions were saved as text files and managed using Microsoft Word. The interview questions served as a guide for coding at the beginning of the process. Additional codes were developed inductively later in the process and then applied retrospectively to all data as appropriate. Transcripts were coded on a line-by-line basis. Units of coding included sentences or paragraphs of text, and some

units were coded with more than one code. After the data were coded and patterns became more visible, categories of codes were developed (Morse & Field, 1995). Category selection is a step in the analysis process used to organize and reduce the data into more manageable portions by linking several related codes into coherent groups. Categories may be described as a meta-code; they reduce substantial amounts of information into more meaningful and compact units of analysis (Miles & Huberman, 1994). From the 179 codes identified from these data, 30 categories were developed. The data were further reduced and sorted into five summarizing themes (Sidebar).

RESULTS

Twenty farmers participated; all but one were men. Most (90%) were middle-aged (35 to 60 years old); one was 18 and one was 65. Farmers produced crops (75%), livestock (15%), and dairy (10%). Most (95%) identified themselves as owner-operators; one was a paid farm worker and son of the owner-operator.

Five major themes were identified, centering on farmers' experiences with occupational noise exposure and use of hearing protection. Exemplar quotes from participants are provided to elucidate each theme.

Noise Exposure and Its Effects

Participants universally reported that they experienced frequent exposure to hazardous noise. Common sources of noise exposure mentioned included heavy equipment, tractors, harvesters, sprayers, vacuum-operated grain augers, grain dryers, chain saws, grinders, gas motors, trucks, combines, power washers, hammers, drills, and air wrenches. Some farmers also noted that their occupational noise exposure was compounded by recreational noise, such as use of firearms.

> Pretty much every day on repairs of the machinery, moving grain, or just running the machine, combine, or tractors, you name it. There is always some noise.

Many participants demonstrated knowledge of the effects of noise on hearing and the less commonly recognized risk of tinnitus.

> We used to run grain vacs and stuff and at the end of the day your ears would have that ringing. I couldn't fall asleep at night because of the ringing of the ears.

Some participants articulated awareness of the insidious nature of NIHL and its effects on verbal communication and functioning in work and family life. Many expressed a perceived vulnerability to these negative effects.

> All you have to do is look around and see all the farmers with hearing aids sticking in their ears and you know that it's a problem. It hurts your hearing.

One farmer compared the permanence of NIHL to another common type of farm injury.

Themes and Categories of Farmers' Experience With Noise and Hearing Protection

- I. Noise exposure and its effects
  - A. My job is loud
  - B. Recreational noise
- II. Describing use
  - A. When I use hearing protection
  - B. Initiation of my use of hearing protection
    - 1. Influence of role models
    - 2. Influence of hearing loss
      - a) Mine
      - b) Others
    - 3. Influence of perceived benefits of use
    - 4. Influence of noise annoyance
    - 5. Influence of other sources
    - 6. I did it myself
- III. How I make it work
  - A. Strategies: keeping hearing protection devices (HPDs) on hand
  - B. My use of earplugs
  - C. My use of ear muffs
  - D. Access to HPDs
  - E. Buying HPDs
- IV. Barriers
  - A. General barriers
  - B. Barriers to communication
  - C. Barriers to hearing equipment sounds
- V. Influencing others
  - A. My family
  - B. My kids: concern for youth
  - C. My employees
  - D. Our future
  - E. Too late smart
  - F. Value of HPDs and advice to other farmers

> It doesn't come back. It's like cutting off a finger. When it's gone, it's gone forever.

It is not uncommon for farmers to disregard their need for hearing protection, citing their well-established hearing loss. One farmer recognized the fallacy of this concept, stating:

> My damage has already been done, although I try to make sure it doesn't get worse.

Describing Use

Participants reported that they were very frequent users of hearing protection. Most reported that they rarely failed to use hearing protection.

> I have for the last 15 years used ear protectors. I use them pretty religiously.

Participants were asked how they selected types of hearing protection to use. Many were unaware of the variety of types of hearing protectors available for purchase, but did know that foam plugs and muffs were available for use. One farmer described his trial-and-error method of selection, although it was common for farmers to simply select the one model of hearing protection that was sold in the stores (e.g., farm supply or hardware) where they did business.

Participants reported that they commonly used earplugs or ear muffs or alternated between the two. Farmers often selected one or the other of these types of hearing protection based on their personal experience with convenience and comfort. None of the participants reported using semi-aurals or custom molded plugs, and none reported using two types synchronously. One participant reported using active noise reduction headphones during equipment operation.

Unlike workers in most other industries, the principal operators interviewed were responsible for the cost of purchasing hearing protection for their operation. No farmers expressed concern about this cost; farmers commonly referred to hearing protection as "cheap" or "well worth it."

How I Make It Work

Participants described their motivation to adopt protective behaviors as originating from their desire to prevent losing their hearing, to prevent extension of their hearing loss, or to avoid the annoyance of loud noise. A few farmers reported that they had normal hearing, believed they were susceptible to NIHL, and were motivated to use HPDs in an effort to avoid future negative consequences of NIHL. They understood these consequences to include loss of ability to communicate and tinnitus. Other influencing factors reported by participants included noise annoyance and perceived benefits of HPD use. Only one participant reported being taught techniques for inserting foam plugs; participants generally considered this skill to be simple and themselves to be self-taught.

Other farmers reported they began using hearing protection later in their farming careers. Like the well-known German expression of their Midwestern ancestors, "Ve get too soon oldt, und too late smart," these participants related that they were aware of NIHL and its negative consequences. Some had become aware that their own hearing acuity had begun to deteriorate as a result of years of noise exposure on the farm, resulting in occasional difficulties in their daily functioning (e.g., using the telephone). Others' awareness had resulted from living or spending time with a family member or other farmers who had NIHL. Their use of hearing protection was motivated by a desire to avoid the negative consequences of hearing loss that had become apparent to them either directly or indirectly through others.

> Hearing my Dad say 'What?' all the time and seeing older people wearing hearing aids and everything else. And hearing that whistle from hearing aids, from people just trying to get that stuff to work. Realizing that it's from those old tractors making that noise every day. That is what kind of triggered me to do it.

Some participants discussed the benefits of using hearing protection beyond the prevention of NIHL. Among the benefits cited were prevention of tinnitus and headache associated with noise exposure. One farmer noted that he experienced reduction in noise as well as fatigue as a result of using HPDs. Another farmer found an additional reason to wear hearing protection: it reduced the annoyance that noise caused him.

Barriers

As frequent users of HPDs, participants related using a variety of methods to ensure convenient access and overcome common barriers to HPD use. Farmers often report barriers to hearing protection use, and these are among the most influential factors associated with low HPD use in this worker group (McCullagh et al., 2002). Fear of failure to hear equipment sounds that may signal malfunction is the most common of these barriers. Farmers also fear difficulties in verbally communicating with coworkers on the farm. Both of these perceived barriers are highly significant to farmers, as many farmers are principal operators. Both equipment failure and difficulty communicating are feared to result in negative effects on the operation's bottom line. However, many participants in this study reported developing effective techniques to overcome perceived barriers to HPD use, including strategically placing HPDs in work locations where noise exposure was most likely.

> I have these little earplugs on a cord that you can just put around your neck. A lot of places that wear hard hats, in factories and stuff, they all have them, or it's required. So you can buy boxes of them and have them laying all over. They're cheap.

Farmers commonly believe using hearing protection will interfere with hearing equipment sounds that may signal malfunction. However, several of the frequent users interviewed expressed contrasting opinions. Some actually believed that using hearing protection enhanced their ability to hear their in-cab radios and critical equipment sounds.

> Earplugs, well actually they are noise filters. You can actually hear radios better with them in, than you can

> without. It says right on them, high-pitch noises are what they weed out.

Some participants reported overcoming fears of not hearing equipment sounds after adapting alternative techniques for monitoring equipment operation, including relying on other senses, such as vision, and being more cognizant of changes in vibrations that may signal changes in equipment functioning.

> Watching the gauges on the dash. Looking. Using my eyes as much as my ears, so routine stopping and checking things over, just the normal routine checkups that I should be doing regardless of whether I'm wearing hearing or not; it should be done anyway.

These farmers expressed surprise in finding that HPDs were easier to use and more user-friendly to the farm operator than they anticipated or is commonly believed. They expressed a sense of dispelling their learned myths of HPD use through their personal experiences.

In addition to overcoming fears of not hearing equipment sounds, farmers reported other techniques for overcoming common barriers to use. One of these was purchasing HPDs in bulk for use in their operation. Some had discovered that purchasing this way was more economical and facilitated wide distribution of HPDs around the farm. Thus, HPDs were more likely to be conveniently located when they were needed, as many farmers indicated they would not be inclined to interrupt a farm task to retrieve HPDs from a remote location.

> They're in every glove compartment in my pickups, they're in my trucks, they're on the dash, you know, in the cubby of the combines and the tractors. Basically, I buy a 500 pack and I spread it around. I take handfuls and I put them in everything that I've got.

Farmers also reported adopting the practice of carrying HPDs with them when they conducted their work activities. As intermittent, rather than continuous, exposure to noise is common in farm work, the need for HPDs is similarly intermittent. Farmers often reported carrying a supply of foam plugs in their pocket (many displayed these during the interview), ready for immediate insertion.

> I have a pile on my dresser and every morning I just throw them in my pocket on my way out. I make sure I have some in my T-shirt pockets because they are easy to grab.

Several spoke of developing a habit of filling their pockets with HPDs at the beginning of the day. Doing so had become second nature.

Some farmers mentioned keeping the supply of HPDs in a highly visible location in their home or shop, to help them remember to restock their supply of HPDs. Locations were selected based on their high visibility and proximity to sources of noise exposure.

Influencing Others

Many participants described how another individual influenced their decision to use hearing protection. This individual was most frequently a family member. One farmer described how he started using HPDs.

> Pretty much when I got into the livestock business, because my father urged me to use them, because he does not have good hearing. He understands that hearing is a good thing to have.

The participants were divided regarding their intentional influence on other farmers' use of HPDs. Some farmers reported trying to influence others' use of HPDs, particularly their children, other family members, and farm employees. Methods of influencing others' use of HPDs included verbal persuasion, providing a supply of HPDs for their use, and modeling HPD use. Several reported that their own use of hearing protection had been influenced by someone else, generally a family member.

> It is kind of, I think, it is just that one person started doing it. They probably have all seen that there was a reason why the other one was doing it. It kind of snowballed.

Other farmers reported that they did not try to influence others.

DISCUSSION

Some farmers, in a variety of production areas (e.g., crops, livestock, and dairy), consistently use hearing protection in their high-noise work environments. This perspective is in contrast to, but not inconsistent with, the results of several previous studies showing farmers overall are infrequent users of HPDs (Carruth et al., 2007; Gates & Jones, 2007; Jenkins et al., 2007; McCullagh et al., 2002; Stewart et al., 2003). A second major finding of this study was that some farmers who consistently use HPDs have developed their own methods to overcome common obstacles to HPD use. These methods are straightforward and may be adopted in a variety of farm work settings.

Several farmers related the benefits of using hearing protection beyond the more obvious prevention of NIHL. These benefits included reduction in fatigue, headache, and noise annoyance. Another notable finding was that participants denied that HPD use interfered with work tasks. In fact, some farmers reported that HPD use actually enhanced their ability to hear equipment sounds. These additional benefits of HPD use may not be known to most farmers and may provide important motivation and reinforcement.

Farmers who frequently used HPDs often reported they were motivated by a desire to preserve their hearing or to avoid problems associated with noise exposure and NIHL. Most had witnessed the negative effects of NIHL on communication, work, and family. This finding demonstrates that these individuals value the utility

of HPDs in avoiding the development or extension of hearing loss. However, McCullagh et al. (2002) found that HPD users and non-users did not differ significantly in their value of HPD use. The role of this belief in adoption and maintenance of this health behavior is not yet well understood.

Conducting this study involved several challenges, including participant recruitment. Because of the high rate of non-users and low overall HPD use, the process of identifying frequent users was anticipated to be a potential barrier to conducting interviews. However, one-on-one solicitation of farm show and commodity meeting participants was fruitful. Nevertheless, once high-frequency users were identified, recruiting them for participation in the study was another obstacle. Inviting farmers to share their personal expertise in HPD use was a successful approach to this problem.

Given the recruitment challenges, the investigators expected participants to be challenging to interview. This proved not to be the case. Participants were very willing to discuss hearing protection. Many immediately reached into their pockets to retrieve and display the hearing protection they carry with them at all times, even at farm shows. On several occasions, participants revealed their passion for HPDs by relating their ideas about HPD use even before the consents were signed and the interview began.

The study is limited by its small scope and geographic catchment area. Most participants were middle-aged male resident farmers and owner-operators. Further research with an expanded scope of producers (e.g., farm laborers, migrant workers, unpaid family workers, and children and older adults active in production) and product types (e.g., fruits, vegetables, and cotton) would provide additional insights into the experiences of a broader variety of farmers.

Findings of this study are consistent with and validate the Predictors of Farmers' Use of Hearing Protection Model. Farmers described factors influencing HPD use in detail, including barriers and access. These stories also illustrated the influence of others on the farmers' use of HPDs, as well as the influence of the farmers on others, particularly family members.

Several farmers identified the influence of another farmer's loss of hearing on their own motivation to adopt hearing protection. The Expectancy-Value Theory (Feather, 1982) suggests that these consistent users of HPDs perceive these devices as valuable in reducing their risk of developing hearing loss and tinnitus. However, the perceived value of HPD use was not found to be predictive of HPD use in previous studies, and risk of hearing loss is well-known to HPD users and non-users in the farming community. Further study is indicated to understand the mechanism by which others' hearing loss motivates HPD use.

IMPLICATIONS FOR OCCUPATIONAL HEALTH NURSES

Results of this study have important implications for the development of interventions to increase HPD use and decrease rates of NIHL among farmers. The study demonstrates that consistent use of HPDs in farm work is more than a hypothetical idea; it is a reality for farmers in a variety of operations.

This study also identifies many straightforward techniques that may increase HPD use on the farm. These techniques may be included in interventions designed to increase farmers' use of HPDs. Of particular interest are participants' statements suggesting myths about HPD use, and information countering these myths.

Recordings of farmers' descriptions of behavioral methods used to overcome barriers to HPD use and access generated in this study are particularly valuable. Edited segments of these recordings may be useful as farmer-to-farmer testimonials, as peers may be particularly influential for this worker group known to prize autonomy and shun outside influences.

Results of this study also have implications for the care of farmers at the individual level. With the knowledge that noise and NIHL are prevalent among farmers, nurses can initiate assessments of noise exposure, patterns of HPD use, and barriers to use. Results of these assessments can be used to structure educational messages that overcome barriers and encourage HPD use. These activities are indicated when providing services to farmers as well as farm family members.

Many farmers in this study cited the influence of others in their decision to use HPDs at work. Nurses can communicate with farmers, farm family members, and other health care providers who are influential in farmers' decisions to adopt HPDs and encourage them to use their influence to promote this protective behavior.

CONCLUSIONS

This study enhances nurses' understanding of farmers' experiences as consistent users of HPDs. It also provides information that may be useful in the development of educational interventions to increase HPD use among this high-risk and underserved worker group. The results are consistent with and validate the Predictors of Farmers' Use of Hearing Protection Model, but also suggest a need for research regarding the concept "value of use" of HPDs in adoption of this health behavior. The farmers in this study who are consistent users of HPDs are successful in protecting their hearing health without subordinating the safe accomplishment of their farm tasks and without the benefit of formal systems available to workers in other industries (e.g., work-based health and safety programs, occupational health nurses, safety specialists, industrial hygienists, labor unions, or hearing conservation programs). This information will be highly relevant in the development of interventions to increase the use of hearing protection and decrease the rate of NIHL among farmers, especially those who are owner-operators, as this group is highly attentive to the business bottom line.

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IN SUMMARY

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McCullagh, M., & Robertson, C.

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1 Farmers are at high risk for noise-induced hearing loss due to their frequent exposure to hazardous noise, low use of hearing protection, and lack of access to work-based hearing health programs.

2 Common obstacles to the use of hearing protection among farmers include fear of interfering with farm tasks, fear of not hearing equipment sounds, and inconvenience of use.

3 In contrast to most farmers, some farmers consistently use hearing protection at work. A sample of these farmers described the methods they use to overcome common obstacles to hearing protection use. These include placing protectors in convenient locations, using multiple (non-aural) techniques of monitoring equipment operation, and discovering benefits to using hearing protection.

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