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HEARING LOSS AND HEARING CONSERVATION PRACTICES AMONG AGRICULTURE INSTRUCTORS

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Abstract

This study was designed to determine the extent of hearing loss experienced by high school agriculture teachers in West Virginia, and the hearing conservation practices used by those teachers and their students. Data regarding teacher training and characteristics were collected and teachers were tested for auditory sensitivity. More than three-fourths of the teachers tested were found to have high frequency hearing loss. Most teachers had not received information in college concerning hearing conservation. More than a third never wear hearing protection in their school shops and only about five percent always do. More than half the teachers reported difficulty in getting students to use safety and health equipment, with safety glasses and hearing protection presenting the greatest problems. The authors suggest that hearing conservation instruction begin in teacher preparation programs and that intensive inservice programs be provided for current teachers. They further suggest that information regarding hearing conservation methods and practices be incorporated into appropriate units and lessons, and that hearing protection equipment be provided by the schools and routinely used by teachers and students.

Agriculture is a noisy business. Levels of noise potentially damaging to hearing have been known to be associated with agricultural activities for nearly 60 years (Bunch, 1937). Logically enough, high levels of noise are also found in the shops of programs preparing young people for careers in agriculture (Weston & Stewart, 1980; Woodford, Lawrence, & Bartrug, 1993). The prevalence of high frequency loss of hearing ostensibly caused by over-exposure to noise has been found to be unacceptably high in students enrolled in general shop classes (Roeser, 1980; Woodford, 1981; Woodford & O'Farrell, 1983; Plakke, 1985) and in agricultural mechanics classes (Woodford et al., 1993). The figures reported in these studies vary somewhat, but generally reflect a prevalence of around 30%.

Woodford et al. (1993) reported that all seven agriculture instructors they tested while studying their high school students, had loss of hearing for high frequency signals. Additionally, it was found that five of these seven did not wear hearing protection in their shops, and over half indicated that they had trouble getting their students to use safety equipment. The purpose of the present study was to provide information to teachers, teacher educators, and supervisors regarding the prevalence of hearing loss among agriculture instructors in West Virginia and teachers' personal and professional hearing conservation practices.

Research Procedures

Subjects were 46 male agriculture instructors attending the West Virginia Vocational Education Conference in Charleston, WV in the summer of 1993. Mean age of these individuals was 40.4 years with a range of 26 to 58 years and standard deviation of 7.54 years. Mean years of experience in agricultural instruction was 16.5 years with a range of 3 to 32 years and standard deviation of

7.69 years. Each instructor was asked to complete a questionnaire which included demographic information and items related to hearing conservation practices. When the questionnaire was completed, each teacher was tested for auditory sensitivity for pure tones at frequencies of .5,1,2,3,4,6, and 8 kHz. Hearing worse than 25 dBHL was considered to constitute hearing loss. Testing was begun at 15 dBHL at each frequency, with threshold obtained any time an individual did not respond to the 15 dBHL signal. Middle ear function was assessed via tympanometry to insure that all subjects included in the study had middle ear function within normal limits.

Results

Thirty six of the 46 instructors, or 78.3%, were found to have some high frequency loss of hearing. Mean thresholds and standard deviations for this group are shown in Table 1. The general configuration of this composite, as well as the configurations of nearly all individual audiograms, is consistent with over-exposure to noise as a primary etiological factor (Burns, 1973; Ward, Fleer, & Glorig, 1961). The relatively large standard deviations reflect considerable variability in the severity of hearing loss.

Table 1. Means and Standard Deviations of Thresholds at 2, 3, 4, 6, and 8 kHz for Agriculture Teachers With High Frequency Hearing Loss

	Frequency, kHz				
	2	3	4	6	8
Right Ear					
Mean	21.9	29.9	39.5	44.7	35.8
SD	13.0	15.7	21.0	22.0	21.9
Left Ear					
Mean	22.0	30.7	41.1	52.4	37.4
SD	13.4	17.0	21.1	22.2	23.0

Responses to questionnaire items indicate that a majority of teachers (66%) did not recall ever being presented with information on hearing conservation in college. Of those who did receive some information, most (63%) received one hour or less.

With the exception of one each from Georgia, Pennsylvania, and Virginia, all participants were educated in West Virginia. Most (79%) grew up on farms, and a majority (63%) continue to farm. These agricultural sciences teachers have all been exposed to a number of noise sources, and with so many still actively engaged in farming, continued noise exposure is likely. Over one third (35%) never wear hearing protectors in their school laboratories and only about 5% always do so.

Sixty two percent of the instructors reported that their schools furnish hearing protection, while 46% indicated that students routinely use hearing protection. Fifty one percent indicated that they have trouble getting students to use safety and health equipment. Safety glasses and hearing protection were most frequently cited as presenting the biggest problems. Reasons given for having or not having problems with use of safety and health equipment were varied. Major reasons for <u>not</u> having problems include the example set by the instructor and enforcement of rules. Reasons, noted by teachers, why students fail to use safety equipment can generally be categorized as related to ignorance and attitude. Both can be improved through appropriate education (Lass et al., 1987).

Only 9% reported that sound levels had been measured in their shops. None of the instructors were aware of the results. In an effort to determine whether or not there were any relationships among behaviors and characteristics of participants, a series of chi square tests and a "t" test were performed. Yates' correction for continuity was used when calculating chi square values for all 2 x 2 tables (Siegel, 1956).

Table 2 presents an analysis of two groups, one of which had a configuration of auditory sensitivity that met the criteria for noise-induced etiology while the other did not show these signs. The criteria or "classic" signs of noise as an etiological factor were a threshold of 40dBHL or greater at 3 or 4kHz, and hearing at 8kHz more sensitive than at 6kHz (Kryter, 1970). A significant difference was found between the two groups with respect to the use of hearing protection. Those who sometimes or always used protective devices had less hearing loss than did those who never used hearing protection. No differences were noted between those who had had instruction in hearing conservation in college or those who use firearms in various degrees. Number of subjects in various categories differs slightly due to failure of some teachers to respond to particular items.

Table 3 presents data concerning the influence of college instruction in hearing conservation on teacher and student behaviors. No significant differences were noted between the use of hearing protection by teachers and hearing conservation instruction, or between difficulty in getting students to use safety/health equipment and hearing conservation instruction.

One might hypothesize that an example set by the teacher would be reflected in student behaviors. Data in Table 4 indicate that this is not the case with regard to hearing protection. No differences were found in student use of safety/health equipment as a result of the teacher's use or non-use of hearing protection.

It was felt that use of hearing protection in the agricultural mechanics laboratory might have some influence on the degree of hearing loss incurred by the subjects. Participants were divided into two groups--those who sometimes or always wear hearing protection and those who reported never wearing protective devices. A "t" test was calculated to assess differences in auditory threshold at 4kHz between these two groups. As seen in Table 5, this analysis yielded a "t" score of 1.42, which is not significant at the .05 level.

Table 2. Influence of Hearing Protection, Instruction in Hearing Conservation, and Use of Firearms on Hearing Loss of Agriculture Teachers

	"Classic" Noise Induced Hearing Loss	
	Yes	No
Use Hearing Protection?		
Sometimes or Always	8 (44%)	19 (76%)
Never	10 (56%)	6 (24%)
Instruction in Hearing Conservation?		
Yes	6 (30%)	10 (38%)
No	14 (70%)	16 (62%)
Use Firearms?		
Great Deal or Some	17 (85%)	20 (77%)
Little or Never	3 (15%)	6 (23%)

Chi Square = 3.21, Significant at .05; Chi Square = .08, Not Significant; Chi Square = 1.73, Not significant

Table 3. Influence of Instruction in Hearing Conservation on Teacher and Student Behaviors

	Instruction in Hearing Conservation?	
	Yes	No
Use Hearing Protection?		
Sometimes or Always	13 (87%)	17 (59%)
Never	2 (13%)	12 (41%)
Have Trouble Getting Students To Use Safety/Health Equipment?		
Yes	12 (67%)	21 (78%)
No	6 (33%)	6 (22%)

Chi Square = 2.40, Not Significant; Chi Square = .23, Not Significant

Table 4. Influence of Teacher's Use of Hearing Protection on Student Behaviors

	Teacher Uses Hearing Protection?	
	Yes	No
Have Trouble Getting Student To Use Safety/Health Equipment?		
Yes	20 (67%)	8 (67%)
No	10 (33%)	4 (33%)

Chi Square = .13, Not Significant

Table 5. Differences in Auditory Threshold at 4 kHz Between Teachers WhoWear Hearing Protection and Those Who Do Not

	Threshold at 4kHz	
Wear Hearing Protection?	Mean	SD
Sometimes or Always	32.20dBHL	17.08
Never	38.85dBHL	24.90

"t" = 1.42, Not Significant

Discussion

Establishment of effective hearing conservation practices in secondary school agricultural shops is important for a number of reasons. First, it is clearly desirable to prevent damage to the auditory systems of our students resulting from noise in our school shops. Secondly, it is important to establish good hearing conservation practices and awareness of consequences of over-exposure to noise early on to increase the probability of continued utilization of these practices as our students leave school and enter the work force. While those accepting employment in most industries will encounter hearing conservation programs mandated and enforced by the Occupational Safety and Health Administration (OSHA), those working in agriculture will have no such protection. The preceding is emphatically not a suggestion that more regulation be placed upon agriculture, but is meant to point out that hearing conservation practices, or lack thereof, will result from decisions made by the individuals involved. It is the responsibility of agricultural education programs to insure that these

are informed decisions and that each student has been exposed to good hearing conservation practices.

In addition to workplace noise, persons living in rural areas are often exposed to high levels of noise in recreational pursuits. The most common source of high levels of noise in rural areas is gunfire (Woodford & O'Farrell, 1983; Peppard & Peppard, 1992). Eighty five percent of the agricultural educators in this study indicated "some" or a "great deal" of exposure to gunfire. When surveys of students in schools have been done, nearly half of the students in rural areas report using firearms (Woodford & O'Farrell, 1983) as compared to about 14% in urban areas (Axelsson, Jerson, & Lindgren, 1981). Less than half of the students surveyed reported that they use hearing protection while shooting (Woodford et al., 1993). Exposure to good hearing conservation programs in our schools is likely to carry over into recreational activities. Support for this notion is provided by Lass et al. (1987). These investigators found that an educational program in junior high school was successful in altering assessed attitudes about hearing conservation and intent to use hearing protection in both work-related and recreational exposures to noise.

Generally, results of this study are discouraging. Many of these instructors have had no training in hearing conservation, do not use hearing protection in their shops, are exposed to noise both in school and in recreational activities, have difficulty getting students to use health and safety equipment, have no idea of the sound levels in their shops, and have loss of hearing ostensibly due to over-exposure to noise.

The lack of significant differences among subgroups in this study should not suggest ineffectiveness of hearing conservation practices in general. In this study, there was no way to control for qualitative factors regarding education in hearing conservation, use of hearing protection, or actual duration of exposure to noise. Additionally, with a mean of over sixteen years of experience in teaching, any information provided on hearing conservation during college may not be clear in detail without followup readings or inservice training. Use of hearing protection is only effective in prevention of hearing loss when it is used properly (Berger, 1983). Incorrect use can actually be worse than not using protective devices at all due to the minimal attenuation of sound coupled with a false sense of security provided by just having the protectors on.

An effective and logical approach to solving this problem is through education (Maas, 1969; Mellard, Doyle & Miller, 1978; Lass et al., 1987; among others). The preceding suggests that education should begin in college programs preparing future agriculture teachers, and that intensive inservice programs should be provided for teachers currently in the field. Information regarding hearing conservation methods and practices should be incorporated into all appropriate lessons and units taught to agriculture students who may be exposed to high noise levels. In addition, hearing protection should be provided by the schools and routinely used by teachers and students. With unacceptably high proportions of both our students and our instructors incurring high frequency loss of hearing ostensibly due to noise exposure, and an apparent lack of good hearing conservation programs in our school shops and rural communities, these educational changes should be made very soon.

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