Supplement

Effectiveness of "Dangerous Decibels," a School-Based Hearing Loss Prevention Program

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Purpose: To evaluate the effectiveness of the "Dangerous Decibels" educational program in increasing students' knowledge *and* positively changing their attitudes and intended behaviors related to hearing and hearing loss prevention.
Method: Baseline questionnaires were completed by 478 4th-grade students and 550 7th-grade students. Approximately half of the students in each grade received a 35-min interactive classroom presentation on hearing and hearing loss prevention. The remaining students served as comparison groups. Students who received the curriculum filled out questionnaires immediately after the presentation. All students filled out follow-up questionnaires 3 months after baseline.
Results: Fourth-grade students who participated in the Dangerous Decibels presentation exhibited significant improvements in knowledge and attitudes related to hearing and hearing loss prevention. These improvements were maintained 3 months after the presentation. Seventh-grade students also experienced long-term improvements in their knowledge base. However, attitudes and intended behaviors in 7th graders returned to baseline levels 3 months postpresentation.
Conclusion: The Dangerous Decibels hearing loss prevention program was effective at producing long-term improvements in the knowledge base of 4th- and 7th-grade students. Future studies should include components on peer pressure and should incorporate repeated, multimodality interventions to increase the likelihood of long-term improvement in adolescents.

Key Words: noise-induced hearing loss, children, hearing conservation

Approximately 10% of Americans between ages 20 and 69—or 22 million Americans—already may have suffered permanent damage to their hearing from excessive noise exposure (National Institute on Deafness and Other Communication Disorders, 2007). According to the National Institute for Occupational Safety and Health (NIOSH), approximately 30 million American workers are exposed to hazardous noise on the job. NIOSH states, "Noise-induced hearing loss … is one of the most common occupational diseases and the second most self-reported occupational illness or injury" (NIOSH, 2007).

Children are often exposed to excessive levels of sound: 97% of 273 third graders surveyed by Blair, Hardegree, and Benson (1996) had been exposed to hazardous sound levels. Chermak and Peters-McCarthy (1991) reported that 43% of the elementary school students in their study routinely listened to a personal stereo system or television at a loud volume. Thirty percent of the students said they sometimes participated in other noisy activities such as shooting firearms or attending auto races; however, only 5.5% of the students ever used hearing protection while engaged in these activities. Sources of excessive sound exposure for children include loud music, real or toy firearms, power tools, fireworks, loud toys, snowmobiles, Jet Skis, and motorcycles.

Several studies suggest that the prevalence of noise-induced hearing loss (NIHL) among children is increasing (Chermak & Peters-McCarthy, 1991; Montgomery & Fujikawa, 1992; Woodford & O'Farrell, 1983). U. M. Anderson (1967) reported a surprisingly high prevalence of NIHL in school-age children more than 30 years ago. Blair et al. (1996) claimed that 1% of the school-age population has some degree of NIHL. Niskar et al. (2001) estimated that 12.5%

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of all children in the United States age 6 to 19 years have noise-induced hearing threshold shifts in one or both ears. Studies by Cozad, Marston, and Joseph (1974), Hull, Mielke, Willeford, and Timmons (1976), and Weber, McGovern, and Zink (1967) all found relatively large numbers of schoolboys who failed hearing screenings at 4000 Hz—an indicator of NIHL. Evidence of NIHL was also observed in Swedish (Costa, Axelsson, & Aniansson, 1988), Chinese (Morioka et al., 1996), and French (Meyer-Bisch, 1996) children.

Consequences of NIHL include communication difficulties, lower academic performance, reduced productivity, social isolation, depression, and tinnitus (ringing, buzzing, or hissing in the ears or head). Based on current census numbers, approximately 15.5 million Americans have severe tinnitus (Brown, 1990). The most common precipitating factor in the onset of severe, problematic tinnitus is excessive noise exposure (Meikle & Griest, 1989). Tinnitus can also be an early indicator of NIHL (Griest & Bishop, 1998).

Costs for remediation, rehabilitation, and lost productivity are substantial for people suffering from NIHL and/or tinnitus. Afflicted individuals experience decreased enjoyment and quality of life. However, there is a ray of hope: Unlike many other causes of hearing loss, *nearly all cases of NIHL can be prevented* if people are taught to take a few simple precautions. For more than 30 years, numerous experts have recommended teaching hearing loss prevention practices to children in schools (K. L. Anderson, 1991; Blair et al., 1996; Brookhouser, Worthington, & Kelly, 1992; Chermak & Peters-McCarthy, 1991; Cozad et al., 1974; Florentine, 1990; Folmer, 2003, 2006; Lankford & West, 1993; Montgomery & Fujikawa, 1992; Roeser, 1980).

In 1990, the National Institutes of Health held a conference on "Noise and Hearing Loss." This panel of experts made the following recommendation in their Consensus Statement: "In addition to existing hearing conservation programs, a comprehensive program of education regarding the causes and prevention of NIHL should be developed and disseminated, with specific attention directed toward educating school-age children" ("Noise and Hearing Loss," 1990).

In 1997, the World Health Organization held a conference titled "Prevention of Noise-Induced Hearing Loss." Recommendations from this conference included the following: "There is a great need for creating more public awareness of the harmful effects of noise on hearing and the prevention of NIHL. It is recommended that this matter should be included in school and all health educational programmes" (World Health Organization, 1997, p. 41).

In 2000, the U.S. Department of Health and Human Services published *Healthy People 2010,* "a statement of national health objectives designed to identify the most significant preventable threats to health and to establish national goals to reduce these threats." *Healthy People 2010* states the following about hearing: "Prevention of noise-induced hearing loss is necessary for people both on and off the job. Public education can promote hearing health and behavior to reduce noise-induced hearing loss, which is a fully preventable condition." *Healthy People 2010* objectives include the following: "Increase the use of appropriate ear protection devices, equipment, and practices; reduce noise-induced hearing loss in children and adolescents aged 17 years and under; and reduce adult hearing loss in the noise-exposed public."

Effective prevention of NIHL, as with other environmental health risks, should begin prior to one's exposure to the hazard. The *Healthy Youth!* Web site within the Division of Adolescent and School Health, Centers for Disease Control and Prevention (CDC), states:

> Establishing healthy behaviors during childhood is easier and more effective than trying to change unhealthy behaviors during adulthood. Schools have a critical role to play in promoting the health and safety of young people and helping them establish lifelong healthy behavior patterns because … each school day is an opportunity to teach behaviors to America's 54 million students [and] the nation's 121,000 schools provide many opportunities for students to practice healthy behaviors. (CDC, n.d., p. 2)

Sporadic efforts have been made to teach hearing loss prevention practices to school-age children. A review of curricula and materials available for this purpose found that many educational resources exist, but the widespread dissemination of this information in our nation's schools is lacking (Folmer, Griest, & Martin, 2002). Several hearing loss prevention programs evaluated the effectiveness of their efforts, usually by administration of a pre- and postinstruction questionnaire (Bennett & English, 1999; Blair et al., 1996; Chermak, Curtis, & Seikel, 1996; Chermak & Peters-McCarthy, 1991; Knobloch & Broste, 1998; Lass et al., 1987; Lerman, Feldman, Shnaps, Kushnir, & Ribak, 1998; Lewis, 1989; Lukes & Johnson, 1998; Randolph, Hudak, & Vaught, 2003). Administration of postquestionnaires varied from immediately after to 6 weeks following program delivery. Long-term evaluations (2 or more months after postquestionnaires) were not included in most of these studies but are critical to determine whether program results can be sustained. All of these studies concluded that, compared with preinstruction responses, students' postinstruction knowledge about hearing and hearing loss prevention strategies improved significantly. However, increasing students' knowledge on a topic will not necessarily motivate them to effectively change their health-protective behaviors (Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Weichbold & Zorowka, 2003). Fishbein and Ajzen (1975) suggest that any strategy for health behavior change must consider the context of relevant social influences. One such strategy, the Theory of Reasoned Action and Social Influence, originally developed by Fishbein and Ajzen (1975), is particularly well suited to behavior change interventions and has been successfully tested in adolescent populations. The theory suggests that three constructs can affect an individual's intention to adopt a new behavior, and in order to motivate an individual to make a behavior change, health educators must address each of the three constructs: the *attitude* the individual has about the given behavior, whether or not significant others think the behavior is important (*subjective norms*), and individuals' *perceived control* over their behavior. These three variables affect the intention of the individual to perform the behavior. Researchers determined that health behaviors were related to behavioral intentions and that reports of behavioral intentions were closely associated with attitudes and the subjective norm.

The "Dangerous Decibels" classroom program has incorporated the constructs of the Theory of Reasoned Action in the task of educating early adolescents about hearing loss and tinnitus prevention. Changing adolescent attitudes must be an essential goal of a hearing loss prevention program. The curriculum needs to focus on those attitudes associated with normative beliefs about avoiding loud noises, while addressing essential information about hearing loss and effectively teaching the skills needed to practice healthy behaviors.

The Oregon Hearing Research Center at Oregon Health & Science University (OHSU), in conjunction with the Oregon Museum of Science and Industry (OMSI), the Veterans Affairs National Center for Rehabilitative Auditory Research, and the American Tinnitus Association (all located in Portland) formed a public health partnership in 1999 to educate children about NIHL and tinnitus. The Dangerous Decibels project, through both private and public funding, resulted in the development of three major program activities designed to communicate the sources of dangerous sounds, consequences of exposure to dangerous sounds, and simple methods to protect oneself from dangerous sounds: (a) a permanent museum exhibition at OMSI consisting of 12 high-impact, interactive exhibit components; (b) an interactive, inquiry-based classroom outreach and teacher training program targeting K-12 students; and (c) a Dangerous Decibels Web site (www.dangerousdecibels.org) providing information about the project, NIHL and tinnitus prevention, and other related information. The Web site includes a virtual museum exhibition with educational information, images, simulations, and activities translated from equivalent components of the museum exhibition. The site includes a fully downloadable Teacher's Resource Guide with instructions on how to conduct classroom activities and presentations on hearing, hearing loss, tinnitus, and hearing loss preventions. A DVD with additional resources is also available. The resource guide and DVD can be used by anyone desiring to develop a hearing health education program.

The Dangerous Decibels outreach educational program was developed by OHSU hearing scientists and the OMSI educational outreach staff. An external evaluation team conducted formative evaluation of the outreach program in two phases: Phase 1 focused on age-appropriate and culturally sensitive content and the instructional approach, and Phase 2 focused on program effectiveness of changing knowledge, attitudes, and intended behavior within three grade levels (first, fourth, and seventh). The formative evaluation included student and teacher focus groups, teacher consultants, and educational experts from OMSI. The present study was undertaken to evaluate the effectiveness of the Dangerous Decibels educational program at increasing students' knowledge *and* positively changing their attitudes and intended behaviors related to hearing and hearing loss prevention. Both immediate and longer term assessment instruments were utilized.

Methods

Classroom Program

Dangerous Decibels is a 35-min interactive classroom program on the physics of sound, mechanisms of hearing, how loud sounds damage hearing, consequences of hearing loss, and hearing loss prevention strategies.

Participants

A summative evaluation of the Dangerous Decibels program on hearing loss prevention was conducted using both study and comparison groups consisting of 478 fourth-grade students and 550 seventh-grade students in Oregon and southwest Washington schools. Classrooms were assigned either to a study group (those who received the program) or a comparison group (those who did not receive the program).

Study and comparison groups were matched according to grade, gender, ethnicity, and geographic region (see Tables 1 and 2). A randomized design was not implemented for this study because relationships with the schools had not yet been established and it was unknown how many classrooms would agree to participate in the study. The process for recruiting classrooms to participate varied from school to school and was quite laborious, sometimes requiring several weeks of communication with a variety of school personnel. Once a relationship with the schools was established, future studies did include a randomized design.

Study groups consisted of 223 fourth-grade students and 284 seventh-grade students. Comparison groups consisted of 255 fourth graders and 266 seventh graders.

Measurement Instruments

Questionnaires evaluating baseline, postpresentation, and retained knowledge and attitudes about NIHL and tinnitus (3-month follow-up) were developed for fourth- and seventh-grade students in collaboration with evaluation specialists in preventative health and education as part of the Dangerous Decibels project (see Appendices). Student focus groups and pilot studies were conducted to assess the clarity of questionnaire items and their sensitivity to measure changes resulting from a brief educational program on hearing and hearing conservation.

Table 1. Demographics (%) by research group for fourth-grade students (*N* = 478).

	Comparison group (*N* = 255)	Study group (*N* = 223)
Gender		
Male	56	54
Female	44	46
Self-reported ethnic/racial background		
White	51	47
Black	5	5
Hispanic	10	17
Native American	2	3
Asian	2	4
Other	7	5
No answer	23	19
Geographic status		
Urban	84	82
Rural	16	18

Table 2. Demographics (%) by research group for seventh-grade students (*N* = 550).

	Comparison group (*N* = 266)	Study group (*N* = 284)
Gender		
Male	50	52
Female	50	48
Ethnic/racial background		
White	60	73
Black	0	2
Hispanic	6	4
Native American	2	2
Asian	3	2
Other	6	1
No answer	23	16
Geographic status		
Urban	42	55
Rural	58	45

Measurements

Baseline questionnaires included items about students' current hearing health behavior (Q1–Q3) and knowledge addressing three main messages: (a) how loud is too loud (Q4, Q6 for fourth grade; Q4, Q7 for seventh grade); (b) how hearing is damaged (Q8, Q9); and (c) how to protect hearing (Q5). Additional items addressed attitudes toward hearing and hearing loss prevention (Q6, Q10, Q11, Q12, Q13) and intended hearing health behavior (Q14). Postintervention and 3-month follow-up questionnaires contained similar items, in a different order and with slightly altered format so as to reduce students' ability to simply replicate their previous answers.

Based on recommendations from our educational experts, age-appropriate distinctions were made between the fourth- and seventh-grade questionnaires. Fourth-grade questionnaires were composed primarily of dichotomous response items (e.g., true/false, yes/no, agree/disagree), whereas seventh-grade questionnaires contained more items with a multiple-choice format.

Data Acquisition

All students (study and comparison groups) were administered the baseline questionnaires (Appendices A and B) by project staff members prior to classroom presentations. Administration of questionnaires required approximately 10–15 min. Study group classrooms were then given the Dangerous Decibels program presented by professional educators from OMSI. Educators were trained by OHSU hearing scientists and codevelopers of the classroom program from OMSI to ensure competence of hearing and hearing health knowledge.

At the conclusion of the presentation, project staff members administered a postpresentation questionnaire (Appendices C and D) to students in the study group. The comparison group classrooms did not receive the educational program and therefore did not complete a postpresentation questionnaire. Three months following completion of the baseline questionnaire, all students (comparison and study groups) completed a follow-up questionnaire (Appendices E and F) administered by project staff members.

The OHSU internal review board approved this study. Approval from the research review boards for Washington and Multnomah County Education Service Districts was also required and obtained. Formal consent for participation by each student in this study was not obtained. (The logistics of sending consent forms home and compliance for returning them were concluded to be overwhelming obstacles by both school and research personnel.) Instead, an informal consent form with a description of the study was sent home. Parents and guardians were required to send the form back to the classroom teacher only if they did not want their student to participate. Without a formal consent form, tracking of individual students was not permitted. Consequently, comparison of results across questionnaires was analyzed at the classroom level rather than at the student level.

Data Analysis

Responses from all questionnaires were entered into a computer by an external data entry service and analyzed by the first author using SPSS. Since students could not be tracked individually, percentages of correct responses within a classroom were computed for each questionnaire item using the SPSS aggregate function.

To determine equivalency between intervention groups, baseline comparisons between the study and comparison classrooms were analyzed using independent *t* tests. Because analyses were performed using percentage correct at the classroom level, and the number of participants within a classroom varied slightly across questionnaires, nonparametric tests were also performed using the Mann–Whitney *U* test.

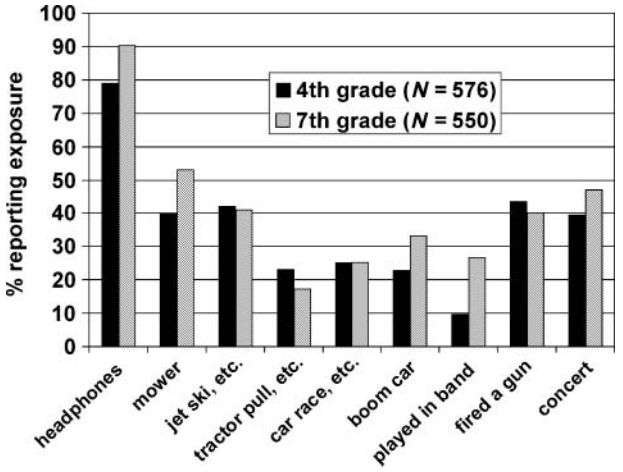
To determine the immediate effectiveness of the educational program, percentages of correct responses at baseline were compared to percentages of correct responses at postpresentation for the study classrooms using paired *t* tests (parametric) and Wilcoxon matched pairs tests (nonparametric). To determine whether changes that occurred following the education program were attributable to the educational intervention, changes in percentages of correct responses from baseline to 3-month follow-up were compared between the study and comparison groups using independent *t* tests and Mann–Whitney *U* tests. To evaluate the long-term effectiveness of the educational program, percentages of correct responses for the study group at baseline were compared to percentages of correct responses at 3-month follow-up using paired *t* tests (parametric) and Wilcoxon matched pairs tests (nonparametric).

Results

Noise Exposure History and Hearing Loss Prevention Practices at Baseline

At baseline, students reported a wide range of potentially hazardous noise exposures during the preceding year (see Figure 1). The use of stereo headphones was reported most frequently (80% of fourth-grade students and 90% of seventh-grade students used stereo headphones during the

Figure 1. Types of noise exposure experienced by students during the past year.



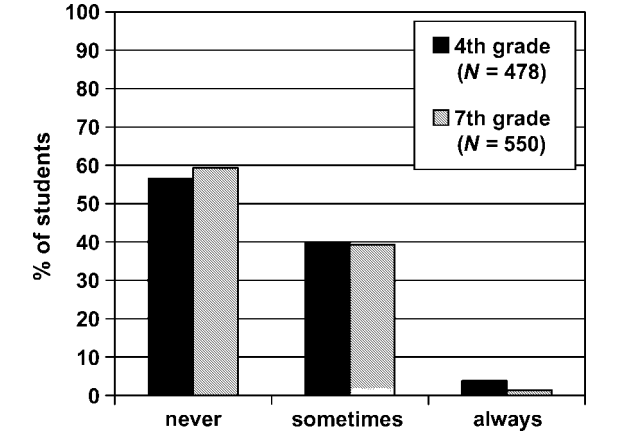
past year) followed by lawn mowers; concerts; motorized vehicles such as Jet Skis, snowmobiles, or motorcycles; and gunfire. In baseline questionnaires, approximately 60% of both fourth- and seventh-grade students reported that they never wore hearing protection when they were around loud sounds (see Figure 2). Less than 3% of the students reported that they "always" used hearing protection when they were around loud sounds. These results indicate that both fourth- and seventh-grade students are involved in behaviors that increase their risk for developing NIHL and tinnitus.

Knowledge of Hearing and Hearing Loss Prevention

Fourth-Grade Students

Baseline comparisons between intervention groups were performed for each of the questionnaire items using independent t tests. There were no statistically significant differences found, establishing equivalency between the two groups at baseline ($p > .05$). Nonparametric tests (Mann–Whitney U) were also performed with results comparable to the t-test analysis.

Figure 2. Baseline responses to "I wear earplugs or ear muffs whenever I am around loud sounds."



Baseline, postpresentation, and follow-up results for the fourth-grade students are presented in Table 3. Paired t tests (parametric) and Wilcoxon paired tests (nonparametric) were performed with similar results. Comparing postpresentation with baseline responses indicated that fourth-grade students significantly improved ($p \leq .01$) in their knowledge for questions regarding the three educational messages: sources of dangerous sounds (Items 1a–d), consequences of dangerous sounds (Items 6 and 7), and how to protect oneself from dangerous sounds (Items 2a–e). Large improvements occurred in Items 1a–d, which addressed the concept of "How loud is too loud?" For example, prior to receiving the program, stereo headphones was identified as a source of loud sound by just 34% of the fourth graders. Following the program, 82% of fourth graders correctly identified stereo headphones as a source of potentially dangerous sound. The greatest increase in correct responses occurred for Item 6 ("Sound that is too loud can damage the tiny hair cells of the inner ear"). The percentage of correct responses increased from 42.6% at baseline to 93.7% following the presentation.

Three months following the classroom presentation, fourth-grade students in the study group retained significant increases in 12 of 14 knowledge items. In the comparison group, only one knowledge item (2e) showed modest improvement ($p \leq .05$) at follow-up compared to baseline responses.

Seventh-Grade Students

Baseline comparisons between intervention groups were performed for each of the questionnaire items using both independent t tests and nonparametric Mann–Whitney U tests. Results between the parametric and nonparametric tests were found to be identical. Two out of 16 items (Item 2d and 6) were significantly different between the intervention groups at baseline (see Table 4). For Item 2d, percentage correct responses at baseline were lower for the study group (52% compared to 65.2%) whereas comparison group responses were lower at baseline for Item 6 (77.6% compared to 89.2%).

Though not equivalent at baseline, the study group showed significant improvements for Item 2d at postpresentation and 3-month follow-up in sharp contrast to little or no improvement made by the comparison group. Item 6, however, revealed similar improvement for the study group at post-intervention (7.5%) as it did for the comparison group at 3-month follow-up (8.7%). Item 6 received a high percentage of correct responses at baseline (77.6% comparison; 89.2% study group), suggesting that a majority of seventh graders understand that people of any age may experience hearing loss caused by loud sounds.

Baseline, postpresentation, and follow-up results for the seventh-grade students are shown in Table 4. Like the fourth graders, seventh-grade students in the study group exhibited significant improvement in knowledge for all three of the educational messages. Like the fourth graders, seventh-grade students demonstrated large improvements for items that identified sources of loud sounds (stereo headphones, 46.1% increase; sounds measuring 85 dB and over are damaging to human hearing, 63.5% increase).

Seventh-grade students showed the largest improvement in correct answers for Item 5, which asked students to identify

Table 3. Fourth-grade students.

Question	Comparison group, N = 10 classrooms, 255 students		Study group, N = 11 classrooms, 223 students		
	Baseline mean % correct	3-month follow-up mean % correct	Baseline mean % correct	Postpresentation mean % correct	3-month follow-up mean % correct
Knowledge					
1. Which of the following types of sound can be loud enough to damage your hearing?					
a. Stereo headphones or Walkman	32.5	38.5	34.0	82.0****	57.9****
b. Fireworks	53.7	61.5	46.4	91.8****	77.0****
c. Gunfire	64.0	72.4	63.2	90.8****	78.9****
d. Concert	62.4	62.5	54.4	90.1****	78.6****
2. Which of the following are good ways to protect your hearing when you are around loud sound?					
a. Walk away from the loud sound	63.6	70.4	57.1	90.5****	82.5****
b. Turn down the volume	69.0	74.2	73.1	89.6****	82.0
c. Make yourself listen to loud sound for longer periods of time	88.6	86.6	84.6	95.7****	90.1
d. Spend less time around loud sounds whenever possible	52.3	58.3	46.4	71.8****	73.7****
e. Use earplugs or ear muffs	66.8	55.5*	58.8	89.5****	75.9***
3. I know a lot about the types of sound that can cause hearing loss.	41.8	44.8	41.2	81.5****	62.6****
4. I know a lot about how to protect my hearing when I'm around loud sound.	69.7	75.6	67.4	86.4**	83.4****
5. Hearing an extremely loud sound even one time can cause you to lose some of your hearing.	57.6	51.4	62.9	77.5**	75.8**
6. Sound that is too loud can damage the tiny hair cells of the inner ear.	43.7	47.4	42.6	93.7****	87.7****
7. Hearing loss is only a problem for elderly people.	77.0	77.0	61.9	85.6****	79.8****
Attitudes					
8. Having a hearing loss is not a big deal.	79.0	80.0	70.8	81.8***	83.3****
9. Kids who listen to loud music all the time don't seem to have a hearing loss, so I don't have to worry about getting a hearing loss.	64.7	66.0	53.9	76.7***	83.2****

Note. Postpresentation and 3-month follow-up comparisons with baseline values: *$p \leq .05$. **$p \leq .01$. ***$p \leq .001$. ****$p \leq .0001$.

the structure in the ear that is damaged by loud sound. The most common incorrect response at baseline was that the eardrum is damaged by loud sound (65.9%). Only 1.3% of the students identified the correct answer (hair cells in the inner ear) at baseline. On the postpresentation questionnaire, 78.4% of the seventh-grade study group identified the correct answer. On the 3-month follow-up questionnaire, this group retained significant increases in knowledge for 11 of 13 items. The comparison group showed significant improvement on just one of the knowledge items (1d) at 3-month follow-up compared to baseline responses. However, the amount of improvement from baseline to follow-up for the study group was notably higher than the comparison group for that item. As mentioned earlier, Item 6 received a high percentage of correct responses at baseline for the study group (89.2%), limiting the amount of possible postinstruction improvement for this item. This explains the small improvement observed at postintervention and 3-month follow-up for this item.

Attitudes and Intended Behavior Regarding Hearing Loss Prevention

Increased knowledge does not necessarily lead to changes in attitudes or intended behavior. Therefore, questionnaire items were included to measure whether this educational program could positively affect attitudes about hearing loss and intended behaviors regarding noise exposure.

Fourth-Grade Students

The intended behavior item ("If I go to a loud concert, I will wear hearing protection") was not included on the fourth-grade questionnaires used in this study. Revised questionnaires containing this item are included in Appendices A, C, and E.

In Table 3, responses to Items 8 and 9 (significance and personal concerns about hearing loss) by the fourth-grade study group exhibit significant improvement on both postpresentation and follow-up questionnaires compared to baseline. The fourth-grade comparison group did not exhibit any improvement for these items on the follow-up questionnaire. Therefore, the classroom presentation appears to be effective at improving the attitudes of fourth graders about hearing loss and noise exposure.

Seventh-Grade Students

The seventh-grade group exhibited significant improvement only for Item 8 (concerns about hearing loss) at postpresentation (see Table 4). However, at the 3-month follow-up, seventh-grade responses to this item were no longer significantly different from their baseline responses. The seventh-grade comparison group did not exhibit significant improvement for these items on the follow-up questionnaire.

The seventh-grade questionnaire contained one item designed to assess the intended behavior of students: "If I go to a loud concert, I will wear hearing protection." Table 4 and Figure 3 show the percentages of students who responded

Table 4. Seventh-grade students.

Question	Comparison group, N = 9 classrooms, 266 students		Study group, N = 11 classrooms, 284 students		
	Baseline mean % correct	3-month follow-up mean % correct	Baseline mean % correct	Postpresentation mean % correct	3-month follow-up mean % correct
Knowledge					
1. Which of the following types of sound can be loud enough to damage your hearing?					
a. Stereo headphones or Walkman	38.0	57.8	44.0	90.1****	66.0*
b. Fireworks	56.5	71.9	60.4	95.7****	82.7**
c. Gunfire	68.7	77.7	70.4	94.2****	86.7*
d. Concert	51.4	68.1*	53.8	93.8****	82.3*
2. Which of the following are good ways to protect your hearing when you are around loud sound?					
a. Walk away from the loud sound	65.5	68.8	61.0	94.9****	80.2**
b. Turn down the volume	79.5	84.1	79.3	96.7***	90.2**
c. Make yourself listen to loud sound for longer periods of time	90.2	85.7	83.3	77.3	88.8
d. Spend less time around loud sounds whenever possible	65.2	66.3	52.0+†	95.6****	76.8**
e. Use earplugs or ear muffs	69.4	83.0	64.5	96.0****	89.1*
3. Sounds measuring _____ and over are damaging to human hearing.					
a. 65 decibels	8.0	8.5	5.6	7.1	28.8
b. 70 decibels	11.1	20.8	9.2	10.9	20.6
c. 85 decibels	9.0	11.1	8.4	71.9****	18.1
d. not sure	72.4	60.4	76.7	10.1	32.4
4. Hearing an extremely loud sound even one time can cause you to lose some of your hearing.	53.3	63.6	51.8	86.3****	73.5*
5. Sounds that are too loud can damage the _____, causing hearing loss.					
a. ear drum	64.3	49.5	65.9	4.5	14.3
b. Eustachian tube	2.0	0	1.0	0	1.3
c. hair cells in the inner ear	2.0	9.4	1.3	78.4****	43.0**
d. all of the above	12.9	22.9	10.5	12.7	24.7
e. not sure	18.9	18.2	21.4	4.5	15.6
6. Hearing loss caused by loud sounds is something people _____ may have.					
a. over age 40	5.0	5.5	4.0	1.1	2.3
b. over age 50	7.7	3.2	3.6	1.0	2.9
c. over age 60	11.5	4.6	3.2	1.5	4.6
d. of any age	77.6	86.3	89.2+†	96.7***	90.2
Attitudes					
7. Having a hearing loss is not a big deal.	77.2	80.9	72.6	80.4	77.6
8. Kids who listen to loud music all the time don't seem to have a hearing loss, so I don't have to worry about getting a hearing loss.	59.4	63.1	59.8	83.0***	66.0
Intended Behavior					
9. If I go to a loud concert, I will wear hearing protection.	17.3	17.6	15.1	44.0****	16.2

Note. Baseline comparisons between intervention groups: $+p \le .05$ independent t tests (parametric); $\dagger p \le .05$ Mann–Whitney U tests (nonparametric). Postpresentation and 3-month follow-up comparisons with baseline values: $*p \le .05$. $**p \le .01$. $***p \le .001$. $****p \le .0001$. For Q3, Q5, and Q6, correct response in boldface.

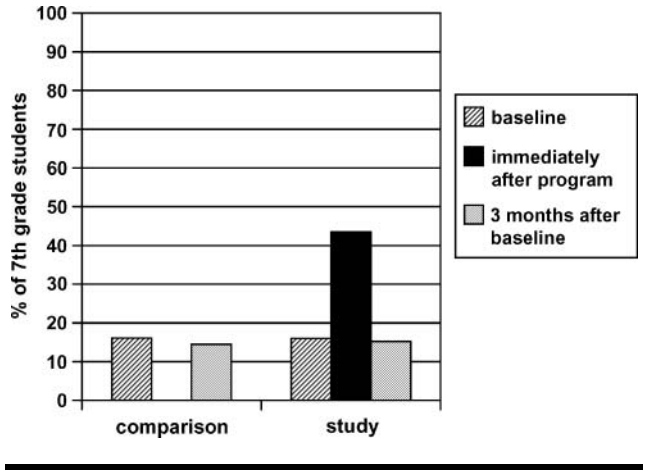
"yes" to this statement. At baseline, only 15.1% of seventh graders in the study group said they would wear hearing protection at a loud concert. On the postpresentation questionnaire, 44% of the seventh-grade study group claimed they would wear hearing protection at a loud concert. However, 3 months later, affirmative follow-up responses for the study group (16.2%) did not differ significantly from their baseline values.

Effectiveness of Dangerous Decibels Program

Fourth-Grade Students

To determine whether improvements in the study group's responses could be attributed to fourth-grade students' participation in the Dangerous Decibels program, changes from baseline to 3-month follow-up were computed for both study and comparison groups and then compared using independent t tests and Mann–Whitney U tests (see Figure 4). Results between the parametric and nonparametric tests were comparable. The study group's improvements from baseline to 3-month follow-up were significantly greater than the comparison group for 12 out of 16 items, strongly suggesting that the classroom presentation is effective at improving the knowledge of fourth graders about hearing loss and noise exposure. Items that were not significantly different (1c, 2b, 2c, and 4) received high percentages of correct responses at baseline from both intervention groups, suggesting that

Figure 3. Percentages of seventh-grade students who responded "yes" to the statement "If I go to a loud concert, I will wear hearing protection."



these were concepts already known by the fourth graders or were concepts that could be ascertained simply by filling out the questionnaire. Further evaluation is needed to determine whether these items should be omitted from the questionnaire for future studies.

Seventh-Grade Students

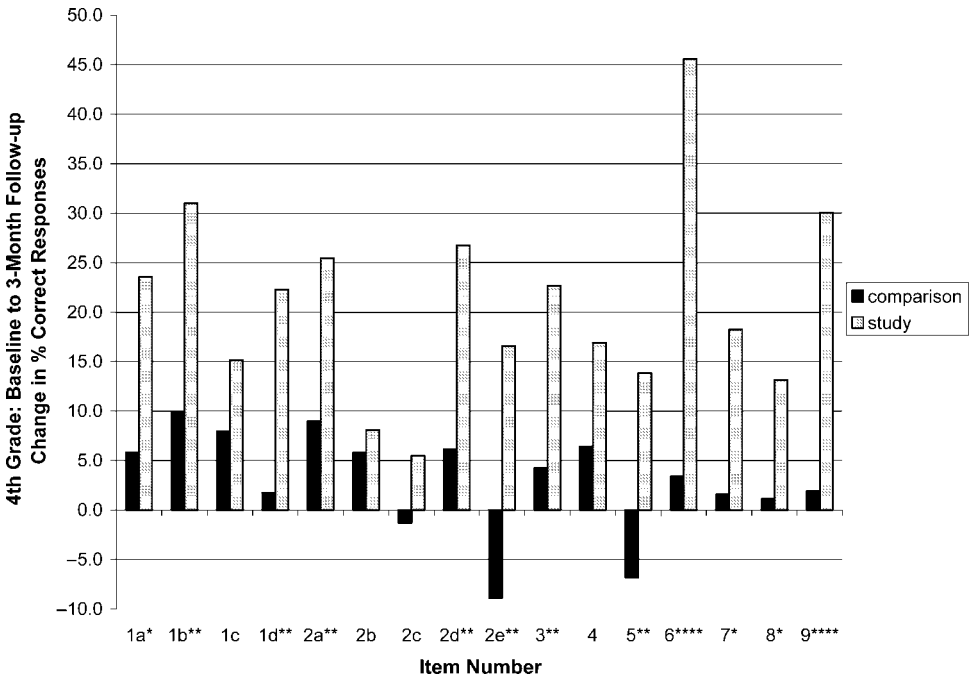
To determine whether improvements made by the study group could be attributed to the seventh-grade students' participation in the Dangerous Decibels program, responses from baseline to 3-month follow-up were evaluated between the study and comparison groups using independent *t* tests and Mann–Whitney *U* tests (see Figure 5). Results from the parametric and nonparametric analyses were similar. Four of the 16 items showed improvements significantly greater than the comparison group at the time of 3-month follow-up. Although the study groups' postpresentation results were significantly improved from their baseline responses, follow-up data revealed that the gains were not retained 3 months after the classroom presentation.

Discussion

Results from this study support previous assertions that children are often exposed to excessive levels of sound. Sources of excessive sound exposure for children include loud music (Fligor & Cox, 2004; Lipscomb, 1972; Meyer-Bisch, 1996), real or toy firearms (Lipscomb, 1974; Woodford, 1973), power tools (Plakke, 1985; Roeser, 1980), fireworks (Gupta & Vishwakarma, 1989; Ward & Glorig, 1961), loud toys (Axelsson & Jerson, 1985; Hellstrom, Dengerink, & Axelsson, 1992), and snowmobiles or other vehicles with loud engines such as Jet Skis or motorcycles (Bess & Poynor, 1972).

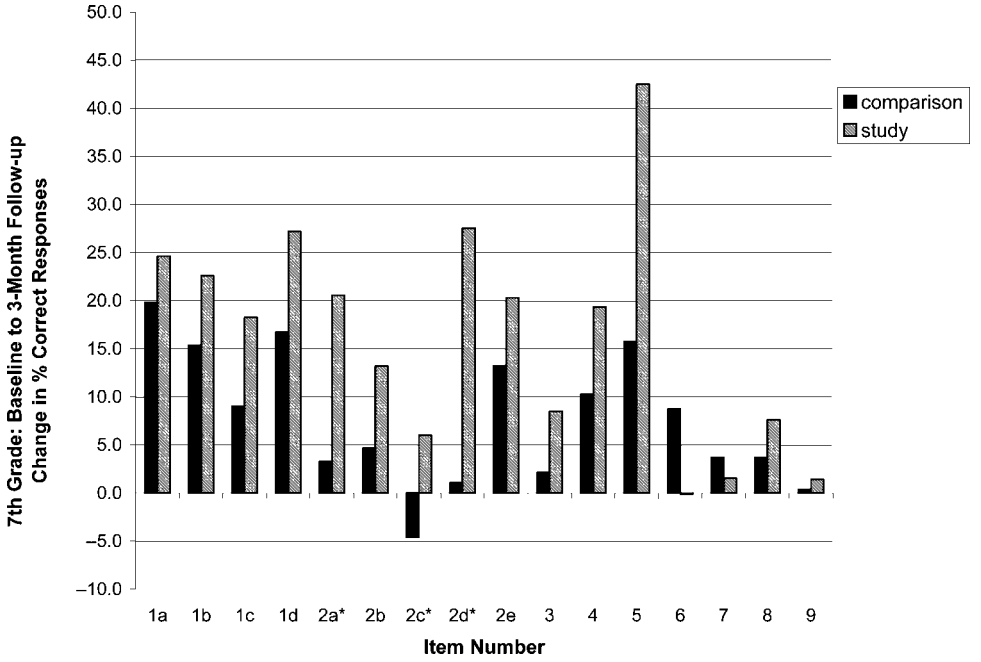
Prior to hearing the Dangerous Decibels classroom presentation, less than 3% of the fourth- and seventh-grade students in the present study regularly used hearing protection devices when they were exposed to hazardous sounds. This result is similar to findings by Chermak and Peters-McCarthy

Figure 4. Fourth-grade students: changes in percentage of correct responses from baseline to 3-month follow-up by intervention group.



*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$. ****$p \leq .0001$.

Figure 5. Seventh-grade students: changes in percentage of correct responses from baseline to 3-month follow-up by intervention group.



*$p \leq .05$.

(1991) who reported that only 5.5% of the elementary school students in their study used hearing protection while engaged in noisy activities.

According to the Occupational Safety and Health Administration's (1983) Occupational Noise Exposure Standard and Hearing Conservation Amendment, if workers are exposed to excessive sound levels, "the employer shall administer a continuing, effective hearing conservation program." Despite evidence that children are often exposed to hazardous sounds and yet do not exhibit hearing loss protection behaviors, there are *no* policies requiring hearing conservation practices to be taught in our nation's classrooms. In spite of evidence that NIHL is a problem among children—and contrary to the recommendations of countless audiologists and other experts in the field—basic hearing loss prevention information remains conspicuously absent from most school curricula.

Results from the present study demonstrated that the Dangerous Decibels hearing loss prevention program effectively increased students' knowledge about sources of hazardous sounds, how loud sounds damage hearing, and how to protect their hearing from loud sound exposure. For the most part, students retained these increases in knowledge for at least 3 months following the classroom presentation. However, improvements for seventh-grade students who received the program were only slightly better than those attained by the comparison group at the 3-month follow-up.

Results from this study also showed that students' attitudes and intended behaviors regarding hearing loss and noise exposure improved as a result of the Dangerous Decibels program. However, while fourth-grade students retained their improved attitudes at least 3 months after the presentation, seventh-grade students did not. The greatest challenge in health education for adolescents is changing their high-risk behaviors. Students learning hearing loss prevention skills will be more likely to apply the learning if they find that their parents, teachers, and/or other important adults identify this issue as important. In addition to important adult influences, the influence of the student's peer group is very strong. The attitude of peers about the use of hearing protection and noise avoidance behavior can have a dramatic effect on students' willingness to apply hearing conservation strategies (Chermak et al., 1996). The classroom program in this study did not include a component that specifically addressed the issue of peer pressure and the influence of significant others in students' hearing health decision making.

Another limitation of this study is that the classroom program consisted of a single, 35-min intervention. Research in health behavior has demonstrated that multicomponent and multimodality interventions are more effective than single component programs (Black, Tobler, & Sciacca, 1998; Greene et al., 2002; Schall, 1994). The literature also demonstrates that program repetition, especially in the form of a "booster" separated in time from the original program, is essential to the long-term effectiveness of health behavior interventions (Foshee et al., 1998; Freimuth, Plotnick, Ryan, & Schiller, 1997; MacDonald, 1999; Main et al., 1994).

Other limitations of this study included (a) lack of a randomized design (unknown differences between the study and comparison groups may not have been controlled for

using a matched design); (b) students could not be tracked individually, so data analysis was restricted to classroom comparisons; and (c) measures of attitudes and intended behaviors were limited. Further development of evaluation measures is needed to more fully detect changes in attitudes and behaviors. Reliability testing of measurement instruments is also needed.

Future studies should evaluate the effectiveness of adding a peer pressure component and the use of multiple, repeated interventions with different formats to increase the long-term effectiveness of educational programs for inspiring healthy hearing protection practices.

Summary

This study demonstrated that a single, 35-min hearing loss prevention program was effective at producing long-term improvements in the knowledge base and attitudes of fourth-grade students regarding sources of dangerous sounds, consequences of dangerous sound exposure, and ways to protect oneself from dangerous sounds. Seventh-grade students also exhibited long-term improvements in their knowledge base. However, while attitudes and intended behaviors in seventh graders showed initial evidence of improvement immediately after the classroom program, attitudes and intended behaviors related to hearing loss prevention returned to baseline levels 3 months after the presentation. Future studies should include the following: randomization of intervention groups with individual tracking of participants; program components on peer pressure; additional measures relating to attitudes and intended behavior; incorporation of repeated, multimodality interventions to increase the likelihood of long-term, positive impact on adolescents; and finally, follow-up assessments, administered at least 3 months after the intervention, to evaluate long-term retention.

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Appendix A

Dangerous Decibels: Fourth-Grade Baseline Questionnaire

Teacher's Name:_____

1. During the past year, I have done the following (*check all that apply*):
   - ☐ Used stereo headphones or Walkman
   - ☐ Used a gas-powered lawn mower or leaf blower
   - ☐ Fired a gun
   - ☐ Rode on a jet ski, snowmobile, or motorcycle
   - ☐ Went to a tractor pull or monster truck show
   - ☐ Rode in a "boom" car
   - ☐ Played in a band
   - ☐ Went to a motorcycle or car race
   - ☐ Went to a concert

2. During the past year, I have been around loud sound that made my ears hurt or gave me "ringing" sounds in my ears.
   ☐ Yes ☐ No ☐ Not Sure

3. I wear earplugs or ear muffs whenever I am around loud sound.
   ☐ Always ☐ Sometimes ☐ Never

4. Which of the following types of sound can be can be loud enough to damage your hearing? (*check all that apply*):
   - ☐ Stereo Headphones or Walkman
   - ☐ Fireworks
   - ☐ Gunfire
   - ☐ Dishwasher
   - ☐ Washing machine
   - ☐ Concert

5. Which of the following are good ways to protect your hearing when you are around loud sound? (*check all that apply*):
   - ☐ Walk away from the loud sound
   - ☐ Turn down the volume
   - ☐ Put cotton or Kleenex in your ears
   - ☐ Use earplugs or ear muffs
   - ☐ Make yourself listen to loud sound for longer periods of time so your ears will get use to it
   - ☐ Spend less time around loud sounds whenever possible

6. I know a lot about the types of sound that can cause hearing loss.
   ☐ True ☐ False ☐ Not Sure

7. I know a lot about how to protect my hearing when I'm around loud sound.
   ☐ True ☐ False ☐ Not Sure

8. Hearing an extremely loud sound even one time can cause you to lose some of your hearing.
   ☐ True ☐ False ☐ Not Sure

9. Sound that is too loud can damage the tiny hair cells of the inner ear.
   ☐ True ☐ False ☐ Not Sure

10. Hearing loss is only a problem for elderly people.
    ☐ True ☐ False ☐ Not Sure

11. People with hearing loss often have problems with the following (*check all that apply*):
    - ☐ Hearing alarms, the doorbell, or the telephone ringing
    - ☐ Understanding road signs
    - ☐ Understanding what is said in a group
    - ☐ Getting to work
    - ☐ Understanding what is said at movies, plays or on TV
    - ☐ Understanding what is said in a classroom

12. Having a hearing loss is not a big deal.
    ☐ Agree ☐ Disagree ☐ Not Sure

13. Kids who listen to loud music all the time don't seem to have a hearing loss, so I don't have to worry about getting a hearing loss.
    ☐ Agree ☐ Disagree ☐ Not Sure

14. If I go to a loud concert, I will wear hearing protection.
    ☐ Yes ☐ No ☐ Not Sure

15. Do you ever experience ringing or other noises in your ear(s) or head?
    ☐ Always ☐ Sometimes ☐ Never

16. Have you visited the hearing exhibit at OMSI?
    ☐ Yes ☐ No ☐ Not Sure

17. Are you: ☐ Male or ☐ Female?

18. How old are you? _____ years old

19. Are you:
    - ☐ Hispanic
    - ☐ White
    - ☐ Black, African American
    - ☐ Other
    - ☐ American Indian, Eskimo, or Aleutian
    - ☐ Asian or Pacific Island
    - ☐ No response

Appendix B

Dangerous Decibels: Seventh-Grade Baseline Questionnaire

Teacher's Name_____

1. During the past year, I have done the following (*check all that apply*):
   - ☐ Used stereo headphones or Walkman
   - ☐ Used a gas-powered lawn mower or leaf blower
   - ☐ Rode on a Jet Ski, snowmobile, or motorcycle
   - ☐ Went to a tractor pull or monster truck show
   - ☐ Went to a motorcycle or car race
   - ☐ Rode in a "boom" car
   - ☐ Played in a band
   - ☐ Fired a gun
   - ☐ Went to a concert

2. During the past year, I have been around loud sound that made my ears hurt or gave me "ringing" sounds in my ears.
   - ☐ Yes ☐ No ☐ Not Sure

3. I wear earplugs or ear muffs whenever I am around loud sound.
   - ☐ Always ☐ Sometimes ☐ Never

4. Which of the following types of sound can be loud enough to damage your hearing? (*check all that apply*):
   - ☐ Stereo Headphones or Walkman
   - ☐ Dishwasher
   - ☐ Fireworks
   - ☐ Gunfire
   - ☐ Concert
   - ☐ None of the above

5. Which of the following are good ways to protect your hearing when you are around loud sound? (*check all that apply*):
   - ☐ Walk away from the loud sound
   - ☐ Put cotton or Kleenex in your ears
   - ☐ Listen to loud sound for longer periods of time so your ears will get use to it
   - ☐ Spend less time around loud sounds whenever possible
   - ☐ Turn down the volume
   - ☐ Use earplugs or ear muffs

6. People with hearing loss from loud sounds can hear normally if they:
   - ☐ Wear a hearing aid
   - ☐ Get closer to a sound
   - ☐ None of these will make a person hear normally
   - ☐ Turn the volume up
   - ☐ All of the above

7. Sounds measuring _____ and over are damaging to human hearing.
   - ☐ 65 decibels
   - ☐ 85 decibels
   - ☐ 70 decibels
   - ☐ Not sure

8. Hearing an extremely loud sound even one time can cause you to lose some of your hearing.
   - ☐ True ☐ False ☐ Not Sure

9. Sounds that are too loud can damage the _____, causing hearing loss.
   - ☐ Ear drum ☐ Eustachian tube ☐ Hair cells in the inner ear
   - ☐ All of the above ☐ Not sure

10. Hearing loss caused by loud sounds is something people _____ may have.
    - ☐ Over age 60 ☐ Over age 40
    - ☐ Over age 50 ☐ Of any age

11. People with hearing loss often have problems with the following (*check all that apply*):
    - ☐ Hearing alarms, the doorbell, or the telephone ringing
    - ☐ Understanding what is said in a group
    - ☐ Getting to work
    - ☐ Understanding what is said at movies, plays or on TV
    - ☐ Understanding what is said in a classroom

12. Having a hearing loss is not a big deal.
    - ☐ Agree ☐ Disagree ☐ Not Sure

13. Kids who listen to loud music all the time don't seem to have a hearing loss, so I don't have to worry about getting a hearing loss.
    - ☐ Agree ☐ Disagree ☐ Not Sure

14. If I go to a loud concert, I will wear hearing protection.
    - ☐ Yes ☐ No ☐ Not Sure

15. Do you ever experience ringing or other noises in your ear(s) or head?
    - ☐ Always ☐ Sometimes ☐ Never

16. Have you visited the hearing exhibit at OMSI?
    - ☐ Yes ☐ No ☐ Not Sure

17. Are you:
    - ☐ Male ☐ Female?

18. How old are you? _____ years old?

19. Are you:
    - ☐ Hispanic
    - ☐ White
    - ☐ Black, African American
    - ☐ Other
    - ☐ American Indian, Eskimo, or Aleutian
    - ☐ Asian or Pacific Island
    - ☐ No response

Appendix C

Dangerous Decibels: Fourth-Grade Postpresentation Questionnaire

Teacher's Name _____

1. Which of the following are good ways to protect your hearing when you are around loud sound? (*check all that apply*):
   - ☐ Walk away from the loud sound
   - ☐ Put cotton or Kleenex in your ears
   - ☐ Turn down the volume
   - ☐ Use earplugs or ear muffs
   - ☐ Make yourself listen to loud sound for longer periods of time so your ears will get use to it
   - ☐ Spend less time around loud sounds whenever possible

2. Which of the following types of sound can be damaging to your hearing? (*check all that apply*):
   - ☐ Stereo Headphones or Walkman
   - ☐ Fireworks
   - ☐ Gunfire
   - ☐ Dishwasher
   - ☐ Washing machine
   - ☐ Concert

3. I know a lot about how to protect my hearing when I'm around loud sound.
   ☐ True ☐ False ☐ Not Sure

4. Sound that is too loud can damage the tiny hair cells of the inner ear.
   ☐ True ☐ False ☐ Not Sure

5. Hearing loss is only a problem for elderly people.
   ☐ True ☐ False ☐ Not Sure

6. I know a lot about the types of sound that can cause hearing loss.
   ☐ True ☐ False ☐ Not Sure

7. Hearing an extremely loud sound even one time can cause you to lose some of your hearing.
   ☐ True ☐ False ☐ Not Sure

8. People with hearing loss often have problems with the following (*check all that apply*):
   - ☐ Understanding what is said in a group
   - ☐ Understanding what is said at movies, plays or on TV
   - ☐ Getting to work
   - ☐ Hearing alarms, the doorbell, or the telephone ringing
   - ☐ Understanding what is said in a classroom
   - ☐ Understanding road signs

10. During the next month, if I am around loud sound, I would be likely to try something to protect my hearing.
    ☐ Yes ☐ No ☐ Not Sure

11. If I go to a loud concert, I will wear hearing protection.
    ☐ Yes ☐ No ☐ Not Sure

12. Kids who listen to loud music all the time don't seem to have a hearing loss, so I don't have to worry about getting a hearing loss.
    ☐ Agree ☐ Disagree ☐ Not Sure

13. Having a hearing loss is not a big deal.
    ☐ Agree ☐ Disagree ☐ Not Sure

14. Have you visited the hearing exhibit at OMSI?
    ☐ Yes ☐ No ☐ Not Sure

15. Are you:
    ☐ Male ☐ Female?

16. How old are you? _____ years old.

17. Are you:
    - ☐ Hispanic
    - ☐ White
    - ☐ Black, African American
    - ☐ Other
    - ☐ American Indian, Eskimo, or Aleutian
    - ☐ Asian or Pacific Island
    - ☐ No response

Appendix D

Dangerous Decibels: Seventh-Grade Postpresentation Questionnaire

Teacher's Name_____

1. Hearing loss caused by loud sounds is something people _____ may have.
   - ☐ Over age 60
   - ☐ Over age 40
   - ☐ Over age 50
   - ☐ Of any age

2. Which of the following types of sound can be loud enough to damage your hearing? (*check all that apply*):
   - ☐ Gunfire
   - ☐ Stereo Headphones or Walkman
   - ☐ Dishwasher
   - ☐ Concert
   - ☐ Fireworks
   - ☐ None of the above

3. Hearing an extremely loud sound even one time can cause you to lose some of your hearing.
   - ☐ True
   - ☐ False
   - ☐ Not Sure

4. Which of the following are good ways to protect your hearing when you are around loud sound? (*check all that apply*):
   - ☐ Walk away from the loud sound
   - ☐ Put cotton or Kleenex in your ears
   - ☐ Turn down the volume
   - ☐ Use earplugs or ear muffs
   - ☐ Listen to loud sound for longer periods of time so your ears will get use to it
   - ☐ Spend less time around loud sounds whenever possible

5. People with hearing loss often have problems with the following: (*check all that apply*)
   - ☐ Hearing alarms, the doorbell, or the telephone ringing
   - ☐ Understanding what is said in a group
   - ☐ Getting to work
   - ☐ Understanding what is said at movies, plays or on TV
   - ☐ Understanding what is said in a classroom

6. During the next month if I am around loud sound, I would be likely to try something to protect my hearing.
   - ☐ Yes
   - ☐ No
   - ☐ Not Sure

7. People with hearing loss from loud sounds can hear normally if they:
   - ☐ Wear a hearing aid
   - ☐ Turn the volume up
   - ☐ Get closer to a sound
   - ☐ All of the above
   - ☐ None of these will make a person hear normally

8. Sounds that are too loud can damage the _____, causing hearing loss.
   - ☐ Ear drum
   - ☐ Eustachian tube
   - ☐ Hair cells in the inner ear
   - ☐ All of the above
   - ☐ Not sure

9. If I go to a loud concert, I will wear hearing protection.
   - ☐ Yes
   - ☐ No
   - ☐ Not Sure

10. Having a hearing loss is not a big deal.
   - ☐ Agree
   - ☐ Disagree
   - ☐ Not Sure

11. Sounds measuring _____ and over are damaging to human hearing.
   - ☐ 65 decibels
   - ☐ 70 decibels
   - ☐ 85 decibels
   - ☐ Not sure

12. Kids who listen to loud music all the time don't seem to have a hearing loss, so I don't have to worry about getting a hearing loss.
   - ☐ Agree
   - ☐ Disagree
   - ☐ Not Sure

13. Have you visited the hearing exhibit at OMSI?
   - ☐ Yes
   - ☐ No
   - ☐ Not Sure

14. Are you: ☐ Male or ☐ Female?

15. How old are you? _____ years old

16. Are you:
   - ☐ Hispanic
   - ☐ American Indian, Eskimo, or Aleutian
   - ☐ White
   - ☐ Asian or Pacific Island
   - ☐ Black, African American
   - ☐ No response
   - ☐ Other

Appendix E

Dangerous Decibels: Fourth-Grade Follow-Up Questionnaire

Teacher's Name: _____

1. During the past 3 months, I have done the following (*check all that apply*):
   - ☐ Used stereo headphones or Walkman
   - ☐ Used a gas-powered lawn mower or leaf blower
   - ☐ Rode on a jet ski, snowmobile or motorcycle
   - ☐ Went to a tractor pull or monster truck show
   - ☐ Went to a motorcycle or car race
   - ☐ Fired a gun
   - ☐ Played in a band
   - ☐ Rode in a "boom" car
   - ☐ Went to a concert

2. During the past 3 months, I have been around loud sound that made my ears hurt or gave me "ringing" sounds in my ears.
   ☐ Yes ☐ No ☐ Not Sure

3. I wear earplugs or ear muffs whenever I am around loud sound.
   ☐ Always ☐ Sometimes ☐ Never

4. Which of the following types of sound can be damaging to your hearing? (*check all that apply*):
   - ☐ Stereo Headphones or Walkman
   - ☐ Fireworks
   - ☐ Gunfire
   - ☐ Dishwasher
   - ☐ Washing machine
   - ☐ Concert

5. Which of the following are good ways to protect your hearing when you are around loud sound? (*check all that apply*):
   - ☐ Walk away from the loud sound
   - ☐ Put cotton or Kleenex in your ears
   - ☐ Make yourself listen to loud sound for longer periods of time so your ears will get use to it.
   - ☐ Spend less time around loud sounds whenever possible
   - ☐ Turn down the volume
   - ☐ Use earplugs or ear muffs

6. I know a lot about the types of sound that can cause hearing loss.
   ☐ True ☐ False ☐ Not Sure

7. I know a lot about how to protect my hearing when I'm around loud sound.
   ☐ True ☐ False ☐ Not Sure

8. Hearing an extremely loud sound even one time can cause you to lose some of your hearing.
   ☐ True ☐ False ☐ Not Sure

9. Sound that is too loud can damage the tiny hair cells of the inner ear.
   ☐ True ☐ False ☐ Not Sure

10. Hearing loss is only a problem for elderly people.
    ☐ True ☐ False ☐ Not Sure

11. People with hearing loss often have problems with the following (*check all that apply*):
    - ☐ Hearing alarms, the doorbell, or the telephone ringing
    - ☐ Understanding road signs
    - ☐ Understanding what is said in groups
    - ☐ Getting to work
    - ☐ Understanding what is said at movies, plays or on TV
    - ☐ Understanding what is said in the classroom

12. Having a hearing loss is not a big deal.
    ☐ Agree ☐ Disagree ☐ Not Sure

13. Kids who listen to loud music all the time don't seem to have a hearing loss, so I don't have to worry about getting a hearing loss.
    ☐ Agree ☐ Disagree ☐ Not Sure

14. If I go to a loud concert, I will wear hearing protection.
    ☐ Yes ☐ No ☐ Not Sure

15. During the past 3 months, if you were around loud sound did you try any of the following ways to protect your hearing? (*check all that apply*):
    - ☐ Ear plugs
    - ☐ Turned down the volume
    - ☐ None of the above
    - ☐ Ear muffs
    - ☐ Walked away from loud sound
    - ☐ I wasn't around loud sound

16. During the past 3 months, did you experience ringing or other noises in your ear(s) or head?
    ☐ Always ☐ Sometimes ☐ Never

17. Have you visited the hearing exhibit at OMSI?
    ☐ Yes ☐ No ☐ Not Sure

18. Are you: ☐ Male or ☐ Female?

19. How old are you? _____ years old

20. Are you:
    - ☐ Hispanic
    - ☐ White
    - ☐ Black, African American
    - ☐ American Indian, Eskimo, or Aleutian
    - ☐ Asian or Pacific Island
    - ☐ Other
    - ☐ No response

Appendix F

Dangerous Decibels: Seventh-Grade Follow-Up Questionnaire

Teacher's Name_____

1. During the past *three months,* I have done the following (*check all that apply*):
   - ☐ Used stereo headphones or Walkman
   - ☐ Used a gas-powered lawn mower or leaf blower
   - ☐ Rode on a Jet Ski, snowmobile, or motorcycle
   - ☐ Went to a tractor pull or monster truck show
   - ☐ Went to a motorcycle or car race
   - ☐ Rode in a "boom" car
   - ☐ Played in a band
   - ☐ Fired a gun
   - ☐ Went to a concert

2. During the past *three months,* I have been around loud sound that made my ears hurt or gave me "ringing" sounds in my ears.
   - ☐ Yes ☐ No ☐ Not Sure

3. I wear earplugs or ear muffs whenever I am around loud sound.
   - ☐ Always ☐ Sometimes ☐ Never

4. Which of the following types of sound can be loud enough to damage your hearing? (*check all that apply*):
   - ☐ Stereo Headphones or Walkman
   - ☐ Dishwasher
   - ☐ Fireworks
   - ☐ Gunfire
   - ☐ Concert
   - ☐ None of the above

5. Hearing an extremely loud sound even one time can cause you to lose some of your hearing.
   - ☐ True ☐ False ☐ Not Sure

6. Hearing loss caused by loud sounds is something people _____ may have.
   - ☐ Over age 60
   - ☐ Over age 50
   - ☐ Over age 40
   - ☐ Of any age

7. Having a hearing loss is not a big deal.
   - ☐ Agree ☐ Disagree ☐ Not Sure

8. If I go to a loud concert, I will wear hearing protection.
   - ☐ Yes ☐ No ☐ Not Sure

9. Which of the following are good ways to protect your hearing when you are around loud sound? (*check all that apply*):
   - ☐ Walk away from the loud sound
   - ☐ Turn down the volume
   - ☐ Listen to loud sound for longer periods of time so your ears will get use to it
   - ☐ Spend less time around loud sounds whenever possible
   - ☐ Put cotton or Kleenex in your ears
   - ☐ Use earplugs or ear muffs

10. People with hearing loss often have problems with the following: (*check all that apply*)
   - ☐ Hearing alarms, the doorbell, or the telephone ringing
   - ☐ Understanding what is said in a group
   - ☐ Getting to work
   - ☐ Understanding what is said at movies, plays or on TV
   - ☐ Understanding what is said in a classroom

11. People with hearing loss from loud sounds can hear normally if they:
   - ☐ Wear a hearing aid
   - ☐ Get closer to a sound
   - ☐ None of these will make a person hear normally
   - ☐ Turn the volume up
   - ☐ All of the above

12. Sounds that are too loud can damage the _____, causing hearing loss.
   - ☐ Ear drum ☐ Eustachian tube ☐ Hair cells in the inner ear
   - ☐ All of the above ☐ Not sure

13. Kids who listen to loud music all the time don't seem to have a hearing loss, so I don't have to worry about getting a hearing loss.
   - ☐ Agree ☐ Disagree ☐ Not Sure

14. During the past *three months,* if you were around loud sound did you try any of the following ways to protect your hearing? (*check all that apply*):
   - ☐ Ear plugs
   - ☐ Walked away from loud sound
   - ☐ None of above
   - ☐ Ear muffs
   - ☐ Turned down volume
   - ☐ I wasn't around loud sound

15. Sounds measuring _____ and over are damaging to human hearing.
   - ☐ 65 decibels
   - ☐ 85 decibels
   - ☐ 70 decibels
   - ☐ Not sure

16. Have you visited the hearing exhibit at OMSI?
   - ☐ Yes ☐ No ☐ Not Sure

17. Are you:
   - ☐ Male or ☐ Female?

18. How old are you? _____ years old

19. Are you:
   - ☐ Hispanic
   - ☐ White
   - ☐ Black, African American
   - ☐ Other
   - ☐ Asian or Pacific Island
   - ☐ American Indian, Eskimo, or Aleutian
   - ☐ No response