

THE KNOWLEDGE AND ATTITUDES REGARDING NOISE-INDUCED HEARING
LOSS AMONG ADOLESCENTS

By

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Communication Sciences and Disorders
to the Office of Graduate and Extended Studies of East Stroudsburg University of
Pennsylvania

August 6, 2021

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ABSTRACT

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Communication Sciences and Disorders to the Office of Graduate
and Extended Studies of East Stroudsburg University of Pennsylvania.

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Title: The Knowledge and Attitudes Regarding Noise-Induced Hearing Loss Among
Adolescents

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Abstract

The risk of noise-induced hearing loss (NIHL) increases with age due to engagement in loud activities and beginning work. Thirty-five students within grades 5, 6, 7, and 8 participated in this 100% online/asynchronous hearing conservation program (HCP) at a New Jersey K-8 public school. This program included a pre-survey, a 27-minute online education, a post-survey, and a 3-month post-survey. Participants were randomized into treatment and control groups. All participants received the surveys. Only the treatment group received the HCP. No significant differences were found between treatment and control groups when comparing knowledge and attitude scores on the pre-, post, and 3-month post-surveys. However, significant differences were found within the post-survey knowledge questions without any significant change in the attitude questions for the treatment group, which indicated that students who participated in the HCP had a positive increase in knowledge of NIHL although their attitudes toward prevention did not change.

DEDICATION

This work is completely dedicated to my grandmother, Mary R. Cestone. She was always interested in learning new information throughout her life, and she encouraged me to do the same.

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CHAPTER 1

INTRODUCTION

Anyone, at any age could be affected by noise-induced hearing loss (NIHL). Although everyone is exposed to noise every day, some studies have demonstrated that adolescents have the potential to learn about NIHL while attending school and prevent hearing loss before it becomes a life-long hearing impairment. Schlauch (2013) reported that 6% of teenagers (ages 12-19) have noise-induced hearing loss and this percentage has remained stable. Agrawal (2008) found that the prevalence of NIHL to be 8.5% among young adults (ages 20-29). Furthermore, Phillips et al. (2010) found that the risk of noise-induced hearing loss (NIHL) increases with age due to engagement in loud activities and beginning work. According to the National Institute on Deafness and Other Communication Disorders (2019), NIHL is believed to be 100% preventable. Therefore, adolescents may be the ideal age group to teach about NIHL as well as safe hearing practices since they are young enough to stop poor listening practices and old enough to retain the information throughout adulthood.

Several studies were conducted to evaluate the attitudes and awareness of NIHL among the adolescent and young adulthood population. Chung et al. (2005) conducted an

online survey evaluating the amount of noise exposure adolescents and young adults experience on a daily basis. The data for this study was collected within the pop-up survey that was presented to every 30th MTV website visitor for three consecutive days. Surveys were collected from 9458 total participants where 99% were aged 15-34 years and 35% of the participants were male and 65% were female. Only 8% of participants indicated hearing loss as a serious health issue. Sixty percent of participants indicated that they have already attended 1-9 concerts. However, 44% indicated that they have already attended 1-9 clubs. Over half of the responses indicated that a major factor for using hearing protection would be if information was provided regarding how even short exposure to loud music can still impact hearing. This study revealed that most young people have already experienced events in which there was loud noise exposure. However, over half of the population indicated that knowledge of NIHL would motivate them to use hearing protection during the loud events.

Alnuman et al. (2019) conducted a similar study which utilized the survey originally created by Chung et al. (2005). However, Alnuman et al. (2019) slightly altered the survey and administered the study in person at three different universities in Jordan rather than over the internet. This study added questions that involved the frequency of hearing loss symptoms, attitude towards the use of ear plugs, and the current use of hearing protection. In contrast to the study completed by Chung et al. (2005), 64% of the 245 participants indicated hearing loss as a serious health issue. Similar to the study conducted by Chung et al. (2005), this study revealed that most young people attend events or expose themselves to environments that involve loud noise. However,

Alnuman et al. (2019) reported that over half of the population selected hearing loss as a serious health issue but less than 10% of the population reported using hearing protection and only 2% of the population indicated positive attitudes towards ear plugs. Although many participants acknowledged hearing loss as a serious health issue, the awareness of hearing loss that can be caused from noise exposure was low. Keppler et al. (2015) conducted a study similar to Alnuman et al. (2019) and Chung et al. (2005) which analyzed the attitudes and beliefs of participants aged 18-30 in regard to noise exposure, hearing loss, and hearing protection devices (HPDs). The survey featured questions from the Youth Attitude to Noise Scale (YANS) by Widen and Erlandsson (2004), which addressed self-reported tinnitus and noise sensitivity among adolescents in Sweden. In addition, an audiological test battery was administered to each participant. This study revealed that the participants who indicated that noise exposure was not problematic had worse hearing thresholds at 6.0 kHz than the participants who indicated noise exposure as problematic. Alnuman et al. (2019), Chung (2005), and Keppler et al. (2015) concluded that there is a need for quality and engaging hearing educational programs in order to change the attitudes of those who find noise exposure not problematic and influence positive attitudes towards hearing protection.

Khan et al. (2018) reported the efficacy of hearing protection programs within a systematic review. Only 10 studies published between 2010-2018 fit the criteria for this systematic review. The interventions reviewed incorporated educationally based learning, increasing knowledge of hearing loss, reducing the risk of hearing loss, and influencing the usage of hearing protection. One strength across the hearing conservation programs

was that two studies showed considerable efficacy, in which hearing protection usage was significantly increased after the intervention. Another strength reported was how technology was integrated into the programs. This study revealed that there is a need for more hearing conservation programs with significant efficacy in order to increase the usage of hearing protection to reduce NIHL.

Is knowing that excessively loud noise exposure can cause NIHL enough to change the behavior? Johnson et al. (2016) conducted a study in which students from 2 different universities completed a survey modified from the YANS (Widen & Erlandsson, 2004) regarding hearing protection use and attitudes about loud sounds. Results of the study revealed that both Communication Sciences and Disorders (CSD) majors and non-CSD display similar attitudes toward use of hearing protection despite the additional training CSD majors have acquired. The results of the questionnaire revealed that students who received hearing conservation education were significantly more likely to agree that loud environments can damage their hearing; however, they were not any more likely to use hearing protection when in excessively loud environments. The researchers concluded that young adults, even those that have chosen the speech and hearing field and have received additional knowledge, have already established their attitudes toward use of hearing protection (Johnson et al., 2016). They recommended educating students before they are young adults so that their attitudes will match their knowledge regarding NIHL.

However, some schools have already provided their students with NIHL education by utilizing companies and groups outside of the school system. Three hearing

conservation programs which have been commonly utilized among public school systems throughout the last thirteen years are Dangerous Decibels® by Meinke et al. (2008), the American Speech-Language-Hearing Association (ASHA) Listen to your Buds campaign (2021), and Sound Sense by Neufeld et al. (2011). Phillips et al (2010) identified that the risk of NIHL increases with age due to engagement in loud activities and the beginning of work. Therefore, the program targeted elementary and middle school students.

Dangerous Decibels® has been successful because it is a multi-component program which considers the interests of the target audience, utilizes interactive instruction, highlights appropriate scientific content for students, provides skills-based learning as well as repetition within the program. Essential components of Dangerous Decibels® included the program's DVD, stereocilia model, "physics of sound" demonstration, "sound is vibration" demonstration, "how loud is too loud" game, sound level meter activity, hearing education handouts, free ear protection, proper ear plug instruction, and review of the noise reduction rating (NRR) from packaging (Meinke et al., 2008).

Currently, Dangerous Decibels® is one of the leading hearing conservation programs for students in elementary and middle schools.

Griest et al. (2008) analyzed the effectiveness of Dangerous Decibels® when taught to 4th and 7th grade students. The results of the study indicated that the 4th grade students found improvements in their knowledge and attitudes after the program and maintained their knowledge and attitudes after three months, while the 7th grade students only found immediate improvements in knowledge and attitudes (Griest et al., 2008).

This study revealed that young students can change their attitudes about NIHL and maintain them 3 months after a hearing conservation program.

Similar to the study by Griest et al. (2008), Dell & Holmes (2012) analyzed the efficacy of hearing conservation programs (HCP) that change the knowledge and attitudes of adolescents. The participants included 64 students, ages 12-14. The HCP analysis involved a pretest which utilized the YANS (Widen & Erlandsson, 2004). Following the pretest, the Dangerous Decibels® HCP was performed by a licensed audiologist for 1 hour. At the end of the program, the students completed a post-test. The results of this study revealed that the HCP had a statistically significant effect in reducing the pro-noise attitude among adolescents (Dell & Holmes, 2012).

Another program targeting young children was the American Speech-Language-Hearing Association (ASHA) Listen to your Buds campaign in which audiologists visited schools to educate elementary and middle school students about safe listening practices in an interactive, fun way. However, no information regarding the current state of the campaign has been published since 2014 (ASHA, 2021).

Neufeld et al. (2011) created a hearing conservation program (HCP), Sound Sense, which was presented to 846 students in grade 6 within 16 Vancouver School Board schools in Canada. The study analyzed personal music player (MP3, iPod, Smart Phone) habits and exposure to excessive noise. The HCP involved a 10-minute video and a 45-minute interactive session which educated students on the hearing anatomy and physiology, causes of NIHL, symptoms of NIHL, consequences, and prevention. At the end of the program, students received ear plugs and stickers. All students participated in

the program and there was no control group. Students were assessed before the program, 2 weeks after the program, and 6 months after the program. The results of this study revealed that participants who participated in Sound Sense increased their long-term earplug use in loud environments (Neufeld et al., 2011). This study revealed rewards acted as positive reinforcement which increased the use of ear protection.

Although the three commonly utilized HCPs are effective, there is a need for an online uncommercialized program, which is more cost effective, within a speech-language pathologist's scope of practice, as well as more accessible to schools. The COVID-19 pandemic changed the way schools are providing education. Many schools are continuing to educate students in an online or hybrid (online and in-person classes available to all students) manner. There needs to be an online option for HCPs so that this information can still reach all students if schools continue to provide online education or bring students back into the classroom full time. In addition, there is a heightened need for younger students to participate in the HCPs, as it could benefit them more than the older students. Therefore, the purpose of the current study is to increase the knowledge regarding NIHL and improve attitudes of adolescents toward ear protection and excessive noise exposure through an HCP. The importance of hearing protection education is to learn how NIHL can affect everyday life and how to prevent NIHL. This study will evaluate if there is a significant difference in the knowledge and attitudes about noise-induced hearing loss (NIHL) measured before and after an uncommercialized, online hearing conservation program for middle school students.

CHAPTER 2

METHODS

Thirty-five students within grades 5, 6, 7, and 8 voluntarily participated in an uncommercialized 100% online/asynchronous hearing conservation program developed by this lead investigator at a New Jersey K-8 public school. This study was approved by East Stroudsburg University's Instructional Review Board (IRB). A parental consent form was distributed to the consenting parents of students in grades 5, 6, 7, and 8 via Google Forms®. Students in grades 5 and 8 were in the treatment group. Students in grades 6 and 7 were in the control group. Participants did not know whether they were in the treatment group or the control group. The control and treatment groups were determined by grade using a random generator within Microsoft Excel®. Participants in both the control and treatment groups had access to all electronic surveys via Google Forms®. Only participants in the treatment group had access to the pre-recorded hearing conservation program via Screencast-O-Matic®.

A pre-survey was electronically distributed and completed by students in grades 5 (n=12, 7 males, 5 females), 6 (n=6, 3 males, 3 females), 7 (n=10, 6 males, 4 females), and 8 (n=7, 2 males, 5 females). After 40 days, the hearing conservation program link was

electronically distributed to the treatment group. After 39 days, a post-survey was electronically distributed and completed by students in grades 5 (n=11, 5 males, 6 females), 6 (n=8, 3 males, 5 females), 7 (n=12, 10 males, 2 females), and 8 (n=4, 2 males, 2 females). After all data was collected, the hearing conservation program link was sent to students in grades 6 and 7 so all could benefit from the program. Ninety-days after the post-survey closed, a 3-month post-survey was electronically distributed and completed by students in grades 5 (n=2, 0 males, 2 females), 6 (n=3, 2 males, 1 females), 7 (n=5, 3 males, 2 females), and 8 (n=0, 0 males, 0 females).

The superintendent of a New Jersey public school was contacted via email requesting for the school's participation in a NIHL conservation program. See Appendix B for *NIHL Conservation Program Permission Letter for School*. Students in grades 5, 6, 7, and 8 were asked to participate. All participants passed school hearing screenings, had the ability to read fluently as well as comprehend age-appropriate directions. Teachers were contacted regarding their roles and responsibilities throughout the program which included forwarding information from the lead investigator to parents and students as well as reminding students of completion deadline for each stage of the program (signed content form, pre-survey, video, and post-survey). See Appendix C for more information regarding *Noise-Induced Hearing Loss Conservation Program Directions to Teachers*. A parental consent form was sent out to all parents and caregivers of all students in grades 5, 6, 7, and 8. Parental consent forms were signed and returned prior to beginning the study. See Appendix D for *Noise-Induced Hearing Loss Conservation Program Informed Consent*. All participants had access to a computer in order to participate in the study.

As a result of the COVID-19 pandemic, this study was conducted in an asynchronous manner, in which the surveys were sent out electronically via Google Forms®. The pre-, post-, and 3-month post-surveys utilized the questionnaire created by Johnson et al. (2016), which is a modified version of the YANS (Widen & Erlandsson, 2004). Questions were modified for middle school students and reflected age-appropriate vocabulary and syntax. The surveys contained questions relating to the knowledge and attitudes regarding NIHL and prevention. The surveys included 10 questions, with 2 questions addressing knowledge of NIHL and 8 questions addressing attitudes towards NIHL prevention. Participants had 3 options when answering each question; agree, neutral (sometimes agree/sometimes disagree), or disagree. The surveys were used to collect participant responses for data analysis of the treatment group as well as the control group. All participants had access to the pre-survey 40 days before the program link was available. See Appendix E for *Noise-Induced Hearing Loss Conservation Program Pre-Survey Link* and Appendix F *Noise-Induced Hearing Loss Conservation Program Pre-Survey*. The post-survey was available to all participants 39 days after the program link was available. See Appendix G for *Noise-Induced Hearing Loss Conservation Program Post-Survey Link* and Appendix H for *Noise-Induced Hearing Loss Conservation Program Post-Survey*.

The NIHL conservation program, which included information regarding NIHL and prevention, was a 27-minute pre-recorded video developed and delivered online by the lead investigator using Microsoft PowerPoint® and Screencast-O-Matic®. See

Appendix I for *Noise-Induced Hearing Loss Conservation Program Link*. The asynchronous, online hearing conservation program shared many of the same premises that Meinke et al. (2008) outlined when creating Dangerous Decibels®, the successful hearing conservation program for children from ages 6-19. Dangerous Decibels® catered to the attention span of a target audience as well as providing interactive instruction, skills-based learning opportunities, and repetition of information (Meinke et al., 2008). In order to effectively engage students in grades 5, 6, 7, and 8, the lead investigator limited this presentation to 27 minutes and presented via PowerPoint® in order to share concise information and incorporate multiple infographics.

The program was separated into four sections. The first section included NIHL background information (9.5 minutes) which featured the anatomy and physiology of the hearing process, causes of NIHL, noise levels, exposure limits, as well as types of hearing loss. The second section provided interactive instruction and skills-based learning opportunities as it included a video, hearing loss simulation, as well as application to everyday life (7.5 minutes). This section featured a Fred Flintstone video simulation of types of hearing loss by Shaw (2016), explanation of how hearing loss affects speech, explanation of sound level apps (iOS vs Android), the Support Success For Children with Hearing Loss (2016) version of the iconic 1970s *Unfair Spelling Test*® simulation/check answers, as well as a reflection of *Unfair Spelling Test*®. Participants were provided with the opportunity to download and utilize one of two different free sound measurement applications on a smartphone during the simulation portion of the program. Both

applications were selected after viewing a sound-level-meter software application list, for iOS and android devices, created by Dr. Tina Childress (n.d.), an educational audiologist. Among all the applications listed, the two applications selected were free, and had the highest ratings and accuracy. The National Institute for Occupational Safety and Health (NIOSH) Sound Level Meter (SLM) application was available to iOS devices. The Decibel X application was available to Android devices. Both applications were used to teach the participant about identifying the amount of noise produced in any listening environment and which environments suggest limited exposure as well as utilizing hearing protection. The *Unfair Spelling Test*® (Support Success For Children with Hearing Loss, 2016) was utilized within the program to simulate taking a spelling test with a mild hearing loss. This section of the program required students to record their responses using a pencil and a piece of paper. The third section provided skills-based learning opportunities and repetition as it included prevention of NIHL (8 minutes) which featured strategies and ear plug demonstration as well as check your knowledge questions (3 true/false questions). The last section provided repetition as it included a review of the presentation (2 minutes). See Appendix J for *Noise-Induced Hearing Loss Conservation Program Outline*. After the completion of the study, the control group was given the option to experience the entire hearing conservation program. Three months after the post-survey closed, all participants were provided with a 3-month post-survey to complete. See Appendix K for *Noise-Induced Hearing Loss Conservation Program 3-Month Post-Survey Link* and Appendix L for *Noise-Induced Hearing Loss Conservation Program 3-Month Post-Survey*. This survey was nearly identical to the post-survey and

analyzed the retention of participants in terms of their knowledge and attitudes regarding NIHL. Statistical analysis is discussed in the next section.

CHAPTER 3

RESEARCH DESIGN

Surveys were collected from a sample of students in an elementary school in northern New Jersey. The students were in grades 5-8 and ranged in ages from 10-14. Students in grades 5 and 8 were in the treatment group and received the NIHL conservation program. The students in grades 6 and 7 served as the control group and received no training.

Data were extracted from the surveys, coded, and analyzed with the IBM® Statistical Package for the Social Sciences (SPSS)® (Version 27) software platform. After the surveys were collected and scored by the lead investigator, surveys were analyzed by a statistician. Parametric and nonparametric procedures were utilized to compare the groups (treatment vs. control, gender). Independent variables included the knowledge and attitude scores on the surveys. The dependent variables included the total survey scores. Parametric procedures included multivariate analyses of variance (*MANOVAs*) and summary statistics, which were used to analyze the pre- and post-survey data. Because of the small sample size for the 3-month post-survey, these data were

analyzed with the Mann-Whitney U test, a nonparametric procedure. This quasi-experimental study maintained anonymity of all research study participants, which precluded the use of repeated measures procedures for the analyses of survey data.

CHAPTER 4

RESULTS

Thirty-five students participated in the study. Table 1 shows total participation throughout all survey responses.

| Grade Level | Pre-Survey | Post-Survey |
|--------------------|-------------------|--------------------|
| 5 | 12 | 11 |
| 6 | 6 | 8 |
| 7 | 10 | 12 |
| 8 | 7 | 4 |
| Total: | 35 | 35 |

Table 1 – Total participation on all forms

Table 2 shows the total pre-survey participation.

| Grade Level | <i>n</i> | Male | Female |
|--------------------|-----------------|-------------|---------------|
| 5 | 12 | 7 | 5 |
| 6 | 6 | 3 | 3 |
| 7 | 10 | 6 | 4 |
| 8 | 7 | 2 | 5 |

Table 2 – *n* = sample size; total: 35 participants

Table 3 shows the total post-survey participation.

| Grade Level | <i>n</i> | Male | Female |
|--------------------|-----------------|-------------|---------------|
| 5 | 11 | 5 | 6 |
| 6 | 8 | 3 | 5 |
| 7 | 12 | 10 | 2 |
| 8 | 4 | 2 | 2 |

Table 3 – *n* = sample size; total: 35 participants

Table 4 shows the total 3-month post-survey participation.

| Grade Level | <i>n</i> | Male | Female |
|--------------------|-----------------|-------------|---------------|
| 5 | 2 | 0 | 2 |
| 6 | 3 | 2 | 1 |
| 7 | 5 | 3 | 2 |
| 8 | 0 | 0 | 0 |

Table 4 – *n* = sample size; total: 10 participants

There were no significant differences found between the pre- and post-survey knowledge and attitude factor scores within the control and treatment groups after treatment group participation in the hearing conservation program. Table 5 shows summary statistics for the pre- and post-survey total scores by group.

| Variable | <i>n</i> | <i>M</i> | <i>SD</i> | 95% <i>CI</i> |
|------------------------------|-----------------|-----------------|------------------|----------------------|
| Pre-survey: Treatment group | 19 | 2.03 | 0.26 | [1.91, 2.16] |
| Pre-survey: Control group | 16 | 2.05 | 0.45 | [1.81, 2.29] |
| Post-survey: Treatment group | 15 | 1.95 | 0.34 | [1.76, 2.13] |
| Post-survey: Control group | 20 | 2.03 | 0.47 | [1.80, 2.25] |

Table 5 – *n* = sample size; *M* = mean; *SD* = Standard Deviation; *CI* = Confidence Interval

There were no significant differences found when comparing the knowledge and attitude scores of the treatment and control groups. There were 2 knowledge questions (numbers 9 and 10) and 8 attitude questions (numbers 1-10) on the pre-survey (Appendix F). Questions Table 6 shows the summary statistics for the pre-survey knowledge and attitude scores.

| Variable | <i>n</i> | <i>M</i> | <i>SD</i> | 95% <i>CI</i> |
|--------------------------------|-----------------|-----------------|------------------|----------------------|
| Pre-Knowledge Score: Treatment | 19 | 1.58 | 0.51 | [1.33, 1.82] |
| Pre-Knowledge Score: Control | 16 | 1.59 | 0.52 | [1.31, 1.87] |
| Pre-Attitude Score: Treatment | 19 | 2.14 | 0.32 | [1.99, 2.30] |
| Pre-Attitude Score: Control | 16 | 2.16 | 0.49 | [1.90, 2.43] |

Table 6 – *n* = sample size; *M* = mean; *SD* = Standard Deviation; *CI* = Confidence Interval

However, significant differences were found within the post-survey responses when comparing the knowledge and attitude scores within the treatment group, with significantly lower scores for the knowledge factor. No significant differences were found when comparing treatment and control group knowledge and attitude scores. There were 2 knowledge questions (numbers 3 and 9) and 8 attitude questions (numbers 1, 2, 4-8, and 10) on the post-survey (Appendix H). Table 7 shows the summary statistics for the post-survey knowledge and attitude scores.

| Variable | <i>n</i> | <i>M</i> | <i>SD</i> | 95% <i>CI</i> |
|---------------------------------|-----------------|-----------------|------------------|----------------------|
| Post-Knowledge Score: Treatment | 15 | 1.43 | 0.42 | [1.20, 1.66] |
| Post-Knowledge Score: Control | 20 | 1.68 | 0.59 | [1.40, 1.95] |
| Post-Attitude Score: Treatment | 15 | 2.08 | 0.38 | [1.86, 2.29] |
| Post-Attitude Score: Control | 20 | 2.11 | 0.49 | [1.88, 2.34] |

Table 7 – *n* = sample size; *M* = mean; *SD* = Standard Deviation; *CI* = Confidence Interval

There were no significant differences found when comparing the knowledge and attitude scores of the treatment and control groups on the 3-month post-survey. There were 2 knowledge questions (numbers 3 and 9) and 8 attitude questions (numbers 1, 2, 4-8, and 10) on the 3-month post-survey (Appendix L). Table 8 shows the summary statistics for the 3-month post-survey knowledge and attitude scores by group.

| Variable | <i>n</i> | <i>Mean Rank</i> | <i>p-Value</i> |
|------------------------------------|-----------------|-------------------------|-----------------------|
| 3-month Knowledge Score: Treatment | 2 | 8.75 | .09 |
| 3-month Knowledge Score: Control | 8 | 4.69 | |
| 3-month Attitude Score: Treatment | 2 | 7.50 | .40 |
| 3-month Attitude Score: Control | 8 | 5.00 | |

Table 8 – *n* = sample size; total score = mean of items 1-10; knowledge score = mean of items 3 and 9; attitude score = mean of items 1, 2, 4 to 8, and 10

There were no significant differences found when comparing the knowledge and attitude scores between male and female participants on the 3-month post-survey. Table 9 shows the summary statistics for the 3-month post-survey knowledge and attitude scores by gender.

| Variable | <i>n</i> | <i>Mean Rank</i> | <i>p-Value</i> |
|---------------------------------|-----------------|-------------------------|-----------------------|
| 3-month Knowledge Score: Female | 5 | 7.10 | .10 |
| 3-month Knowledge Score: Male | 5 | 3.90 | |
| 3-month Attitude Score: Female | 5 | 7.10 | .10 |
| 3-month Attitude Score: Male | 5 | 3.90 | |

Table 9 – *n* = sample size; total score = mean of items 1-10; knowledge score = mean of items 3 and 9; attitude score = mean of items 1, 2, 4 to 8, and 10

CHAPTER 5

DISCUSSION

There was a significant difference between post-survey knowledge and attitudes scores of the treatment group, which indicated that students who participated in the hearing conservation program had a positive increase in knowledge of NIHL although their attitudes toward protecting hearing did not change. Middle school training may not be early enough. In Griest et al. (2008) study, the 4th and 7th grade students both benefited from the hearing conservation program; however, the 7th grade students did not maintain their change in attitudes when assessed after 3 months. In this current study, there was still no significance between the 5th and 8th grade treatment group when analyzing the 3-month post-survey retention of knowledge. Similar effects were found by Johnson et al. (2016) when comparing collegiate CSD students with collegiate non-CSD students, as there was no difference in the behavior of ear protection use even with knowledge regarding harmful effects of excessive noise exposure. It is possible that older middle school students may have already formed their opinions, like young adults. Younger children are more impressionable and can be more willing to consider other viewpoints (Meinke et al., 2008). They are less influenced by peers, therefore, there is a possibility

that their attitudes may be able to change before they have already formed their opinions about NIHL prevention and protection.

This study found that there was no overall significant difference between the pre-, post-, and 3-month post-surveys. However, Dell and Holmes (2012) found statistically significant effects in reducing the pro-noise attitude among adolescents and Neufeld et al. (2011) found statistically significant effects in increasing long-term earplug use in loud environments (Neufeld et al., 2011). One of the possible reasons why there was no significance found in this current study was that this program was different from Dell and Holmes (2012) and Neufeld et al. (2011) as it was delivered in a 100% online and asynchronous format. Dangerous Decibels® by Meinke et al. (2008) provided multiple skills-based learning activities within the program. Although there were a few skills-based learning opportunities embedded into this study's online video, there was no way to make sure students were practicing the skills in the correct manner. There was a time delay of 39-40 days between surveys and program. Therefore, there was a possibility of limited retention of information. Dell and Holmes (2012) found significant results in reducing the pro-noise attitude among adolescents and provided their participants with their post-survey immediately after the HCP. The asynchronous and online format made it very difficult to maintain anonymity and track students. Therefore, students were not matched on the pre-, post-, and 3-month post-surveys.

Since the program was asynchronous, the home environments of the participants could have played a role in their performance and participation. Family members or friends could have assisted the participants during the program. Although there was no

specific tracking mechanism to see which participant watched the program, there was a mechanism within the program which counted the number of times the video was watched. In total, the video was watched 10 times and 19 participants were in the treatment group which means that not everybody watched the video. Due to the online delivery manner, there was no way to distribute ear protection (ear plugs) during the program. Due to the age of the participants, they needed to rely on their parents or family members to provide them with ear protection whereas Dell and Holmes (2012) provided their participants with ear plugs at the end of their program. Another reason why significance may not have been found between the pre-, post-, and 3-month post-surveys could be because the same survey was given for all grades, and students in grades 5-8 have different reading comprehension and vocabulary levels, which could have led to confusion and impacted their responses. For example, this survey might have been the first survey they completed which utilized a rating scale for their responses. The options included the terms *agree*, *disagree*, and *neutral*. In addition, the term *hearing protection* was utilized often. If the participants did not know what those terms meant, that would greatly affect the accuracy of their responses. In addition, a substantial amount of development occurs between grades 5 and 8, which can affect participant attention, motivation, and interest.

One major reason why there might not have been significant differences found in the 3-month post-survey would be that there were only 10 total participants with only 2 participants in the treatment group. Perhaps the timing of this survey was related to the

low participation rate as this survey was available during the last two weeks of the participants' school year.

Due to the nature of COVID-19, this study was presented with challenges. Only one school chose to participate, which limited the possible number of participants. Although there was a total of 129 students in grades 5, 6, 7, 8, only 35 agreed to participate. Different delivery methods were utilized when contacting the participants and their parents. Sometimes the superintendent sent the information from the lead investigator to parents and participants, and other times, the health teachers were the main form of contact. This study had limited free resources and there was a lack of funding. There were no incentives provided to the participants and no physical reward system was present. In a previous study by Neufeld et al. (2011), the 6th grade participants changed their long-term behavior and received stickers at the end of the program. There is a possibility that the participants of this study might have changed their attitudes if there was a physical reward system present.

CHAPTER 6

CONCLUSION

There was a significant difference between post survey knowledge and attitude scores, which indicated that students who participated in the hearing conservation program had a positive increase in knowledge of NIHL although their attitudes did not change. Although this program had a positive increase in knowledge, presenting this HCP in the same online and asynchronous manner to younger children in grades 3-5 might have a greater impact of behavior change toward the use of ear protection. Researchers should alter presentation style and interest suitable for grades 3-5 and utilize a program which tracks student activity to hold students more accountable. There should be an increase in communication among teachers/participating schools as well as an increase in the number of participants. Another possibility is conducting a longitudinal study which would track how knowledge and attitudes change throughout the years, beginning in younger grades such as kindergarten to 2nd grade. If the program is repeated in a synchronous manner to participants in grades 3-5, an in-class facilitator with a CSD background should be utilized to distribute the surveys and present the program. Since NIHL is 100% preventable (National Institute on Deafness and Other Communication

Disorders, 2019), further study is warranted to find effective HCP programs that will both educate and result in positive behavioral changes.

APPENDICES

Appendix A



East Stroudsburg University Institutional Review Board
Human Research Review
Protocol # ESU-IRB-015-2021

Date: August 11, 2020
To: Mary Bulger and Susan Dillmuth-Miller
From: Shala E. Davis, Ph.D., IRB Chair
Proposal Title: "Knowledge and Attitudes Regarding Noise-Induced Hearing Loss Among Adolescents Pre and Post Conservation Program"

Table with 4 columns: Review Requested, Exempted, Expedited X, Full Review. Review Approved: Exempted, Expedited X, Full Review.

FULL RESEARCH

- Three bullet points describing full review research proposal outcomes: approved, approved with recommendations, and not approved.

EXEMPTED RESEARCH

- Three bullet points describing exempted review research proposal outcomes: approved, approved with recommendations, and not approved.

EXPEDITED RESEARCH

- Three bullet points describing expedited review research proposal outcomes: approved, approved with recommendations, and not approved.

Please revise or submit the following:

Appendix B

NIHL Conservation Program Permission Letter for School

July 28, 2020

Dear Superintendent of New Jersey School:

I am a graduate student under the direction of Professor Susan Dillmuth-Miller in the Department of Communication Sciences and Disorders at East Stroudsburg University. I am conducting a research study to investigate the knowledge and attitudes regarding noise-induced hearing loss (NIHL) among adolescents. Would you please consider allowing your school to participate in this study?

The purpose of the *NIHL Conservation Program* is to determine if there is a significant difference in the knowledge and attitudes about noise-induced hearing loss (NIHL) measured before and after a hearing conservation program for middle school students. The *NIHL Conservation Program* includes a slide presentation about NIHL as well as a NIHL simulation which will feature the interactive components so that students may deepen their understanding of what NIHL is and how to prevent it.

This study will include an online pre-survey, an online hearing conservation program, and an online post-survey, which will be completed by students in grades 5, 6, 7, and 8. The *NIHL Conservation Program Pre-Survey* will take up to ten minutes for a student to complete. The actual hearing conservation program is approximately 20-25 minutes long. The *NIHL Conservation Program Post-Survey* will take about ten minutes to complete. In order to measure the effectiveness of the program, half of the students participating will view the hearing conservation program while the other half will not.

Each student's participation in this study is voluntary. If parents choose for their children not to participate, there will be no penalty. Parents can choose to have their children discontinue the study at any time. The pre and the post-surveys will not collect any identifying information. The results of the study may be published but the participant names will not be disclosed.

I am kindly requesting your school's participation. The potential benefits of the study include education regarding the harmful effects of excessive noise. In addition, this research may encourage other school systems to provide electronic NIHL programs for the teenage population each year, as they are at a greater risk for developing NIHL. There are no risks involved in participating in this study.

Following my research study, the hearing prevention program will be available to all students. If you have any questions concerning the research study, please email me at mbulger@live.esu.edu or my faculty advisor at sdmiller@esu.edu.

Thank you for considering your school's participation in this valuable study.

Sincerely,

Mary K. Bulger
mbulger@live.esu.edu
(908)455-0538

Dr. Susan Dillmuth-Miller
Associate professor/clinical audiologist
sdmiller@esu.edu
(484)330-9022

Appendix C

Noise-Induced Hearing Loss Conservation Program Directions to Teachers
September 27, 2020

Dear Teachers:

I am a graduate student under the direction of Professor Susan Dillmuth-Miller in the Department of Communication Sciences and Disorders at East Stroudsburg University. I am conducting a research study to investigate the knowledge and attitudes regarding noise-induced hearing loss (NIHL) among adolescents. Would you consider participating in this study?

This study will include an online pre-survey, an online hearing conservation program, and an online post-survey, which will be completed by the students. The *NIHL Conservation Program Pre-Survey* will take up approximately ten minutes for your students to complete. The hearing conservation program is approximately 20-25 minutes long and the *NIHL Conservation Program Post-Survey* will take approximately ten minutes to complete. In order to measure the effectiveness of the program, half of the students will view the hearing conservation program while the other half will not.

The potential benefits of the study include education regarding the harmful effects of excessive noise. In addition, this research can encourage other school systems to provide electronic NIHL programs for the teenage population each year, as they are at a greater risk for developing NIHL. There are no risks involved in participating in this study.

Each student's participation in this study is voluntary. If parents choose for their children not to participate, there will be no penalty. Parents can choose to have their children discontinue the study at any time. The both the pre- and the post-surveys will not collect any identifying information. The results of the study may be published but participant names will not be known.

Following my research study, the hearing prevention program will be available to all students. I have outlined the following steps in order so that the study can be as accurate as possible:

1. When instructed, forward email #1 to all parents in your homeroom which will include informed consent.
2. When instructed, forward email #2 with pre-survey link to either parents or participants, depending on class format.
3. I will randomize students by homeroom to determine who will view the hearing conservation program. If your class is chosen to watch the hearing conservation program, then I will ask you to forward email #3 to all parents or participants in your homeroom. This is the email in which students will click on the link and participate in activities during the online program. **If your class is not chosen to watch the hearing conservation program, you will not receive email #3 to forward to parents or participants, as your class will not participate in this step.**
4. When instructed, forward email #4 to all parents or participants in your homeroom which will include post-survey link. This is the email in which students will complete the post-survey.

I will be in touch with you via email every step of the way, reminding you of which email to send to parents and when. Thank you for considering participating in this valuable study. If you have any questions concerning the research study, please email me at mbulger@live.esu.edu or my faculty advisor at sdmiller@esu.edu.

Sincerely,
Mary K. Bulger
mbulger@live.esu.edu

Appendix D

Noise-Induced Hearing Loss Conservation Program Informed Consent

October 6, 2020

Dear Parents/Guardians:

I am a graduate student under the direction of Professor Susan Dillmuth-Miller in the Department of Communication Sciences and Disorders at East Stroudsburg University. I am conducting a research study to investigate the knowledge and attitudes regarding noise-induced hearing loss (NIHL) among adolescents. Would you consider allowing your child to participate in this study?

This study will include an online pre-survey, an online hearing conservation program, and an online post-survey, which will be completed by students in grades 5, 6, 7, and 8. The *NIHL Conservation Program Pre-Survey* will take up approximately ten minutes for your child to complete. The hearing conservation program is approximately 20-25 minutes long and the *NIHL Conservation Program Post-Survey* will take approximately ten minutes to complete. In order to measure the effectiveness of the program, half of the students participating will view the hearing conservation program while the other half will not.

The potential benefits of the study include education regarding the harmful effects of excessive noise. In addition, this research can encourage other school systems to provide NIHL programs for the teenage population each year, as they are at a greater risk for developing NIHL. There are no risks involved in participating in this study

Your child's participation in this study is voluntary. If you choose for your child not to participate, there will be no penalty. Know that you can choose to have your child discontinue the study at any time. Both the pre- and the post-surveys will not collect any identifying information. The results of the study may be published but your child's name will not be known.

Following my research study, the hearing prevention program will be available to all students.

Thank you for considering participating in this valuable study. **Please click on the link below in order to provide consent for your child to participate in this study.**

https://docs.google.com/forms/d/e/1FAIpQLSfCBNjSmYthiaMw2KddkCvxUPpRCv9uGcVI2RTOVFVWUZDHGg/viewform?usp=sf_link

If you choose to have your child participate in this study, an email will be sent to either you or your child (depending on your child's class format) with the *NIHL Conservation Program Pre-Survey* link for your child to complete.

If you have any questions concerning the research study, please email me at mbulger@live.esu.edu or my faculty advisor at sdmiller@esu.edu.

Sincerely,

Mary K. Bulger
mbulger@live.esu.edu

Appendix E

Noise-Induced Hearing Loss Conservation Program Pre-Survey Link

October 22, 2020

Dear Parents/Guardians:

Please have your child complete the *Noise-Induced Hearing Loss Conservation Program Pre-Survey*:

https://docs.google.com/forms/d/e/1FAIpQLScPsU8foVUnXh-bHoYj_sKCn5ihdA0u9WBvErJdFW2gf7nlyw/viewform?usp=sf_link

If you have any questions concerning the research study, please email me at mbulger@live.esu.edu or my faculty advisor at sdmiller@esu.edu.

Thank you so much for your child's participation in my study!

Sincerely,

Mary K. Bulger

mbulger@live.esu.edu

Appendix F

Noise-Induced Hearing Loss Conservation Program Pre-Survey

Age: _____ Grade: _____ Gender: Male _____ Female _____

| | | Agree | Neutral (Sometimes agree/sometimes disagree) | Disagree |
|-----|--|-------|---|----------|
| 1. | I enjoy music when it is played very loud. | | | |
| 2. | Sound levels at concerts, sporting events, or other loud places are NOT a problem to me. | | | |
| 3. | I would leave the room if sounds were too loud. | | | |
| 4. | I often use hearing protection at concerts, sporting events, or other loud places. | | | |
| 5. | I think people are too concerned about loud sounds. | | | |
| 6. | I find it uncomfortable to use hearing protection. | | | |
| 7. | I plan to wear hearing protection at concerts, sporting events, or other places where there are loud sounds. | | | |
| 8. | If my friends used earplugs at concerts, sporting events, or other loud places, I would use them. | | | |
| 9. | Sound levels at concerts, sporting events, or other loud places may cause damage to my hearing. | | | |
| 10. | I have already learned information about how loud sounds can affect my hearing and ways to prevent hearing loss. | | | |

Appendix G

Noise-Induced Hearing Loss Conservation Program Post-Survey Link

January 8, 2021

Dear Parents/Guardians:

Please have your child complete the *Noise-Induced Hearing Loss Conservation Program Post-Survey*:

https://docs.google.com/forms/d/e/1FAIpQLSduocq3qPmPpyO4fsav7gYQtIILCNBGH2gKKLWgEI0m_KRjHw/viewform?usp=sf_link

If you have any questions concerning the research study, please email me at mbulger@live.esu.edu or my faculty advisor at sdmiller@esu.edu.

Thank you so much for your child's participation in my study!

Sincerely,

Mary K. Bulger
mbulger@live.esu.edu

Appendix H

Noise-Induced Hearing Loss Conservation Program Post-Survey

Age: _____ Grade: _____ Gender: Male _____ Female _____

| | | Agree | Neutral (Sometimes agree/ sometimes disagree) | Disagree |
|-----|--|-------|---|----------|
| 1. | I think people are too concerned about loud sounds. | | | |
| 2. | I plan to wear hearing protection at concerts, sporting events, or other places where there are loud sounds. | | | |
| 3. | Sound levels at concerts, sporting events, or other loud places may cause damage to my hearing. | | | |
| 4. | If my friends used earplugs at concerts, sporting events, or other loud places, I would use them. | | | |
| 5. | I enjoy music when it is played very loud. | | | |
| 6. | I would leave the room if sounds were too loud. | | | |
| 7. | Sound levels at concerts, sporting events, or other loud places are NOT a problem to me. | | | |
| 8. | I often use hearing protection at concerts, sporting events, or other loud places. | | | |
| 9. | I have learned information about how loud sounds can affect my hearing and ways to prevent hearing loss. | | | |
| 10. | I find it uncomfortable to use hearing protection. | | | |

Appendix I

Noise-Induced Hearing Loss Conservation Program Link

12/01/2020

Dear Parents/Guardians:

I am requesting your child's participation in the NIHL Conservation Program. Noise-induced hearing loss (NIHL) is the only preventable type of hearing loss, yet it is prevalent among adolescents and young adults. There is a heightened need to increase the awareness and research concerning the knowledge and attitudes of adolescents regarding NIHL.

The purpose of the NIHL Conservation Program is to determine if there is a significant difference in the knowledge and attitudes about noise-induced hearing loss (NIHL) measured before and after a hearing conservation program for middle school students. The NIHL Conservation Program includes a 30-minute slide presentation about NIHL as well as a NIHL simulation which will feature the interactive components so that students can deepen their understanding of what NIHL is and how to prevent it.

Please have your child view the NIHL Conservation Program Link:

<https://screencast-o-matic.com/watch/cYXijiMF18>

If you have any questions concerning the research study, please email me at mbulger@live.esu.edu or my faculty advisor at sdmiller@esu.edu.

Sincerely,

Mary K. Bulger
mbulger@live.esu.edu

Appendix J

Noise-Induced Hearing Loss Conservation Program Outline

27-minute pre-recorded video

- NIHL background information (9.5 mins)
 - Facts, anatomy of the ear
 - Causes of NIHL
 - Noise levels
 - Exposure limits
 - Types of hearing loss
- Video, simulation, and application (7.5 mins)
 - Fred Flintstone video simulation of types of hearing loss
 - How hearing loss affects speech
 - Sound level apps (iOS vs Android)
 - *Unfair Spelling Test*® simulation/check answers
 - Reflection of *Unfair Spelling Test*®
 - (Support Success For Children with Hearing Loss, 2016)
- Prevention of NIHL (8 mins)
 - Strategies and ear plug demonstration
 - Check your knowledge questions (3 true/false questions)
- Review of presentation (2 mins)

Appendix K

Noise-Induced Hearing Loss Conservation Program 3-Month Post-Survey Link

June 1, 2021

Dear Parents/Guardians:

Please have your child complete the *Noise-Induced Hearing Loss Conservation Program 3-Month Post-Survey*:

<https://docs.google.com/forms/d/1eNlotFmP24C7qeGrTwrONVwh6tcpqNrKiuol4Qavw1A/edit>

This survey will be available until Friday, June 11, 2021.

If you have any questions concerning the research study, please email me at mbulger@live.esu.edu or my faculty advisor at sdmiller@esu.edu.

Thank you so much for your child's participation in my study!

Sincerely,

Mary K. Bulger
mbulger@live.esu.edu

Appendix L

Noise-Induced Hearing Loss Conservation Program 3-Month Post-Survey

Age: _____ Grade: _____ Gender: Male _____ Female _____

| | | Agree | Neutral <i>(Sometimes agree/ sometimes disagree)</i> | Disagree |
|-----|--|-------|---|----------|
| 1. | I think people are too concerned about loud sounds. | | | |
| 2. | I plan to wear hearing protection at concerts, sporting events, or other places where there are loud sounds. | | | |
| 3. | Sound levels at concerts, sporting events, or other loud places may cause damage to my hearing. | | | |
| 4. | If my friends used earplugs at concerts, sporting events, or other loud places, I would use them. | | | |
| 5. | I enjoy music when it is played very loud. | | | |
| 6. | I would leave the room if sounds were too loud. | | | |
| 7. | Sound levels at concerts, sporting events, or other loud places are NOT a problem to me. | | | |
| 8. | I often use hearing protection at concerts, sporting events, or other loud places. | | | |
| 9. | I have learned information about how loud sounds can affect my hearing and ways to prevent hearing loss. | | | |
| 10. | I find it uncomfortable to use hearing protection. | | | |

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