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Faculty of Computing, Health and Science

Using Auditory Simulations to Enable Prevention of Noise Exposure in School-Age Children and Young Adults

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Using Auditory Simulations to Enable Prevention of Noise Exposure in School-Age Children and Young Adults

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Disclaimer

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Executive Summary

Health education regarding noise-induced hearing loss and tinnitus is vitally important for a generation that is growing up listening to music via the MP3 player. It is clear that exposure to loud sounds during leisure activities, especially via the ubiquitous iPod and its in-the-ear earphones, is a concern to young people and their parents. The research reported here examined attitudes to the risks of developing hearing loss and tinnitus amongst young people and investigated the effectiveness of auditory simulations of hearing loss and tinnitus as a way to convey a health-based fear appeal aimed at teenagers and young adults.

Key Findings

Key findings from this study regarding a snapshot of current listening behaviours of young people are:

- 47.9% of 12- to 17-year-olds reported that 'sometimes to always' they have noticed ringing in their ears after being at a club, concert, or music festival; of the 18- to 25-year-olds, who, presumably attend music entertainment venues more often, 87.2% reported that 'sometimes to always' they have come home and noticed their ears were ringing;
- 46% of parents worry or complain to their children about their listening to loud music;
- Parents or guardians are reported as being the group of people who most often warn young people of the dangers of listening to music at high volumes, for 12- to 17-year-olds (61.7%) and 18- to 25-year-olds (72.3%);
- 36.1% of the teenagers and 44.6% of young adults listened to their iPod or MP3 player at between 50% to 75% of the maximum volume;
- Nearly half of teenagers/young adults spend a large amount of time involved in activities related to loud music (44.6%);
- The majority of young people in the study have been warned that listening to music at really high volumes can be dangerous to their hearing (89.6%);
- Most young people believe that noise-induced hearing loss is an important issue for young people (65%);
- 70.3% of young people reported that they do not wear any form of hearing protection at music events.

Key findings from this study regarding the effectiveness of auditory simulations of hearing loss and tinnitus to augment the hearing conservation message are:

- Young people who took part in a simulation exercise in conjunction with a health education message demonstrated a
  - 30% increase in **Motivation** to protect themselves against excessive noise;
  - 57% increase in **Attitude** towards reducing excessive noise exposure;
  - 53% increase in **Intention** to change their listening habits;
  - 44% increase in **Fear** regarding overexposure to loud noise.

Recommendations

From the evidence presented in this study, a set of recommended actions are proposed.

- **Early Intervention and Prevention**

It is imperative for young adults and school-age children to be specifically targeted at school and in their leisure time with the aim of developing lifelong changes in their attitudes and behaviours towards hearing conservation.

- **Ongoing Communication Strategies.**

Consistent and ongoing communication strategies are necessary to ensure the dissemination of information about the risks of noise-induced hearing loss and tinnitus. These strategies need to be innovative (e.g., through the use of auditory simulations and other educational messages) and relevant (e.g., focussing on the fidelity of music) to capture the attention of young people.

- **Use of Auditory Simulations of Hearing Loss and Tinnitus in Conjunction with Education.**

The importance of the inclusion of auditory simulations used in conjunction with noise-induced hearing loss education has been shown to be effective with teenagers, probably because it is a novelty.

- **Education Materials Need to be Integrated into School Curricula.**

Education about hearing loss and tinnitus (and hearing conservation) needs to be incorporated into curricula at high school (and earlier).* In addition, it is recommended that age-appropriate material about hearing loss and perhaps its economic, health, and social effects also be integrated into other curricula (such as Economics, Human Biology, or Society and Environment courses), preferably as part of a national curriculum.

- **Involving Parents in Hearing Loss and Tinnitus Education.**

Involving parents in the education of the risk factors leading to noise-induced hearing loss and tinnitus at schools enables them to reinforce any new positive behaviours at home.

* An example of how this may be achieved is provided by researchers at Edith Cowan University and National Acoustic Laboratories who are developing a set of nine hour-long modules that will teach hearing conservation and music-induced hearing loss in a popular course titled Integrated Science offered in WA high schools. These modules are the first promising attempt to provide teachers with a set of resources, activities, learning modules, and simulations in a standardised package that teachers can implement in the Integrated Science course.

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1 Scope of the Report

This is the final report for the research project titled 'Using Auditory Simulations to Enable Prevention of Noise Exposure in School-Age Children and Young Adults' which was implemented by The Hearing Loss Prevention Program for the Department of Health and Ageing over a two-year period. From the beginning in June 2008 through to the end of the reporting period in June 2010, the aim has been to determine whether a health-based fear appeal augmented by simulations of hearing loss and tinnitus would be more effective than warnings that emphasise health concerns alone.

This report provides information relating to the process, outcomes and achievements of the project against each objective, as set out in the funding agreement, for the period 1 June 2008 to 30 June 2010. This includes an overview of what the project aims, objectives and goals initially were at the start of the project. An overview of the significance and importance of noise-induced hearing loss (NIHL) as well as a brief literature review covering a health-based fear appeal augmented by simulations of hearing loss is provided.

In the sections to follow, an outline of each of the stages of the project as well as the methodology in which this project was implemented is provided. In later sections, the preliminary findings and recommendations based on these results are provided.

> "...the aim has been to determine whether a health-based fear appeal augmented by simulations of hearing loss and tinnitus would be more effective than warnings that emphasise health concerns alone."

2 Introduction

2.1 Specific Aims of the Research

The specific aim of this research project was to determine whether a health-based fear appeal augmented by simulations of hearing loss and tinnitus would be more effective than warnings that emphasise health concerns alone. The effectiveness of the message was evaluated by:

a) measuring the attitude (sensibility) to the recommended behaviours;
b) measuring the behavioural intention to adopt the promoted behaviour;
c) measuring attitudes about hearing conservation behaviours;
d) measuring the fear related to developing hearing loss and tinnitus.

2.2 Project Objectives

This research planned to investigate one of the Office of Hearing Services' priority areas, namely, Targeting School-Age Children and Young People With Preventative Education. The research focused on young people (12- to 25-year-olds) who regularly use personal stereo systems including iPods. It was important to focus on this age group because they are notoriously resistant to the hearing conservation message (Florentine et al., 1998; Lewis, 1989; Roeser, 1980). The long-term objectives of the research were to:

- determine the relative contribution of simulation-based appeals to increase hearing conservation and awareness of noise exposure;
- aid in the conceptual and practical design of more effective hearing conservation programs and curricula aimed specifically at young people;
- contribute to knowledge concerning a current trend in health promotion – that is, the trend of emphasising the likely consequences of an unhealthy behaviour (in our case, through the use of auditory simulations of hearing loss and tinnitus);
- define enablers and barriers to the hearing prevention message involving auditory simulations.

2.3 Program Goals

The primary goal of the research was to determine whether exposure to vivid auditory simulations of hearing loss and tinnitus increases the intention and motivation to practise hearing conservation. This goal was evaluated by comparing responses of three groups in a randomised control trial on questionnaires that measured fear of developing hearing loss and tinnitus, as well as attitudes, motivations, and intentions to change behaviour.

A secondary goal was to provide insight into the behavioural characteristics of people regarding hearing conservation. This was evaluated by evaluating demographic and attitudinal data provided by the participants.

3 Background to the Project

3.1 What is Noise-Induced Hearing Loss?

Noise-induced hearing loss (NIHL) is a condition resulting from exposure to sounds of sufficient intensity and duration which permanently damages hearing. Typically, a person with NIHL reports a decreased sensitivity for high-pitched sounds and difficulties understanding speech, especially in background noise (LePage, 1998). The sensitivity is often accompanied by tinnitus, a term given to internally generated noises which a person may hear as “buzzes” or “whistles.”

3.2 Effects of Noise-Induced Hearing Loss on Hearing and Well-Being

There is no surgical or medical intervention that can reverse the effects of NIHL, so traditionally, the focus of research has been on preventative programs aimed at school-age children and young adults to initially reduce the risk of NIHL. Past research and the experience of practising audiologists at Australian Hearing and at the National Acoustic Laboratories is that the vast majority of people are simply not aware of the warning signals of an overexposure to noise (e.g., tinnitus) and that by the time people are aware of a hearing loss, the damage has already been done (e.g., Crandell, Mills, & Gauthier, 2004).

A large part of the reason for this ignorance is the lack of a coordinated educational hearing conservation program undertaken by health promotion agencies. Furthermore, researchers and public policy planners have also stated that it is imperative for young adults and school-age children to be specifically targeted at school and in their leisure time with the aim of developing lifelong changes in their attitudes towards hearing conservation (e.g., Australian Government Hearing Services Research Program: Research Framework, 2007; Chung, Des Roches, Meunier, & Eavey, 2005).

Aside from the obvious financial cost to society, the cost of NIHL to one’s personal life is inestimable: Poor hearing leads to frustration, miscommunication, withdrawal from society, and a quantifiable loss of quality of life (Mathers, Vos, & Stevenson, 1999). In non-occupational settings, engaging in recreational activities (e.g., riding motorcycles, shooting), hobbies (e.g., using power tools, leaf blowers, lawn mowers), and listening to music (attending rock and symphony concerts, using personal and car stereos) also has the potential to cause NIHL. To our knowledge, there are no studies documenting how often hearing protection is used in many non-occupational settings, but the number of people who use earplugs at concerts is small (Royster & Royster, 1990).

3.3 Why the Younger Population is at Increased Risk of Noise-Induced Hearing Loss

The present study focused on young people, especially those who used personal stereo systems (e.g., iPods and other MP3 players). Personal stereos are especially popular with school-age children and young people as well as commuters, and factory workers who wish to mask out background noise. Surveys estimate that between 37% (in England) to 80% (in the USA and Hong Kong) of school children aged between 11 to 18 years own and use personal stereos (Clark, 1992). Comparable usage rates for Australia are not known, but 52% of LePage and Murray's (1998) subjects aged between 10-19 years were classified as moderate or heavy users of personal stereos. The preferred volume level for personal stereos is typically high, with estimates ranging from 90 to 104 dB (Lee, Senders, Gantz, & Otto., 1985; Rice, Breslin, & Roper, 1987). Rice, Rossi, and Olina (1987) have concluded that children are especially at risk from personal stereos after finding that approximately 20% of a sample group of school children reported sensations of fullness or ringing after their listening sessions.

3.4 Effectiveness of Hearing Conservation Programs

The goals of hearing conservation are straightforward and strategies to prevent NIHL can be easily understood. The difficulty, however, is that the development of a hearing loss is insidious: A permanent impairment may not be apparent for years, even though the listener has experienced early warning signs of tinnitus and/or temporary threshold shift (TTS) (Haller & Montgomery, 2004; Niskar et al., 2001). Indeed, by the time a person seeks help with NIHL, thresholds at 4 and 6 kHz are typically around 25 dB, which, though roughly classified as only a 5% hearing loss (Macrae, 1998), is a level that is certainly noticeable.

3.5 Explaining Attitudes towards Noise-Induced Hearing Loss

In health promotion, emotion-based motivational appeals increase positive attitudes to the message (Geller, 2003). It has been suggested that for high involvement issues such as those that encourage behavioural change by an individual, stronger emotional arousal or arousal on progressively deeper levels may be necessary (Donovan, 1995). Indeed, use of personal stereos may be a high involvement issue for many people, and the playing of music at loud levels has been described as an addiction for some (Florentine, Hunter, Robinson, Ballou, & Buus, 1998). The issue of noise exposure is a particularly difficult health promotion topic to address because the long-term effects are difficult to imagine. The main tenet of the present research is that it may be effective to link auditory simulations of hearing loss and tinnitus with the fear of premature ageing, as ageing is a fear that is commonly recognised as severe (Henley, 1997).

3.6 Limitations of Hearing Conservation Programs

The issue of NIHL is a particularly difficult health promotion topic. As yet, there is little public awareness of the severe effect of hearing loss on an individual's life. People more frequently deplore the possibility of going blind even though those who are both deaf and blind state that being deaf is far worse, as it cuts them off from ordinary human interaction (Ackerman, 1990). Age-related hearing loss and tinnitus cannot be eliminated by following the recommendations of hearing conservation programs, but premature NIHL caused by personal stereo usage can be averted.

3.7 Fear Appeals to Promote Attitude and Behaviour Change

Fear appeals have been extensively used for influencing people's health-related attitudes and behaviours (Green & Witte, 2006). Fear appeals are persuasive messages that present information about a particular health issue in a threatening manner to make susceptible individuals more aware of the harmful health outcomes that are likely to occur if message recommendations are not followed (Geller, 2003). When a person is informed about a threat, this usually evokes feelings of fear and apprehension in response to that threat. As a result of feeling fearful, people tend to become motivated to engage in behaviours that will reduce the possibility of a threat occurring.

The problem with NIHL is that it is a relatively remote threat. Even when people believe a remote threat is severe and likely to happen, they may postpone acting on the threat appeal until later. It has been argued that in absence of knowledge pertaining to the fearful health risks associated with engaging in detrimental health behaviours, the potential dangers posed to one's health often go unnoticed or ignored, thereby resulting in individuals failing to take appropriate action (Beck & Frankel, 1981; Smalec & Klingle, 2000).

3.8 Audio Simulations as a Strategy to Enhance Hearing Conservation

The innovation of this project was the inclusion of auditory simulations of hearing loss and tinnitus to convey a comparative experience of NIHL. High frequency components that are electronically filtered from speech almost always impair speech comprehension and detract from the fidelity of music. The experience of practising audiologists at Australian Hearing, and at the National Acoustic Laboratories is that filtered speech, taking into account of the psychoacoustics of hearing impairment, is as close an approximation to how a hearing impaired person hears as possible. It was the use of auditory simulation in conjunction with a health-based fear appeal that was investigated in this project.

4 Hypothesis of the Current Project

It was hypothesised that people listening to the auditory simulations would be able to appreciate more fully the frustration and annoyance of suffering from NIHL and tinnitus, as well as obtain some understanding of the associated isolation from normal everyday human communication compared to a generic health promotion message. It was predicted that this would deepen the experiential level of fear arousal and therefore increase the effectiveness of the message (Geller, 2003).

“It was hypothesised that people listening to the auditory simulations would be able to appreciate more fully the frustration and annoyance of suffering from NIHL and tinnitus...”

5 Achievements Against Each Stage of the Project

5.1 Stage One: Project Set-Up and Consultation

The main activities undertaken during Stage One were creating the appropriate committees of consultation and external review and obtaining ethics clearances for the project.

5.1.1 Establishment of the Management Team

The management team was established and included Dr Paul Chang from the School of Psychology at Edith Cowan University (ECU) and Dr Helen Goulios who has vast experience as an audiologist and manager of audiology clinics for Australian Hearing.

5.1.2 Recruitment of Project Manager and Research Officers

A full-time Project Manager, Ms Sandra Green, was employed in July 2009 to organise the project, including the application of ethics approvals. The Project Manager was responsible for initiating contact with high school staff and university staff to propose being involved in the research project, coordinate with principals, teachers and lecturers, organise materials to conduct the research, coordinate Research Assistants and prepare and distribute follow-up documentation materials.

Four Research Assistants were employed during the data collection phase of the research project. The Research Assistants were ECU post-graduate psychology students who were trained in conducting research.

5.1.3 Refinement of the Consultative Process

An external consultative committee was formed comprising:

Professor Donna Cross

Professor Cross is the Director of the ECU Child Health Promotion Research Centre and has extensive experience in the development of health promotion programs aimed at school-aged children and young adults.

Dr Rob Patuzzi

Dr Patuzzi manages the UWA Master of Clinical Audiology program. He advised primarily on the development of the materials, on the procedures for running the project and evaluation.

Mr Graeme Quelch

Mr Quelch is Manager of the Curriculum Council WA dealing with course accreditation and review. He has links with the Primary Principals Association of WA and advised on the development of the simulations and the process for involving school principals and teachers.

Ms Sharon McBride

Ms McBride is the Senior Portfolio and Policy Officer (Schools and Youth), Child and Adolescent Community Health Division and advised on the process for involving school nurses in delivering the health promotion strategy and in particular, advised on age-appropriate formatting of the hearing conservation materials and program.

5.1.4 Refinement of the Program Design

The proposed program design was used, although components of the questionnaires were refined over the course of the study (i.e., following results of pilot study). Recruitment strategies (and incentives) were also changed over the course of the study to maximise the number of potential participants.

5.1.5 Obtaining Ethics Approval

Ethics approval was granted by ECU Human Research Ethics Committee for the period 30 August 2008 to 31 December 2010. This process included the development of the surveys and the writing of information letters (and consent forms) to principals, students, and parents.

The WA Department of Education and Training provided ethics approval for research to be conducted at primary and high schools. This approval was granted for the period 1 September 2009 to 31 December 2010.

The Catholic Education Office of Western Australia ethics approval was received for the period 1 July 2009 to 31 March 2010. This ethics approval permitted research to be conducted at Catholic education facilities.

Working With Children clearances were obtained for all research staff to allow interaction between researchers and participants under the age of 18.

5.1.6 Establishment of the Review Team

Refer to the section 5.1.3 Refinement of the Consultative Process.

5.2 Stage Two: Focus Groups and Interviews

During Stage Two, the main activities included preliminary interviews conducted with study participants and key stakeholders (i.e., curriculum writers and the Manager of the Curriculum Council WA) and a meeting with project partners at National Acoustic Laboratories (NAL) to establish the specifications for the auditory simulations.

5.2.1 Short Qualitative Study: Preliminary Interviews with Participants

Several interviews were conducted with participants with the sole purpose of interrogating the effectiveness of the auditory simulations in a health promotion campaign aimed at reducing noise-induced hearing loss. A semi-structured interview schedule was designed including a series of questions that attempted to ascertain people's experiences about a draft of a hearing conservation presentation presented in PowerPoint. The primary themes that emerged after viewing the presentation included:

- consciousness raising;
- risk perception;
- personal impact of the hearing conservation message on future intentions.

5.2.2 Meetings with the Manager of the Curriculum Council WA and with Curriculum Writers, and Worksafe WA

Several productive meetings with Mr Graeme Quelch (Manager of the Curriculum Council WA) and Mr Bruno Faletti (drug awareness program curriculum writer) guided the direction of the research. The primary purpose of these meetings was to gain insight of the development of health promotion materials for primary school aged children and the process of involving school principals and teachers in the dissemination of the findings.

The Chief Investigator also met with Pam Gunn (Senior Scientific Officer, Noise Health Hazards Branch, WorkSafe Division, Western Australian Department of Commerce). Ms Gunn consulted on the project on an ad hoc basis.

5.2.3 Meetings with Scitech Representatives Regarding Dissemination of the Auditory Simulations

Two meetings with representatives of Scitech (the science museum in WA) were held. The purpose was to discuss the dissemination of the auditory simulations via a purpose-built exhibit. This exhibit will be known as the "Cone of Deafness," and is currently being developed.

5.3 Stage Three: Construction of the Auditory Simulations and Threat Appeals

During this stage of the project, schools were selected and information letters and consent forms were distributed. The Presentation DVD and Survey Forms were also drafted and finalised.

5.3.1 Creation of the Hearing Loss Simulations and Tinnitus Simulations in Consultation with National Acoustics Laboratories

The development of the auditory simulations was initially scheduled as a Stage Three activity. However, it occurred in Stage Two due to a number of personnel issues that came up early in the project. This did not in any way impact on the timetabling of the rest of the project.

A meeting with project partners was held at National Acoustic Laboratories (NAL) to provide the simulations on CD for use in the presentations.

5.3.2 Development of the Presentations

The following threat-appeal presentations were created to be used in a randomised control trial:

- Simulation+Education;
- Education Only;
- Control.

Consideration was given to the number of graphics included in the presentation movies. It was decided that a minimum number of graphics should be included to ensure that the simulation message was not overwhelmed by a number of flashy visual graphics. Consideration was also given to delivering the presentations over wireless headphones, however, given the different auditoriums and rooms that the participants were to be tested in, it was decided to present the movies on DVD format.

> “It was decided that a minimum number of graphics should be included to ensure that the simulation message was not overwhelmed by a number of flashy visual graphics.”

5.4 Stage Four: Pilot Testing and Study Implementation

5.4.1 Development and Pilot Testing of Questionnaires

The questionnaires were developed and piloted. Feedback from the pilot testing was used to finalise wording and formatting before mass printing of the participant questionnaires.

5.4.2 Selection of High Schools & Liaison with Department of Education, Schools, TAFEs and Universities

After WA Department of Education and Training ethics approval was received, meetings were set up with 17 principals (and schools) to organise distribution of letters and testing. More schools were contacted, but indicated that they were 'saturated' with research requests.

Overall, the principals responded favourably to having this research project conducted at their schools with their students and parents. A number of schools contacted, however, indicated that it is particularly difficult to recruit senior students who were matriculating, and indicated that we should recruit younger students. It was imperative that the project proceed under the advice of the key stakeholders, particularly the principals and school department heads.

5.4.3 Ethics Committee Applications

All required ethics approvals were obtained by Stage Four. Ethics committee clearances were obtained from ECU, the WA Department of Education and Training, and the Catholic Education Office of Western Australia.

5.4.4 Administration of Intervention Strategy and Questionnaires

Participants

A total of 978 young people participated in the study. The sample comprised 356 males and 622 females, all with self-reported normal hearing. Participants' ages ranged from 12 to 25 years (M = 15.09, SD = 2.3). Participants were randomly assigned to one of three conditions: a Simulation+Education (Simulation) group (n = 553), an Education Only (Education) group (n = 335), or a Control group (n = 90).

Presentation	Total %	12 to 17 years %	18 to 25 years%
Simulation+Education	56.5	59.1	28.7
Education Only	34.2	33.2	40.6
Control	9.3	6.7	30.7

Design

The study was a pre- versus post-test randomised control trial. The between-groups independent variable ('presentation group') consisted of three levels: Simulation+Education, Education Only, and Control. Each dependent variable was measured pre-presentation (Time-1) and post-presentation (Time-2).

The four primary dependent variables that were measured were:

- **Intention** to change listening habits;
- **Attitude** towards excessive noise exposure;
- **Motivation** to protect against excessive noise;
- **Fear** regarding overexposure to loud noise.

Materials

PowerPoint slide show presentations. Three PowerPoint slide show presentations were developed. A summary of each presentation is described below:

- **Simulation+Education**

  This presentation consisted of a health-based education message focussing on:

  - Sources of noise and its effect on hearing;
  - Epidemiological facts about noise-induced hearing loss and tinnitus;
  - An explanation of how loud noise is to be regarded as hazardous;
  - The effects noise can have on a person's physical, psychological, social, and occupational functioning;
  - Common warning signs that indicate excessive noise exposure has occurred;
  - Recommendations that people are advised to follow in order to preserve their hearing.

  In addition to this information, the Simulation+Education presentation also included a series of audio simulations interspersed at relevant times throughout the presentation to illustrate the frustration of listening to music and speech with a hearing loss and tinnitus. The hearing loss audio tracks were filtered at 30 and 40 dB, representing a mild hearing loss. The tinnitus simulations consisted of samples of different tinnitus sounds with narrowband noise at 2 kHz and 4 kHz, broadband high frequency noise, and a 4 kHz tone. The Simulation+Education presentation lasted 9 minutes, and contained 57 slides.

- **Education Only**

  The Education Only presentation consisted of the same health-based educational message on noise and hearing loss as the Simulation+Education presentation. However, no audio simulations were included in the Education Only presentation. The Education Only presentation lasted 5 minutes and 30 seconds, and contained 38 slides.

- **Control**

  The Control presentation provided general health information regarding how to live a happy and healthy lifestyle. Emphasis was placed on good lifestyle habits as a way of extending overall well-being, youthfulness, and vitality such as topics covering the importance of a balanced diet, regular sleep, and regular exercise. Only one slide referred to the dangers of noise with the message "In order to maintain good health, it is important to avoid loud noises." The Control presentation lasted 5 minutes and 50 seconds, and contained 47 slides.

Questionnaires and measurement of dependent variables

Four dependent variables were used to measure participants' responses towards noise-induced hearing loss and tinnitus. The dependent variables measured were Intention, Attitude, Motivation and Fear.

To assess these variables prior to presenting the PowerPoint movie, a pre-presentation survey (Noise Survey-1) was administered. Participants were asked to respond to a series of statements using a 5-point Likert scale. To assess the effects of the three presentations on participants' attitudes, intentions, motivations, and fears towards noise-induced hearing loss (Time-2), a post-presentation survey (Noise Survey-2) was administered. Participants were asked to respond to a series of similar statements using a 5-point Likert scale. Questions for both pre- and post-presentation surveys are outlined below under each respective dependent variable.

- **Intention to change listening habits.**

  Pre-presentation:
  "At this present time, how strong is your intention to change your current noise exposure habits?" Possible responses ranged from Not at all strong (1) to Very strong (5).

  Post-presentation:
  "After viewing the presentation, how strong is your intention to change your current noise exposure habits?" Possible responses ranged from Not at all strong (1) to Very strong (5).

- **Attitudes towards excessive noise exposure.**

  Pre-presentation:
  "At this present time, how strongly do you feel that reducing your exposure to noise is a sensible thing to do?" Possible responses ranged from Not at all strong (1) to Very strong (5).

  Post-presentation:
  "After viewing the presentation, how strongly do you feel that reducing your exposure to noise is a sensible thing to do?" Possible responses ranged from Not at all strong (1) to Very strong (5).

- **Motivation to protect against excessive noise.**

  Pre-presentation:
  "At this present time, how strongly do you feel the need to reduce the amount of noise you are exposed to?" Possible responses ranged from No need at all (1) to A very strong need (5).

  Post-presentation:
  "After viewing the presentation, how strongly do you feel the need to reduce the amount of noise you are exposed to?" Possible responses ranged from No need at all (1) to A very strong need (5).

- **Fear regarding overexposure to loud noise.**

  Pre-presentation:
  "At this present time, how fearful do you feel about being overexposed to loud noise?" Responses ranged from Not fearful at all (1) to Extremely fearful (5).

  Post-presentation:
  "After viewing the presentation, how fearful do you feel about being overexposed to loud noise?" Possible responses ranged from Not fearful at all (1) to Extremely fearful (5).

Stimuli and Apparatus

Participants viewed the slide shows on a television screen or from a data projector. This method was used to allow the researchers to test the participants in groups, as recommended by the stakeholders in a way that was flexible with their class schedules.

Procedure

For the WA Department of Education and Training schools, the Project Manager contacted the school principal to arrange meetings to discuss the research, demonstrate ethics approvals and discuss location, timing and consent requirements for parents and students.

For young adult participant groups, the Project Manager contacted university lecturers and tested participants at the end of their lecture.

Every participant under the age of 18 was given an information sheet and consent form which was to be signed by their parent/guardian prior to the testing date. Only participants with a signed consent form participated in the study.

The Research Assistant led the participants in completing the survey, then presented one of the Simulation+Education, Education-Only, or Control presentations.

6. Evaluation and Dissemination Plan

In May 2010, data collection was completed and the data was entered and analysed. Based the preliminary analyses reported here, some dissemination strategies have been planned, and others are recommended. These are outlined at the end of this section.

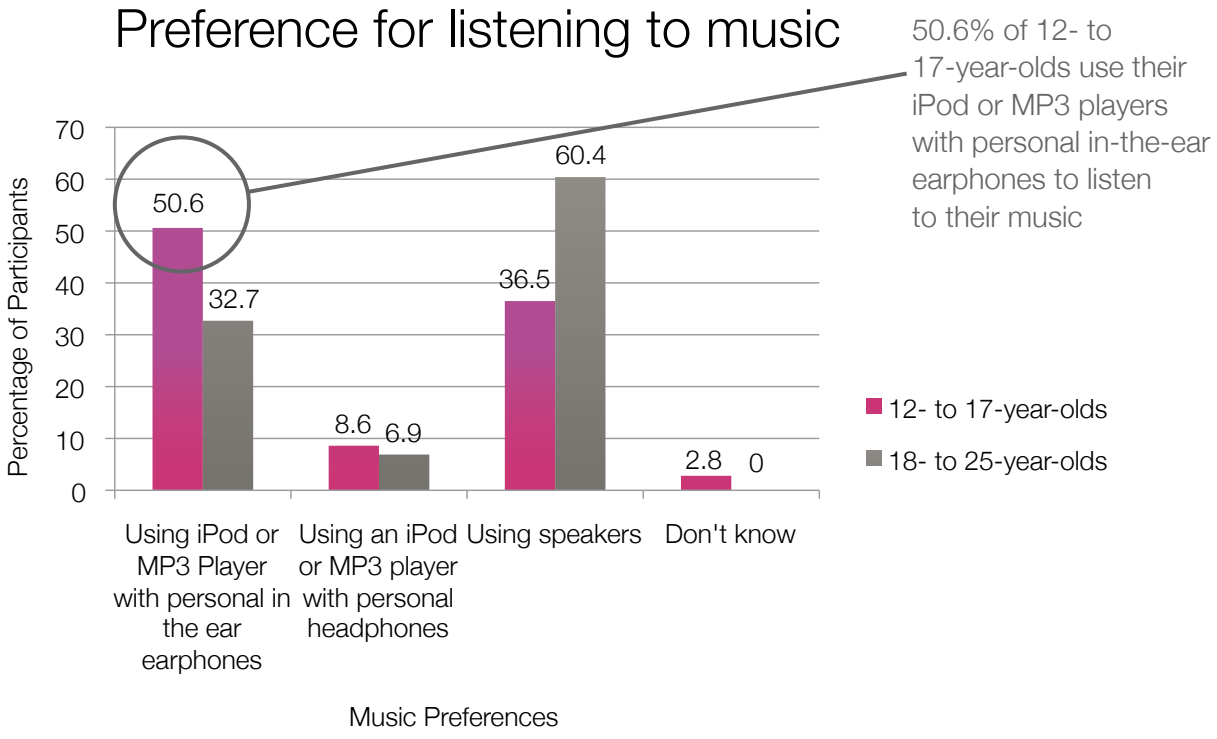
6.1 Data Entry and Analysis

A preliminary analysis has been undertaken on the data. The analysis considered frequencies of pre-presentation data for both the key age groups studied, 12- to 17-year-olds and 18- to 25-year olds, as well as looking at the percentage increase of the three presentation groups (Simulation+Education, Education-Only and Control) with respect to the four main dependent variables. A more in-depth analysis will be undertaken upon completion of the total project.

6.1.1 Results

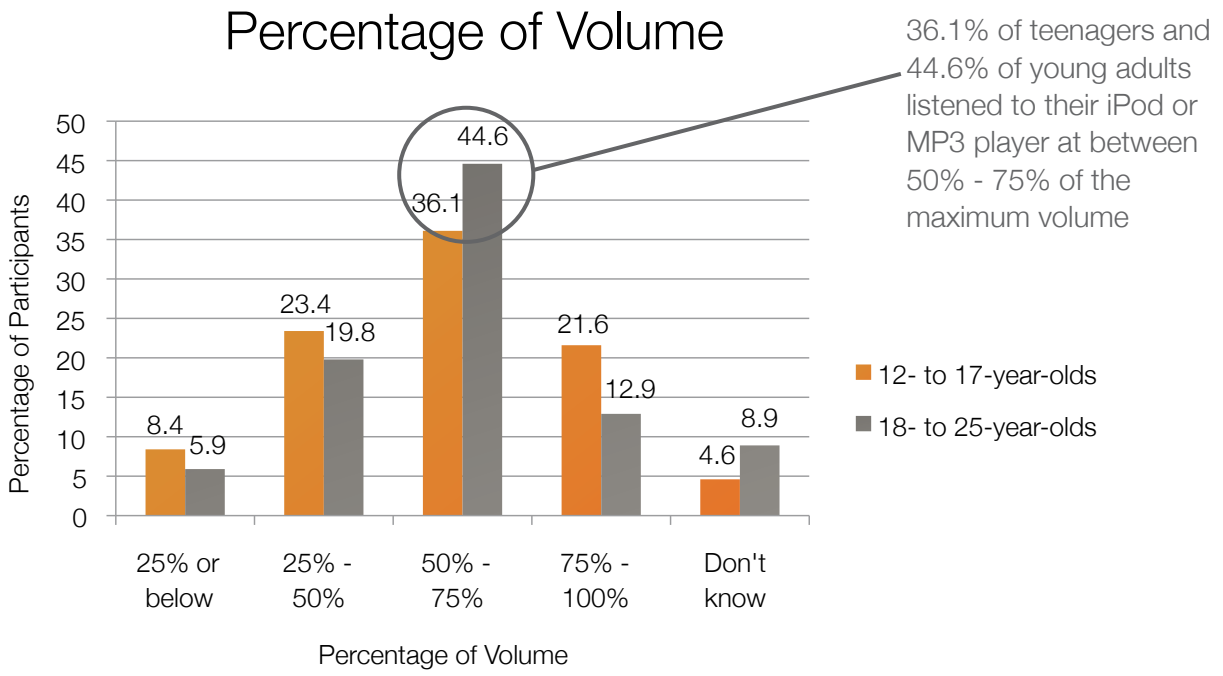
Key findings for this project so far are as follows:

Pre-Presentation Information.



In addition, another finding from the survey was:

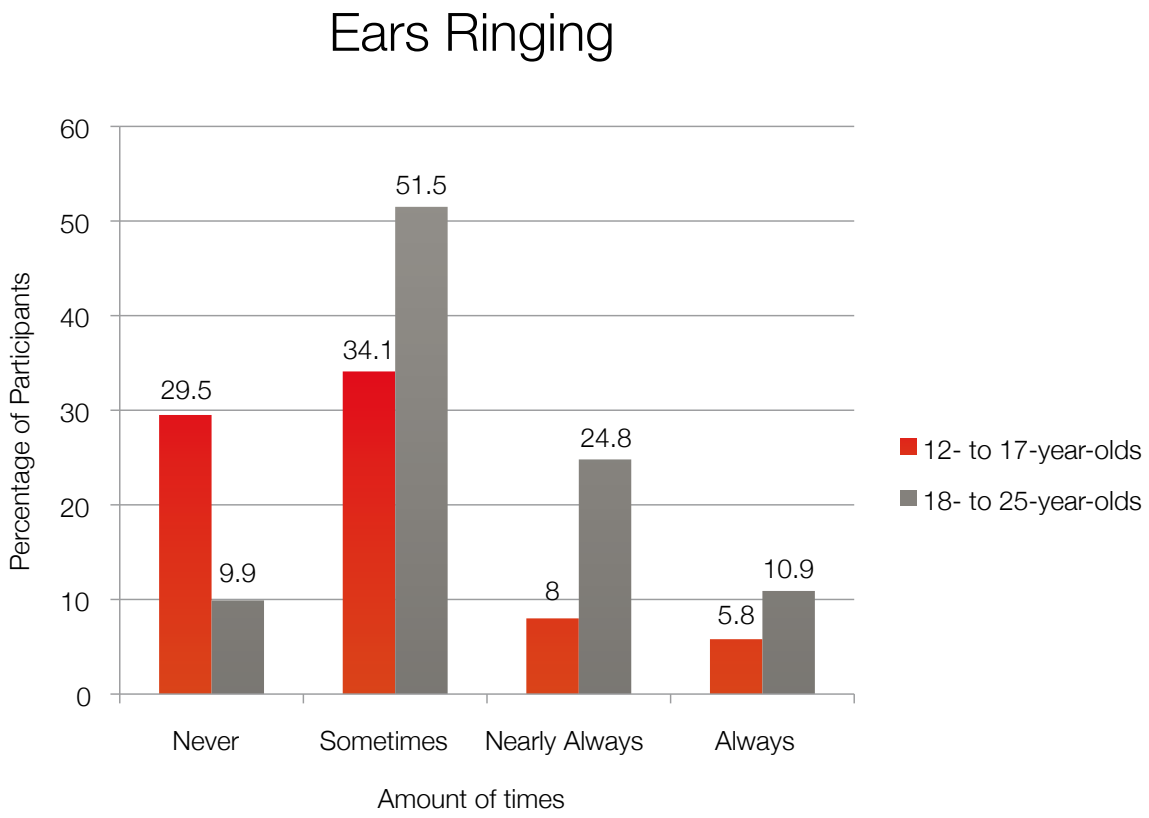
- Teenagers/young adults spend different amounts of time listening to their iPod or MP3 with the majority spending up to an hour a day listening to it (63.7%).



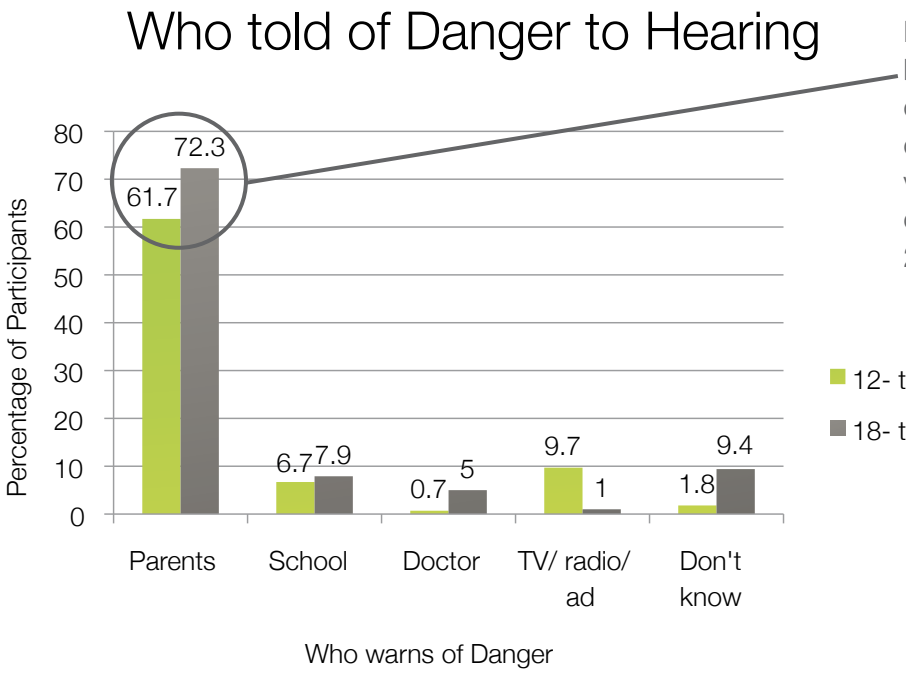
In addition, other findings from the survey were:

- Over half of 12- to 17-year-olds report listening to music between 5 and 7 days per week (52.8%);
- Nearly half of teenagers/young adults spend a large amount of time involved in activities related to loud music (44.6%);
- Many parents worry or complain to their children about them listening to loud music (46%).

In addition, other findings from the survey relating to young people's experiences after attending a club, concert, or music festival include:



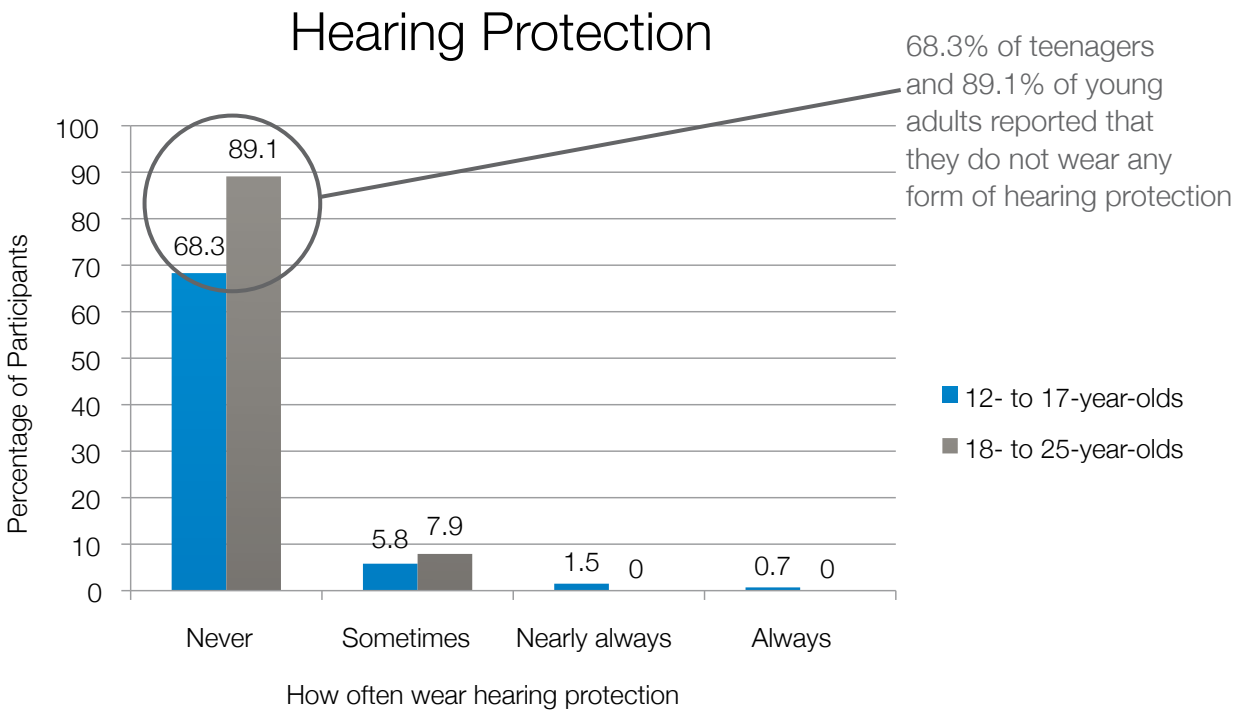
- Of the 12- to 17-year-olds, 47.9% reported that sometimes to always they have noticed ringing in their ears after being at a club, concert, or music festival;
- Of the 18- to 25-year-olds, who, presumably attend music entertainment venues more often, 87.2% reported that sometimes to always they have come home and noticed their ears were ringing.



Parents are reported as being the people who most often warn of the dangers of listening to music at high volumes, for 12- to 17-year-olds (61.7%) and 18- to 25-year-olds (72.3%)

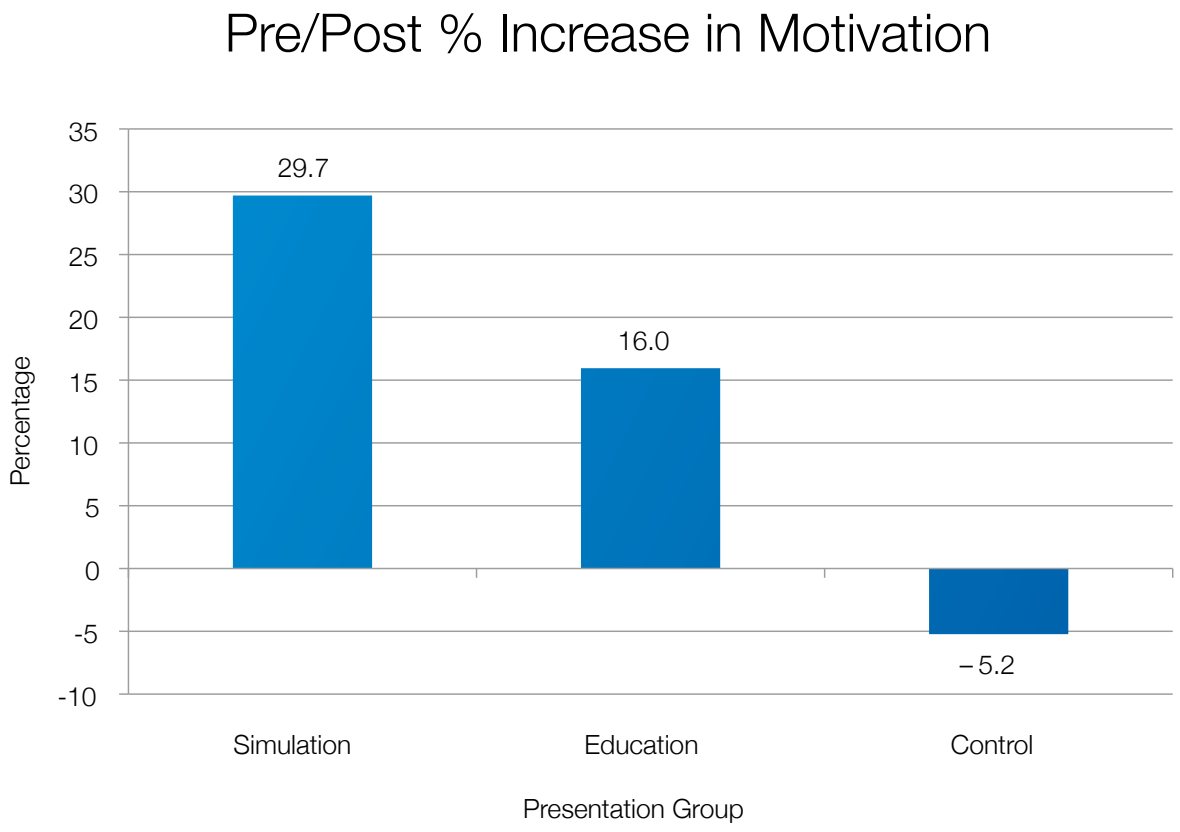
In addition, another finding from the survey was:

- The majority of young people in the study have been warned that listening to music at really high volumes can be dangerous to their hearing (89.6%).



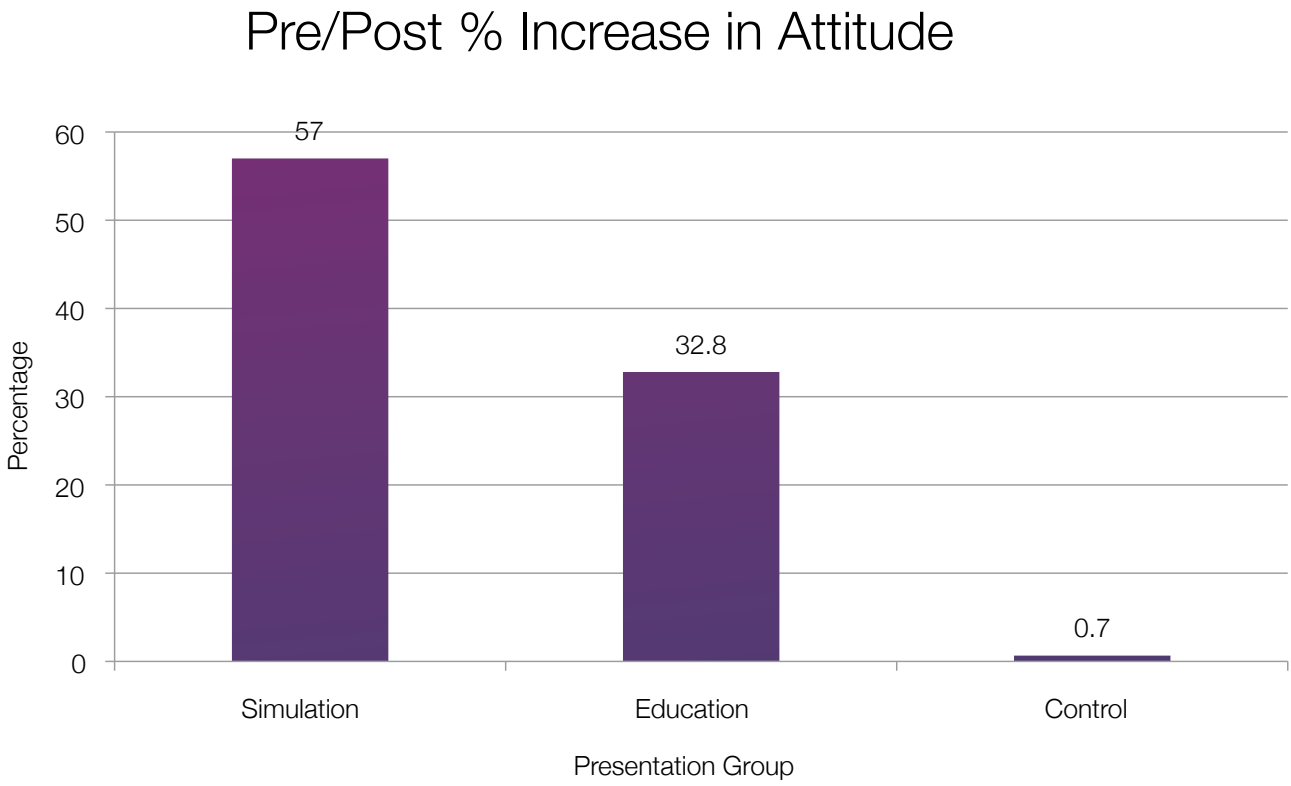
In addition, another finding from the survey was:

- Many teenagers/young adults have attended concerts or music festivals in the past 12 months with 54.2% reporting that they have attended between 1 and 4;
- Most young people believe that NIHL is an important issue for young people, with most disagreeing with the statement that it is not an important issue (65%);
- Most young people believe that NIHL is not only a problem when you are old (74.8%);
- Most young people in the study felt that NIHL can be prevented (71.2%).



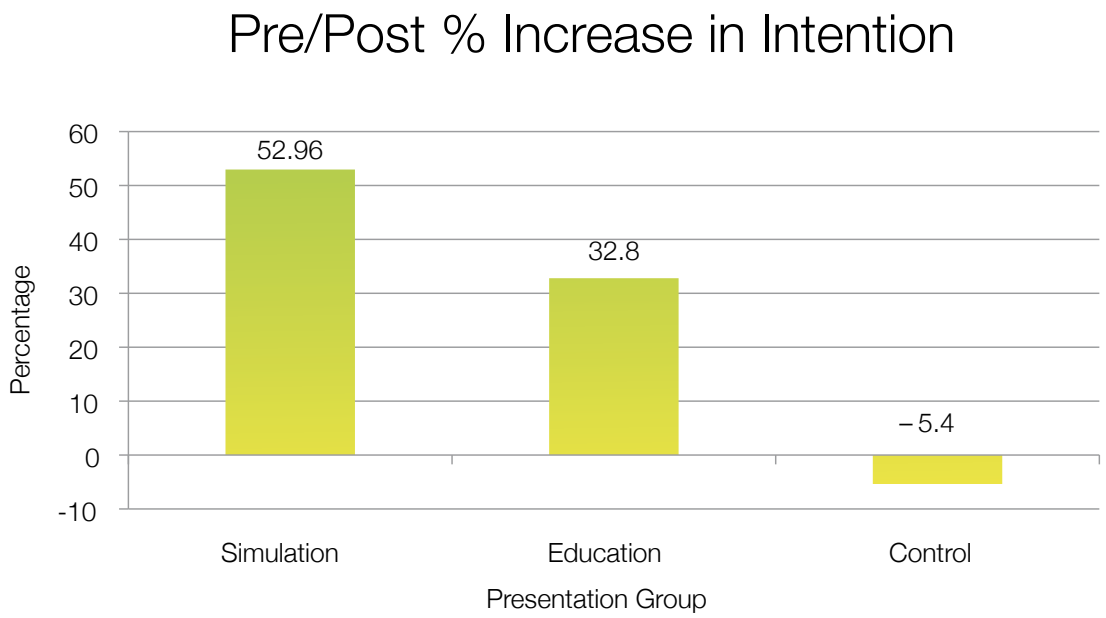
- **Motivation to protect against excessive noise.**

  The percentage increase in **Motivation** to protect against excessive noise for each different presentation group is evident as those participants who took part in the simulation presentation increased their motivation the most (29.7%).



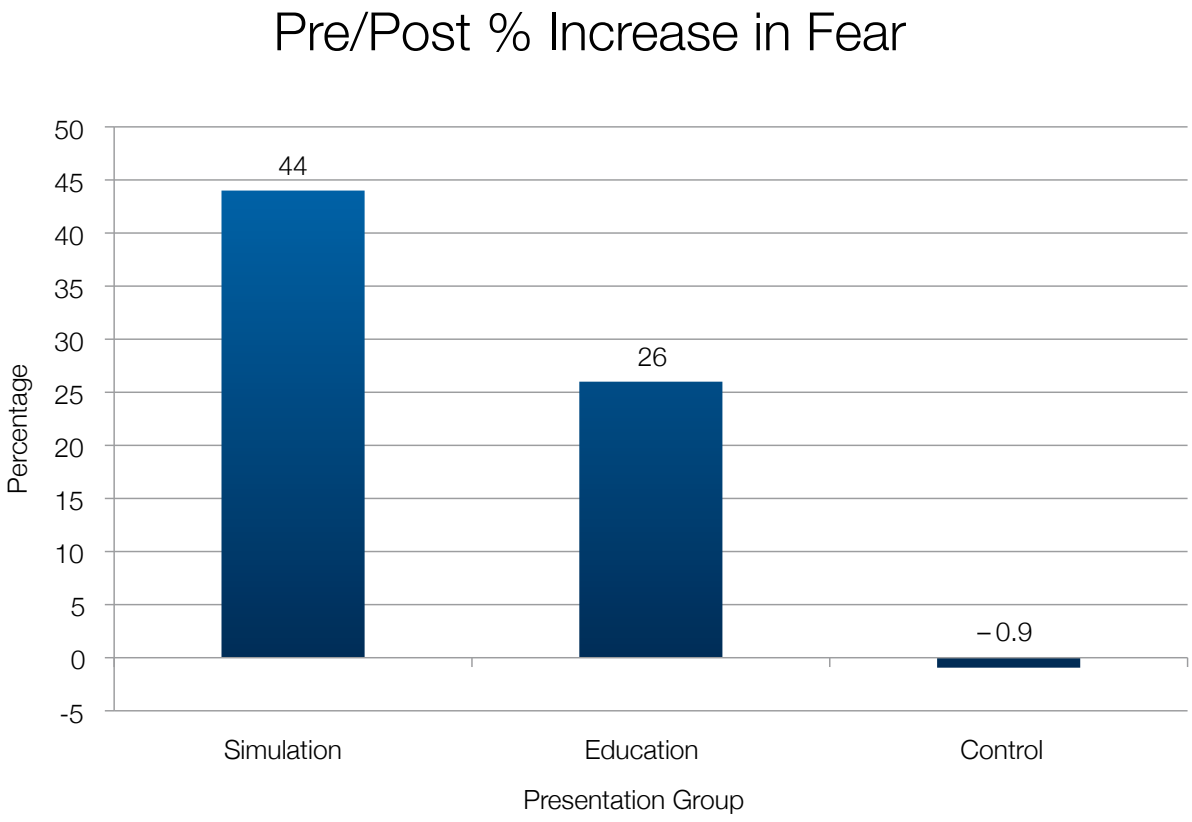
- **Attitude towards excessive noise exposure.**

  Participants who were presented with the simulation program demonstrated a 57% increase in **Attitude** towards excessive noise exposure. This was 24.2% higher than those who were presented the education and 56.3% higher that the control group.



- **Intention to change listening habits.**

  Participants who were presented with the simulation program demonstrated a 53% increase in **Intention** to change their listening habits. This was considerably higher than the education group (32.8%) and the control group (–5.4%).



- **Fear regarding overexposure to loud noise.**

  Participants who were presented with the simulation program demonstrated the highest increase in **Fear** regarding overexposure to loud noise (44%).

6.1.2 Preliminary Summary Relative to the Hypothesis (Section 4).

In relation to the stated hypothesis (Section 4) concerning whether or not the Simulation+Education presentation was more effective than an Education Only presentation, the following conclusions can be made. The preliminary results demonstrate that auditory simulations of hearing loss and tinnitus, presented in conjunction with an educational message:

- increased teenagers' and young adults' motivation to protect themselves against excessive noise;
- increases their attitude (sensibility) towards preventing excessive noise exposure;
- increases their intention to change their listening habits;
- increases their fear regarding overexposure to loud noise.

6.2 Presentation of Research Findings at Health Promotion and Related Conferences

On completion of the entire project, research findings will be disseminated at local, national and international health promotion and psychology conferences.

6.3 Publication of the Results at Presentations to Health Promotion Practitioners and Training Workshops

The results will be published in journals for health promotion practitioners to utilise.

6.4 Dissemination Through Popular Media

The primary way that the results will be disseminated is through the collaborative science exhibit designed by ECU, Scitech, and the National Acoustic Laboratories titled the 'Cone of Deafness'. More information about this exhibit may be obtained by contacting the Author.

6.5 Development of Education Kits including DVDs and CDs for Use in Schools

The teaching of noise and hearing conservation, using some of the simulation resources examined in this study will begin in Semester 2, 2010 in a WA high school course titled 'Integrated Science.' In this course, education about hearing loss and tinnitus (and hearing conservation) will be incorporated into the curriculum at the high school level in a course aimed at Year 11 students. At this time, ECU and the National Acoustic Laboratories are currently designing a full set of all of the necessary resources, activities, learning modules, and simulations in a package that teachers can implement in class.

"The primary way that the results will be disseminated is through the collaborative science exhibit designed by ECU, Scitech, and the National Acoustic Laboratories titled the 'Cone of Deafness'"

7 Recommendations and Future Directions

From the evidence presented in this study, a set of recommended actions are proposed:

- **Early Intervention and Prevention.**

  Given the recent and ongoing popularity of iPods and other MP3 players, teenagers and young adults should be educated from an early age about the relationship between loud sounds and hearing loss and tinnitus. Although irreversible, hearing loss is preventable. It is imperative for school-age children and young adults to be specifically targeted at school and in their leisure time with the aim of developing lifelong changes in their attitudes towards hearing conservation.

- **Ongoing Communication Strategies.**

  Consistent and ongoing communication strategies are necessary to ensure the dissemination of information about noise-induced hearing loss. These strategies need to be innovative (e.g., through the use of auditory simulations and other educational messages) to capture the attention of young people.

- **Use of Auditory Simulations of Hearing Loss and Tinnitus in Conjunction with Education.**

  The importance of the inclusion of auditory simulations used in conjunction with hearing loss and tinnitus has been shown to be effective with young people, probably because it is a novelty. Using simulations allows young people to appreciate the effects of suffering hearing loss and tinnitus.

- **Education Materials Need to be Integrated into School Curricula.**

  Education about hearing loss and tinnitus (and hearing conservation) needs to be incorporated into curricula at high school (and earlier). In addition, it is recommended that age-appropriate material about hearing loss and perhaps its economic, health, and social effects also be integrated into other curricula (such as Economics, Human Biology, or Society and Environment courses), preferably as part of a national curriculum.

- **Involving Parents in Hearing Loss and Tinnitus Education.**

  Findings from this study suggest that parents are the primary people in a young person's life who warn them of the dangers of excessive noise. Involving parents in the education of hearing loss and tinnitus at schools enables them to reinforce any new positive behaviours at home.

8 Conclusion

There are several key findings from this research project suggesting that young people are putting themselves at risk of noise-induced hearing loss by listening to music for long periods of time, often at high volumes. The results also confirm the popularity of iPods and other MP3 players and despite knowing and being warned about the dangers of listening to music at high volumes (particularly from their parents), young people still continue to engage in behaviours that are likely to be detrimental to their hearing.

This project successfully tested the effectiveness of using simulations of hearing loss and tinnitus to augment a health-based fear appeal concerning noise-induced hearing loss. The aim was to see if young people would be able to appreciate the effects of suffering noise-induced hearing loss and tinnitus using these simulations compared to a generic health promotion message. The results suggested that these simulations increased young people's motivations to protect themselves against excessive noise, increased their attitude towards reducing excessive noise exposure, increased their intention to change their listening habits and also increased their fear regarding overexposure to loud noise.

Following on from the key findings of this project, several recommendations have been made. These include early intervention and prevention programs aimed at young people (preferably incorporated into school curricula), continued development of innovative and novel communication strategies (such as the use of auditory simulations of hearing loss and tinnitus) to promote the hearing conservation message, and involving parents in the promotion of hearing-healthy behaviours.

> "This project successfully tested the effectiveness of using simulations of hearing loss and tinnitus to augment a health-based fear appeal concerning noise-induced hearing loss."

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