CHEERS FOR EARS
A health promotion program for children on noise induced hearing loss
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1. Executive Summary

There is a growing recognition that entertainment related noise exposure is an increasing risk for noise induced hearing loss (NIHL), particularly in young people. The high use of personal music players is considered a major contributor to noise exposure.

Hearing loss is one of the world's most common disabilities and is a significant economic cost to the community. Hearing loss affects child development and education.

In 2009, the Ear Science Institute Australia (ESIA) was awarded funding through the Australian Government Department of Health and Ageing’s “Hearing Loss Prevention Programs” to develop a NIHL health promotion program for children.

Project aims:

(i) To develop a health promotion program to educate primary school aged children in the dangers of exposure to dangerous levels of noise and music.

(ii) To develop an application to monitor and track noise exposure from personal music players.

(iii) To develop an Internet resource as a central information site for all matters related to NIHL and exposure to entertainment related sounds.

Project activities:

(i) A 60 minute health promotion program targeted at years 5 to 7 in primary schools was developed, utilising various multimedia materials. The programme was developed to be conducted as interactive sessions in school classrooms. The program was called Cheers for Ears, and the first session was conducted in May 2010. An evaluation was conducted with 318 students.

(ii) An application, called Safe&Sound, was developed for the Android platform, and launched in May 2012. The application monitors the sound output from the device, calibrates the output to the type of ear/head phones, presents the user with the percentage dose of the daily safe allowance as well as historical exposure, and uploads the usage data to the project database server.

(iii) A Cheers for Ears website was launched in May 2010, and updated regularly with resources and program information.

Project outcomes:

(i) Over 22,000 children participated from over 220 schools in the Perth metropolitan area and some regional towns. Surveys were used to assess knowledge and behaviour in 318 children, and showed that the concepts of permanent hearing loss were learnt and retained, and that fewer children set their music players at potentially dangerous levels after the Cheers for Ears session. A peer reviewed paper on the program and evaluation has been accepted to be published (Taljaard, Leishman, Eikelboom. Personal Listening Devices and the Prevention of Noise Induced Hearing Loss in Children: The Cheers for Ears Program. Noise and Health.)

(ii) Over 260 people from over 25 countries have downloaded the Safe&Sound application. An analysis of usage data show that most users are male (72.4%), the mean age is 31.4 years, and in-the-canal (46.5%) and ear-bud style (34.7%) earphones are most commonly used. The median percentage of daily noise allowance is 17.8%. 5.8% of sound level
samples were over 87dB – the level which is considered safe for 8-hour exposure times. The limited amount of usage data shows that those already using their device safely are likely to reduce volume settings, but that those already using their device at high volumes are not likely to change their volume setting.

(iii) The www.cheersforears.org.au website attracts an increasing number of visitors over time; currently 140 per month. Visitors are from all over the world, with most visitors from Australia and USA.

**Other project activities and achievements:**

During the course of the project, with additional funding the Cheers for Ears team have developed:

(i) Safe Hearing Suzie, a sound level monitor and hearing loss simulator in a realistic manikin head.
(ii) Epic Ear Defence, an online game that allows players to defend the ear against dangerous levels of sound from earbuds, whistles and speakers.
(iii) Cheers for Ears Charlie, as a mascot for the program.

Furthermore:

(i) A large mural to convey the Cheers for Ears messages was painted on a wall at the Ear Science Institute building in March 2013.
(ii) Cheers for Ears won the AMA(WA)/Healthway Healthier WA Award for 2011.
(iii) Cheers for Ears received extensive print and electronic media coverage.
(iv) Six presentations were given at national and international conferences, with one awarded a best poster prize at Best Poster Prize at the Frontiers in Otorhinolaryngology meeting, Melbourne 2012.

**Conclusions**

Cheers for Ears has developed into a very successful health promotion program on NIHL for primary school aged children. The Safe&Sound application and program website have supported our core activity. More children and school were reached than initially anticipated. Evaluations of each of these have produced positive results. Innovations such as the mascot, game and hearing loss simulator have been recent additions, adding immense value to the program.

**Recommendations**

Further action is required to alert the community of the dangers that over-exposure to noise poses to hearing. This should include:

(i) Warning messages on personal music players, as is occurring in various jurisdictions internationally.
(ii) A national roll-out of NIHL prevention health programs in primary and high schools.
(iii) Implementing an electronic media campaign that reaches adults and children.
(iv) Providing warning notices, noise protection devices and quiet zones in entertainment venues.

Furthermore, more research is also required on the long-term effects of entertainment-related noise exposure on the hearing of children.

These recommendations echo a number of those made in the *Hear Us: Inquiry into Hearing Health in Australia* report (Community Affairs Committee, Australian Senate, 2010).
2. Rationale

2.1 The importance of hearing and cost of hearing loss

Hearing is a crucial component of everyday life because it is a primary human sense – and losing it significantly affects our quality of life. Hearing loss is an incredibly frequent sensory problem in the human population, affecting 250 million people worldwide. Figures show that, despite medical advances reducing the incidence of hearing loss caused by drugs and meningitis, hearing impairment within the Australian population is increasing. Although a largely hidden and infrequently highlighted disability, The World Health Organisation (WHO) describes the global burden of hearing impairment as the most frequent sensory deficit in the human population. It currently affects one in six Australians but by 2050, with our aging population, this figure is predicted to rise to one in four people – a quarter of all Australians. The economic impact of hearing loss is enormous – currently a $11.75 billion which equates to 1.4% of GDP. Of major concern is the hearing health of our future generation. Currently Australian children are at significant risk from noise induced hearing loss, particularly from entertainment related sounds. The ability to hear properly is critical for the developing child; hearing loss is strongly associated with deficits in language, speech and other communication skills, which lead to significant effects on academic performance and productivity.

2.2 The increasing use of personal music players

Personal music players (PMPs) may be a new major cause of hearing loss in children and adolescents. The most well-known of the PMPs, the Apple iPod, have had quite staggering success: over 350 million units were sold in 2012, and over 1,467 million units in sales since its launch in 2001 (based on Apple announcements). For many, the iPod is a status symbol and an indication of social standing. Over 400 million mobile devices of various brands were sold in one quarter in 2012. The last decade has witnessed PMPs with improved quality, capability and louder output without sacrificing battery drainage. Individuals can listen to louder music for longer periods of time. The maximum sound level for many personal music players ranges between 80 and 115 dB, with different types of earphones potentially increasing the output by 7 to 9 dB. In some cases, it is possible to reach over 120 dB.

While PMPs are particularly popular with teenagers and young adults, their popularity with younger children and adults is also growing. If, in those situations, the listening levels are excessive, it follows that music induced hearing damage in children is a serious and mounting concern.

An increase in the number of publications discussing music related hearing loss is noted. Recent studies have shown that due to the time spent each day listening to PMPs and the average volume levels, approximately 5-10% of listeners are in danger of developing permanent hearing loss after five or more years of exposure. Traditionally, excessive noise exposure in children resulted from activities with loud toys, fireworks and engines and noisy music environments were associated with nightclubs and concert venues. The widespread adoption of PMPs, has enabled traditionally “quiet” activities, such as reading, walking or using transport to carry a noise exposure risk.

Considering the growing market in the pre-teen age group, an entire generation may be at risk for irreversible hearing loss before they reach adulthood. Snowden and Zapala described that more than half of the 58 middle school children in their sample admitted to setting their iPods at unsafe output levels. Middle schoolers also underestimated their listening levels.
Many behaviours and lifestyle choices generally occur during the progression to adolescence \(^{19,20}\). Establishing healthy behaviours during childhood, whilst they are in their formative years, is easier and more effective than attempting to change the unhealthy behaviours that have been carried through to our adult life \(^{1,21}\). It is therefore practical to target children in the pre-adolescence phase in order to avoid the establishment of bad listening habits. Hearing promotion and loss prevention programs remain lacking from primary and middle school health policy \(^{7,9,21,22}\).

Listening to music should not be discouraged; it is a vital part of culture. Fligor \(^{23}\) states that rather than legislation for the use and output limits on the PMPs, education efforts and assisting children with good decision making strategies should be prioritised. One of the greatest challenges for health promoters, however, is to design programs that will motivate, assist and empower young people to change their behaviours \(^{24}\).

### 2.3 Existing programs

A number of programs have been developed in university or research institutes, government departments, or other health initiatives. Some of these programs include some education materials that can be adapted for use in the classroom, whilst others have developed comprehensive programs complete with activities for students, teacher resources and other items, such as videos \(^{24}\). The Portland, USA-based “Dangerous Decibels” (www.dangerousdecibels.org) is an example of an effective NIHL prevention program. This program is multifaceted, offering online resources and lessons for teachers, an informative and interactive website, facilitator training, and a museum exhibit that can be visited by the public. “Dangerous Decibels” has been evaluated \(^{3}\). In a cohort of 478 fourth graders and 550 seventh graders, baseline questionnaires were distributed noting their knowledge and attitudes on hearing and hearing loss prevention. Half of the cohort received a 35 minute intervention. The questionnaire was repeated directly after the session and three months later. The fourth graders showed increased knowledge and attitudes on hearing and hearing loss prevention which were maintained at the three month interval. The seventh graders, on the other hand, showed long term improvements on the knowledge portion of the questionnaire but their attitude and behaviours reverted to baseline levels at the three month checkpoint. The study concluded that repeated multimodal intervention should be implemented and the impact of peer pressure further explored \(^{3}\).

Other projects focusing on NIHL information for younger populations are “Sound Sense”, developed by the Hearing Foundation of Canada (wwwsoundsense.ca) and “It’s How You Listen That Counts” out of the House Research Institute in California (www.earbud.org). Both programs provide curricula and activities for teachers to use in classrooms. “Hear the World.com” has been developed by Phonak and “Listentoyourbud.org” by the American Speech and Hearing Association (ASHA). In New Zealand “Don’t lose the music” focuses on music and tinnitus education for the youth. Many resources from the listed programs are available on-line, allowing the messages of these programs to reach a large audience overcoming geographical isolation in remote areas.

### 2.4 Conclusions to rationale

The conclusions that can be drawn are:

(i) The exposure of young people to potentially dangerous sound levels will continue to increase, as sales of PMPs continue to increase exponentially.

(ii) This will potentially result in a marked increase in hearing loss in young people, effecting their development, education, quality of life and productivity.
(iii) Awareness and prevention programs are required to educate young people of the dangers of hearing loss from overexposure to loud sounds from PMPs and other entertainment noise.
3. Project Aims

The objective of this project was to address the growing problem of overuse of personal music players (PMPs) at high volumes that is potentially causing long-term hearing losses for users of these devices. It was decided there was high importance to fulfil the following requirements:

(i) The Australian community must be made aware of the dangers of loud noise, that hearing loss is permanent resulting in far reaching and measurable consequences for individuals, families and the community, and that those risks can be minimised by simple behavioural changes.

(ii) Create an awareness and prevention program that aims to educate young Australians of the dangers of hearing loss from overexposure to loud sounds from PMPs and other entertainment noise.

(iii) Find other innovative avenues to delivering the important noise-induced hearing loss prevention messages such as a Smartphone application and a comprehensive website.

3.1 Key project aims

(i) To develop a health promotion program to educate primary school aged children in the dangers of exposure to dangerous levels of noise and music.

(ii) To develop an application for PMPs that measures sound output, monitors usage, presents warnings when safe exposure levels are exceeded, and sends usage data back to a central site for data analysis.

(iii) To develop an Internet resource that allows users of PMPs to download the application, provides advice to users of PMPs, and provides a central information site for all matters related to high noise exposure.

3.2 Key Milestones

(i) Development of educational materials
(ii) Implementation of education sessions at schools
(iii) Development of application
(iv) Development of website
(v) Maintenance of website
(vi) Evaluation
(vii) Dissemination of outcomes
(viii) Review
4. Project activities

4.1 Development and implementation of school sessions

4.1.1 Purpose
To develop a hearing loss prevention health promotion program to deliver to children at school.

4.2.2 Background
Based on learning outcomes and best learning practice, the Cheers for Ears school sessions were developed to include a variety of resources, activities and session structure in order to deliver educational messages effectively. The materials used were all developed in order to establish an in-school program that best captured the target audience and effectively relays the NIHL prevention message with lasting impact.

Why focus on children? According to the United States Centers for Disease Control and Prevention, healthy behaviours are more easily established during childhood compared to adulthood. If childhood is the focus area for establishing lifelong healthy behaviour patterns (n.d:p.2), the educational environment in which the child spends most of their day is, by association, bestowed a significant responsibility in the promotion of health during childhood. One of the Healthy People 25 objectives is the prevention of noise induced hearing loss in children aged seventeen and under. A recent report by Henderson et al. 21 described an increase in the exposure to loud noise and music through headphones, and a decrease in hearing-protection use in United States youths by comparing data from 1984-1988 to 2005-2006. The prevalence of noise-induced hearing loss in female youths had also increased to statistically significant levels compared to 20 years previously. Similarly, United Kingdom data indicate that 20% of young people regularly expose themselves to excessive levels of loud music 26.

The success or failure of a program lies less in the information that is available, and more in the opportunities available to deliver, and the methods used in delivering this information to children and young people 24. Interactive, age appropriate programs, which include activities that can be adapted to suit a variety of age groups, have a greater chance of success. The basis for the activities should include education on how hearing loss may affect their life and what activities are potentially dangerous to hearing 21,24.

4.1.3 Design Criteria
(i) Aimed at children in years five, six and seven at primary school, i.e. nine to 12 years of age.
(ii) Delivered in the classroom, i.e. groups of 15 to 30 children.
(iii) Length of session to be 50 to 60 minutes.
(iv) To focus on increasing knowledge of the risks of hearing loss and changing behaviour to reduce the risks.
(v) To use multimedia, demonstrations and interactive exercises.
(vi) To develop a program identity.

4.1.4 Program outline
(i) Program outline
A 50 to 60 minute plan was developed from November 2009 to March 2010 with minor changes throughout 2010 and refreshment of materials and the session plan in 2011 and 2012 (see Appendix D for plan). When designing a hearing loss prevention program for the school setting, the following recommendations for inclusions were made: information about the process of
hearing, varieties of hearing loss and what causes these, how noise affects hearing temporarily and permanently, detection of NIHL and prevention strategies for NIHL. There is a large emphasis on personal music players (PMPs) and other forms of entertainment noise. Children participate in a number of games and activities that combine with the use of videos and simulation equipment to provide a fun and engaging educational experience.

When the sessions were first implemented, 40 minute follow-up sessions were also conducted to most schools, through to the end of 2010. The follow-up sessions were held within 6-12 weeks after the initial session. These sessions consisted of follow-up evaluation surveys to test the knowledge and behaviour changes to the students and also a few other activities to showcase the things they had learnt previously.

These were discontinued in the schools in 2011 due to being overwhelmed with bookings. Additionally, there was not large demand from schools to have the follow-up session. As an alternative, teachers’ packs were developed which provided teachers with guidelines for follow-up activities and website links for further resources (see Appendix G).

(ii) Program name and logo

Cheers for Ears was selected as the name of the program. It was selected to be positive, easy to remember and was not a name in use by any other program. A logo was selected from a number of options developed by an external graphic designer (see Appendix F for logo design).

(iii) Program materials

a. A double-sided A4 fact sheet was designed. It includes a labelled diagram of the ear, a noise level table that included PMP maximum volume limit, information on hearing loss and also prevention strategies. These are utilised within the session during activities (see Appendix A).

b. A model ear and an animated video of the ear anatomy are used in order to teach how the ear functions and how we hear.

c. A sound level meter is used in conjunction with the fact sheets in order to measure the decibel output from personal music player headphones. Students establish safe listening time lengths for a variety of volumes.

d. Picture cards of different sound environments such as music concerts and stadium sports events are used in order to learn about protection methods against a range of potentially loud sounds and environments. The protection methods include turning down volumes, ear plugs and ear muffs, taking breaks, moving further away and using over-ear headphones.

e. A hearing loss simulation video is used to simulate hearing loss and its effect on everyday life. This is included within the slide show towards the end of the session, once students have established knowledge on the cause and prevention of hearing loss. (see Appendix C for slide show; video can be accessed via Youtube at: http://www.youtube.com/watch?v=1EJ4g3J6cJM)

f. The session is concluded by testing the students’ knowledge with some questions regarding the information learnt and prizes, including pens and erasers, are awarded to 5 children who answer things correctly. These all have the Cheers for Ears logo and website address displayed on them.

g. Class teachers are provided with a teacher’s pack which includes various follow up activities and information. It has worksheets for students, the fact sheet, information on where to access resources and an evaluation survey (see Appendix H).

(iv) Take away materials
a. **Fact sheet**: Although designed to be used in the classroom, it was also intended to be information that could be shared with parents and siblings.

b. **Wristband**: Being the most popular item in the take away materials, the wristbands display the Cheers for Ears website link and are something the students will keep with them for a substantial amount of time after the session.

c. **Sticker**: Students received a large Cheers for Ears logo sticker, including website link. This serves as a simple reminder and trademark for the program.

d. **Calico bag**: Displaying the Cheers for Ears logo, the bag not only holds the session materials, it is also a lasting resource that could be used as a library bag or for other things out of school. This provides them with information and reminders of the things they had learnt in the session. The bag includes the fact sheet, wrist band and Cheers for Ears logo sticker (see Appendix B).

(v) **Access to schools**

Initial access to schools was provided through introductions made to various schools through District Offices. A database of all schools in Perth was then generated from information publically available on the WA Department of Education website, and similar websites for Independent Schools and Catholic Education Schools. Emails and letters were sent to all schools at the beginning of each year, who were invited to complete a booking form detailing class sizes and preferred dates. Dates for sessions were negotiated by email or phone.

### 4.2 Website

#### 4.2.1 Purpose

To design, develop and maintain a website to share program information and related materials that can be accessed by a wide audience.

#### 4.2.2 Background

The use of the internet is now universally considered to be the optimal method to share information reaching local through to world audiences. It is used by people of a wide age range, forming an important element of the home, social, commercial and education environments. It is accessible via a number of mediums, from shared workspaces through to mobile devices. It is ideal as a communication tool for our project.

A number of related NIHL health promotional programs have websites that carry information about their activities. Of note are:

- **Dangerous Decibels** (www.dangerousdecibels.org): An American-based program that offers information and educator training packages online. It covers information for noise-induced hearing loss and prevention strategies, along with booking information for trainer workshops. The educator training workshops allow nurses, teachers and health professionals to sign up online to become trained and equipped to run Dangerous Decibels sessions in their area.

- **Hear The World Foundation** (www.hear-the-world.com): A Swiss-based initiative run by the Senova Group, Hear The World advocates for equal opportunities and improved quality of life for people living with hearing loss around the world. They support projects that help people with hearing loss by providing hearing aids and advocating the causes. Their website includes information on hearing, updates on projects currently being supported and also application processes for other interested projects.
• Hear2day (www.growsmartfoundation.org): Similar to Cheers for Ears, Hear2day is based in Perth, Western Australia and provides online information and educational videos and is based around running in-school education sessions. The website provides information for teachers, students and parents regarding noise-induced hearing loss and the program sessions.

• It’s a noisy planet (www.noisyplanet.nidcd.nih.gov): An American based site that provides all information on environmental and entertainment noises and hearing loss. There is a section for parents and a section for ‘tweens’. This site offers an option to order information sheets and posters promoting hearing awareness.

Information and links to other hearing health initiatives are on the program website.

4.2.3 Design criteria

(i) Website to be designed with a young audience in mind.
(ii) To be visually appealing to all demographics, with easy navigation.
(iii) Provide information for children, parents, teachers and schools, as well as links to reports, research papers, other programmes and related information.
(iv) Provide information on school sessions and access to booking forms.
(v) Program materials that can be downloaded.
(vi) Contact information.

4.2.4 Website outline

The Cheers for Ears website was designed using our in-house IT resources and launched in 2010, and then redesigned in 2012 using a professional design company as part of a redesign of our institution’s website. The domain name cheersforears.org.au was secured in 2010. The URL cheersforears.org.au has been included on all materials used in the school-based program, including the wristband, calico bag, stickers, pens, fact sheet, logo and letterhead.

The website provides information from industry, health sectors, research papers, and conveys this in a community focussed manner. The main pages are:

(i) Home / About us: This provides an overview of NIHL and introduces the Cheers for Ears program. Also displayed are links to news, new developments and innovations. It also provides information on the Cheers for Ears team and who is involved with the program.
(ii) NIHL: An explanation of noise-induced hearing loss, the effects of hearing loss and how risks of damage to hearing of difference sounds can be established. A sub-page (How we hear) provides information of the hearing system along with a cross section labelled illustration of the ear.
(iii) For Students: This page is aimed at children, and encourages them to think about their hearing, and the effects of hearing loss. It provides information on risks and ways to minimise risks.
(iv) For Teachers: Teachers are able to access information on improving classroom acoustics and things they can do to improve the environment at school. Cheers for Ears session information and booking information are also available.
(v) For Parents: Similar to the web page for teachers, parents are provided with information on providing a safe listening environment at home and actions they can take to influence listening habits. Links and information for booking Cheers for Ears sessions for their child’s school are also listed.
(vi) Resources: All program resources and booking form can be found here. There is also a list of media coverage of the program, published papers, journal articles, reports and links to other programs and websites.
4.3 Safe&Sound Smartphone Application

4.3.1 Purpose
To design and develop a smart phone ‘app’ that allows users to track their daily dose of sound delivered by their device. Warnings are to be provided when safe limits are approached and users are able to keep track of their safe daily listening percentages.

4.3.2 Background
As today’s society is becoming greater consumer of smart phones not only for communication but as their main source for listening to music, this must be included in a potential risk for NIHL. These devices are open to third party programmers to write applications (apps) to perform a wide variety of tasks.

4.3.3 Method
(i) **Operating systems:** The original proposal in 2009 included plans to develop an app for the iOS operating system, for the various Apple Inc. devices, e.g. iPhone, iPod, iTouch. At the time this platform was by far the most common one on smart phones.

Research in 2010 and 2011 showed that the iOS operating system does not allow for the sound produced to be monitored. Furthermore, running an app/programme in the background whilst the device is used for other functions e.g. as a phone, is difficult to achieve.

Android is an alternative operating system for mobile devices. Pioneered by Google, it is “open-source”, and does not have the same restrictions on programming as raised by iOS.

Since the start of this project the Android operating system has become increasingly popular. Although various methods are used to assess market share, in Quarter 2 of 2012, 64% of operating systems on mobile devices were Android (up from 43% in the same period in 2011) and 19% were iOS.5

Given the barriers to providing a solution on iOS devices, and the popularity of Android-based devices, it was decided to design and develop an app for Android devices.

(ii) **Design criteria:**
The following design criteria were used in the design and development:

a. A service which runs in the background.

b. Monitor the audio output from the device when the user has headphones plugged in and the device is producing music.

c. Collect audio samples and calculate an accurate value of sound output, taking into account the type of head or earphones in use.

d. Record the sound output on the device, with a date-time stamp.

e. Provide information to the user on the current sound level, and daily dose. Furthermore, to warn the user if daily dose approaches recommended maximum daily dose.

f. Collect some user demographics when the app is installed, and seek ask for authorisation to upload user data.

g. Upload user data to enable analysis.

(iii) **Development environment:**
The application was developed using the Android Software Development Kit (SDK). The programming language was JAVA.

(iv) Calculation of the sound level:
The sound pressure level (SPL) was determined using the product of the device volume setting of the device and the audio track data, together with a correction factor for the type of head or earphones in use. This value was converted to a decibel (dB) value using a conversion factor to produce the SPL.

As suggested by Portnuff 28 an adjustment for four different options is sufficient to take into account the effect on sound output of different types of head/earphones. The options are In-Canal, Ear buds, On-Ear and Over-Ear. Another influencing factor is earphone fit. The correction factor is linear in relation to the volume setting.

The mean SPL is determined from a 5 second sample every 20 seconds. The peak SPL during the 20 second sample is also determined. The sound ‘dose’ is added to the daily sound ‘dose’, and converted into a percentage of the recommended maximum daily sound exposure level as per Australia’s National Occupational Health and Safety Commissions Code of Practice has been used. 29 These are similar to those adopted internationally. This recommendation states that exposure to 85dB of sound for 8hrs (a normal working day) avoids permanent hearing loss, and that the exposure time should be halved for every 3dB rise in noise level. Therefore, the maximum exposure to 100dB should be no longer than 15 minutes. Each 20 second sample represents 1/1600th of an 8hr day; listening at 85dB for 20 seconds contributes 0.0625% to the maximum recommended daily sound exposure. If the sound level for the 20 second period is 88 dB, contribution to maximum daily dose is 0.125%; for 94dB the contribution is 0.5%.

The SPL and the volume setting are recorded on the application database, along with a data and time stamp and the user ID. Another table records the daily dose for each day, along with date and user ID.

To calibrate the app, a pink noise audio track from test devices were played through headphones and measured with a calibrated sound level meter. The root mean square (rms) value of the wave data had been was known. This enabled the conversion from the rms value to decibels (dB) to be determined.

(v) Use of the application:
After downloading the application from the Google Play site, the user is invited to install it. Before it can be used, the user is asked for some demographic information: year of birth, country and email address. The user is also asked to acknowledge that sound exposure data will be loaded anonymously to our database, and the type of head or earphones used is requested. Furthermore, three user options can be enabled:

a. ‘Enable notifications’ to allow a warning message to be shown on the device when the daily sound exposure reaches 80% and 100%.

b. ‘Enable volume control’ to allow the volume of the device to be automatically be lowered when the daily allowance reaches 80%.

c. ‘Enable audio monitoring’ to enable a popup for the user to acknowledge each time a head or earphone is plugged into the device.

The main application display prominently shows the accumulated daily dose value as a percentage of the maximum daily recommended level (see Figure 1). Also shown are the SPL and peak value for the previous 20 second sample.
Four icons at the base of the screen allow the following (see Figure 1):

a. Upload: to load sound exposure data to our database.
b. History Graph: The user is also able to view of daily history of noise exposure (see Figure 2).
c. Settings: To change the three user options, and also the type of head or earphones used.
d. ?: Information about the operation of the application.

![Figure 1: Screen Shot of Safe&Sound, showing the percentage of the recommended daily maximum sound exposure, and below it the mean and peak SPL of the last 20 second sample. The four icons below provide addition features. The small blue icon at the top left of the screen remains on the screen when the user moves to another application to show that the app is active.](image)

![Figure 2: Screen Shot of Safe&Sound, showing the daily history of noise exposure.](image)

(vi) Limitations:

a. In some cases samples (about one in ten) the rms value produced would be extremely high or extremely low. The cause of this is unknown and will be addressed in future versions. This unexpected behaviour was dealt with by having the calculated decibel output limited to a range of decibel values relative to the device’s volume setting. For example, if a volume setting on a device results in mean output of x, then the upper limit would be x+y and the lower limit would be x-y, where y is half of the valid decibel range for one volume setting.

b. The best-case for measuring sound output includes a correction factor for frequency, sometimes known an A-weighting, to take into account the frequency response of the hearing system. This would require a conversion of the data from the time into the frequency domain, using a fast Fourier transform (FFT). Current attempts have been
unsuccessful, probably because the resources of the devices were not sufficient to perform the necessary calculations.

4.3.4 Implementation and promotion

The application was named Safe&Sound, and launched on the GooglePlay site on 16 May 2012. Safe&Sound was promoted in a number of ways:

a. Link from the Cheers for Ears website, which directed visitors to the GooglePlay site.
b. A flyer was designed and provided to all children participating in Cheers for Ear who had an Android smart phone, and also included in the Teacher Pack (see Appendix E).
c. Channel 7 Perth interviewed the Cheers for Ears team, which was broadcast as a 90 second feature story on their evening news bulletin 30.
d. Radio station 6PR pre-recorded a 10 minute interview with Dr Eikelboom, and played in the NightLine programme on 11 July 2012.
e. The West Australian newspaper had an online story on Safe&Sound.
f. ESIA’s Winter 2012 edition of the SoundWaves newsletter carried a story on Safe&Sound (see Appendix P).
g. Safe&Sound was mentioned in all presentations made by Cheers for Ears team members at state, national and international meetings.
5. Summary of project key activities and outcomes

<table>
<thead>
<tr>
<th>Project deliverable</th>
<th>Outcome measure</th>
</tr>
</thead>
</table>
| Downloadable software application to measure sound output by a personal music player | The application Safe&Sound was developed for the Android platform.  
The app was launched in May 2012, accompanied by extensive print and electronic media coverage.  
To date over 260 people have downloaded the application.  
It is currently not technically possible to develop an application for the Apple platform. |
| Educational website –setup and maintenance                                          | The domain www.cheersforears.org.au was secured.  
Website was launched in May 2010, and relaunched with a new design in July 2012.  
The site contains the course materials, information on NIHL, and resources.  
The site attracts over 140 unique visitors per month. Most visitors are from Australia.  
Material is regularly added to the website. |
| Development and implementation of course for school children                         | A course for years 5 to 7 (ages 9 to 12) was developed from Nov 2009 to May 2010.  
The program was launched in May 2010.  
Over 3800 children at 46 primary schools participated in 2010, over 7500 children at 80 schools participated in 2011, and almost 10,000 children at over 100 schools participated in 2012. |
| Internal evaluation of course and application                                       | An internal evaluation of the course was conducted on a group of 318 children in 2010. Findings: knowledge was increased and retained, and behaviour was changed. Findings are to be published in a peer-reviewed journal.  
The smart phone application was downloaded by over 260 people from over 25 countries since May 2012; lower than anticipated. A review of usage data shows |
that users who use their device at or slightly below safe levels are likely to reduce their volume settings; but that people using their device at high levels are unlikely to change their behaviour.

| External evaluation of application and program | An external evaluation was conducted by Prof Roberto Togneri, The University of Western Australia. |
| Dissemination of results | The program has been presented at six national and international conferences. The program has received extensive state and national level print and electronic media coverage. The description of the course and the preliminary evaluation will be published in the journal Noise and Health. This report will be sent to national and international institution and bodies, and be made available on the program website. |
6. Project outcomes

6.1 School Program

6.1.1 Number of participants

Over the three years of the program, there was a significant increase each year in the total students who received the in-school sessions (Figure 3). In 2010 Cheers for Ears was delivered to 3,838 year 5 to 7 children in 46 primary schools in the Perth Metropolitan area. In 2011, 7,530 children at 80 schools were visited, including four Wheatbelt schools and one high school. In 2012, a little fewer than 10,000 students from over 100 schools, including 8 rural schools, participated. Therefore a total of almost 22,000 children were involved in Cheers for Ears over the three years of the program (Figure 3).

All the visits were conducted by one Health Promotion Officer in 2010 and 2011; she was assisted by another Health Promotion Officer in 2012.

![Cheers for Ears Participants - 2010-12](image)

Figure 3: Monthly (left axis) and cumulative (right axis) participants in the Cheers for Ears program from May 2010 to December 2012. Blue bars – from May 2010, Green bars – 2011, Orange bars – 2012.

The distribution of schools visited across Perth and the surrounding regions are shown is a series of maps (Appendix H). They show an even geographic distribution across the Perth metropolitan area, although with fewer visits in the southern suburbs compared to central and northern suburbs.

6.1.2 Internal evaluation

a. Student evaluation: An evaluation of the program was conducted in 2010 with 318 children. It surveyed children before the program, immediately after the delivery of the program in their classroom and three months afterwards. The analysis of the data showed that knowledge was gained and retained, and that there was some change of behaviour with children turning down
the volume of their personal music player. The full study was reported in a paper which has been accepted for publication in the journal Noise and Health. The full reference is:


The final pre-publication version of the paper is provided in Appendix R.

b. Teacher evaluation: A survey was conducted in 2011 with 31 classroom teachers. The survey was designed to determine their motivation for booking the Cheers for Ears session, satisfaction with the session, and plans to supplement the session. The findings in summary are:

- Most teachers (38%) invited Cheers for Ears to their classroom because they wanted to improve hearing awareness (see Figure 4).
- All teachers reported being more than satisfied (good or fantastic) with the session. All reported that their students now have the information to make better decisions regarding noise exposure.
- 42% reported that they had conducted a follow-up session with their class, and another 42% reported that they intended to do so.
- Suggested improvements included having more hands on material in the session; however, almost 40% did not think that changes were required.

![Figure 4: Reasons for involvement in Cheers for Ears.](image)

6.2 Safe&Sound Smartphone application

Five outcomes measures have been used to assess the use of application.

6.2.1 Downloads and installs

The GooglePlay Developer Console reports that over 260 people have downloaded the application (Figure 5), as at 25 February 2013. The majority of users have been from the United States (51.9%) and Australia (22.3%) (Table 2).
Figure 5 – Number of downloads by date.

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of downloads</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>137</td>
</tr>
<tr>
<td>Australia</td>
<td>59</td>
</tr>
<tr>
<td>Great Britain (UK)</td>
<td>11</td>
</tr>
<tr>
<td>India</td>
<td>7</td>
</tr>
<tr>
<td>Malaysia</td>
<td>6</td>
</tr>
<tr>
<td>Germany</td>
<td>4</td>
</tr>
<tr>
<td>Singapore</td>
<td>4</td>
</tr>
<tr>
<td>Romania</td>
<td>3</td>
</tr>
<tr>
<td>Ireland</td>
<td>3</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>2</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2</td>
</tr>
<tr>
<td>Austria</td>
<td>2</td>
</tr>
<tr>
<td>Belgium, Denmark, Hong Kong, Brazil, Norway, Turkey, New Zealand, Nepal, Pakistan, Philippines, Egypt, Colombia, Canada, South Africa, Vietnam, Netherlands Antilles, Italy, Kenya, Cambodia, Saudi Arabia, Mexico, Sweden</td>
<td>22</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>264</strong></td>
</tr>
</tbody>
</table>

Table 2: Downloads by country, with single downloads of countries grouped as one.
6.2.2 Registrations

To date (25 February 2013) 172 people have completed the registration procedure, and submitted their details. These show that:

i. 72.4% of the users are male (Figure 6);
ii. The average age is 31.4 years (SD: 14.1; Range 13.6 to 72 years) with no significant difference related to gender (Figure 7);
iii. 46.5% report using an in-the canal earphone and 34.7% an ear-bud type ear phone (Figure 8);
iv. Confirm the data from the Developer Console that the majority of users are from the United States and Australia, with the remainder coming from over 25 different countries including Nepal, Saudi Arabia and Colombia (Figure 9).

Figure 6: Gender of people installing Safe&Sound as reported when registering.

Figure 7: Age of people installing Safe&Sound as reported when registering.
6.2.3 SPL and daily dose recordings

Analysis of the uploaded data revealed the following:

i. Data was available for 42 users. The average percentage of the recommended maximum daily allowance ranged from 0.05% to 1325%. The average was 99.4% and the medium was 17.8%. This indicates that for the most part users were using their device with the recommended safety limits; however, a few users used their device unsafely; 13 users reported at least one day over 100%.

ii. Of those with data for more than two days (n=13), 6 showed a deduction with noise exposure over time, and only 2 an increase. However, as these results are from only a limited number of users and covering only a few days, no firm conclusions can be made.

iii. There were over 11,230 sample recordings, which translates to over 62 hours of listening time.

iv. The median SPL for a 20 second sample was 54.5dB, the average SPL was 55.4dB (SD: 18.4; Range 25.5 to 106.1dB); the SPL values were not normally distributed around the mean. 5.8% of the 20 seconds were over 87dB. 95% of the samples are less than 88.4dB (Figure 10).
6.2.4 Volume settings

i. 34.1% of users had the volume setting at 80% at the first recording, and this number did not change at the last recording. The largest change in volume setting occurred at the 60% to 80% setting; this halved to go from 22% to 11% (Figure 11).

ii. 15 users reduced their volume setting over time (mean decrease=48%, median decrease=46%), 4 after starting with a volume over 80%, and another 6 who started with a volume between 60 and 80%.

iii. 13 users increased it over time (mean increase=46%, median increase=25%). Of the 15 who decreased their volume setting, 4 had started with a volume setting at or over 80%. Of the 11 who increased their volume setting, 7 were already setting their device volume at or over 80%; only one of these 7 increased the volume by over 25% - by 117%.

iv. These results suggest that the use of the app is resulting in reducing the volume setting. However, those who already use their device at lower volume are the ones more likely to decrease their volume setting; and, those are using their device at high volumes are more likely do not change their behaviour.

6.2.5 Survey of users

A project was undertaken from September 2012 to February 2013 as part of the WA BioGENEius Challenge by Ms Ariel Wang, Year 10 student at Rossmoyne High School. The project involved surveying all registered users regarding their use of Safe&Sound to determine whether they liked the app, if it changed their behaviour, and whether they had any comments. The validated Youth Attitude to Noise survey was included. The survey was setup using the LimeSurvey that was deployed on one of our servers, and emailed to all to 143 registered users. However, only seven people responded (<5%).
Results: With only seven responses there was insufficient information to make many conclusions. However, five of the seven found the app “Very Good” to ‘Excellent’ and would recommend it to others, and six downloaded the app because of a personal interest in their health.

YANS scores and sub-scores were calculated (only six people completed this section), and compared to findings of other studies. There was no significant difference to the overall score, and all but one of the sub-scores (Figure 12). The F3 sub-score grading their ability to manage everyday sounds was significantly lower, indicating that this group of people found this more of a challenge. However, this is a notional result only, also because the age of this group was higher than for the comparison studies.

6.3 Website

Website reports on visits to the cheersforears.org.au website were available from May 2010 to July 2012 (Table 3), and from November 2012 to January 2013 after a new website was launched in July 2012 and a new traffic monitoring and reporting system was deployed. Visitor reports exclude those not considered to be true visitors, e.g. search engine robots.

These show that there has been substantial use of the website, and that the number of unique visitors continued to grow over time, although the time spent on the website and number of pages visited per visitor has decreased from a peak; this may indicate that visitors are quickly finding the information they are seeking.

Other information revealed from the traffic reports includes:

- Most visitors found the website through Google, by searching 'cheers for ears' or typing in the URL ‘cheersforears.org.au’.
- Most traffic was generated on weekdays, with most visits occurring during school times and in the early evenings. This suggests a strong link to the school based program, and that children are taking the message home to share with the family.
- The Cheers for Ears fact sheet was the most popular download from the site, followed by the information brochure.
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Hits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>8,301</td>
<td>40,471</td>
<td>17,420</td>
<td>n/a</td>
</tr>
<tr>
<td>per month</td>
<td>1,038</td>
<td>3,373</td>
<td>2,489</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Unique visitors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>191</td>
<td>761</td>
<td>714</td>
<td>419</td>
</tr>
<tr>
<td>per month</td>
<td>24</td>
<td>63</td>
<td>102</td>
<td>140</td>
</tr>
<tr>
<td><strong>Average visit time (seconds)</strong></td>
<td>270</td>
<td>424</td>
<td>281</td>
<td>156</td>
</tr>
<tr>
<td><strong>Top 3 visiting countries</strong></td>
<td>Australia, United States, Japan</td>
<td>Australia, United States, Malaysia</td>
<td>Australia, Great Britain, Ireland</td>
<td>Australia, United States</td>
</tr>
</tbody>
</table>

Table 3: Statistics of visitors to the cheersforears.org.au website
7. External evaluation

An external evaluation was conducted by Associate Prof Roberto Togneri, School of Electrical and Electronic Engineering, as per the funding agreement. His report focussed on the technical aspects, particularly the Safe&Sound application and the website.

See appendix S.
8. Other activities and achievements

Innovation has been ingrained into the program, as in addition to seeing over 15% of all WA children in years 5 to 7 each year, we have continually pushed the boundaries of health promotion and science to keep the program enjoyable, interesting and relevant to our target audience. On top of running the school based sessions, having an interactive website and a Smartphone application, we have implemented some other program tools in order to spread the NIHL prevention message comprehensively.

8.1 Safe Hearing Suzie

Safe Hearing Suzie is a sound level meter and hearing loss simulator built in to a manikin head. PMP headphones can be inserted into her ears and she will read the decibel level of the music being played. This is displayed by the screen along with an indication whether it is a safe listening volume or not. These same tracks or others that have been stored in her internal hard drive can then be programmed to simulate hearing loss.

Suzie provides students with an interactive association with the realistic truths and effects of NIHL. It is an excellent way to engage target audiences and create a real interest in this important topic. Safe Hearing Suzie is currently under final development stages and once completed, is sure to have a positive impact on school visits along with at different expo’s and events attended by ESIA and Cheers for Ears.

8.2 Cheers for Ears Charlie

Cheers for Ears Charlie is the CfE mascot. He visits different events to promote the Cheers for Ears messages. Charlie has been created in the form of a superhero, complete with headphones to show that these are one way to reduce the risk of NIHL. Charlie is utilised at community events such as Hearing Awareness Week, school assemblies, and children’s festivals. Cheers for Ears Charlie gives Cheers for Ears a recognisable ‘face’ which has contributed to gaining exposure within the community and promotes the NIHL prevention message in a new and exciting way.
### 8.3 Epic Ear Defence

*Epic Ear Defence* is an online computer game. Based on the Cheers for Ears NIHL prevention messages, it invites players to protect the ear from loud sounds that are entering it. It teaches the importance of and how to protect hearing from noise in a fun way.

Players have to devise defence techniques that help to turn down the volume of different incoming ‘enemy’ sounds. As more loud sounds escape the player and reach the eardrum, the game begins to subtly simulate hearing loss and tinnitus into the over sound track. It teaches the importance of hearing and how to protect the ears from damaging noise in a fun and entertaining way and is easily accessible to anyone.

Epic Ear Defence was created by a team of computer science and games technology university students at Murdoch University.

A short paper was written and published in 2012:


The game is currently being enhanced to include Cheers for Ear Charlie as the game character, a scoring system, an enhanced heads-up-display, and more sound enemies.


### 8.4 Cheers for Ears Mural

In March 2013 a large wall at the Ear Science Institute Australia was painted with a mural. Artist Chris Nixon will be painting the mural. The activity will be captured on video, and a 10-minute documentary incorporating time-lapse sequences will be produced professionally. Local primary school children will be involved in a science-meets-art session during the painting. The wall itself will be a great program promotional tool for all patrons to the ESIA building in Subiaco and passersby. The short film will then be used to promote the wall and the hearing health messages it conveys through the school sessions, on the Cheers for Ears website and social media accounts.
8.5 Prizes

In 2011 Cheers for Ears was awarded the AMA (WA)/Healthway Healthier WA Award. Cheers for Ears was one of 29 entries in that year.

In July 2012, a poster on the program won a Best Poster Prize at the Frontiers in Otorhinolaryngology meeting, Melbourne.

8.6 Media Coverage

The program has received extensive national attention in various media, including:
West Australian newspaper – 3 August 2010, 21 October 2010, 23 November 2010
West Australian ‘Back to School’ magazine lift out – 19 January 2011
School Matters, WA Department of Education – April 2011
Medical Forum WA magazine, distributed to all medical practitioners in Western Australia – 30 March 2011
Ear Science Institute Australia’s Soundwaves newsletters, sent to over 15,000 ESIA patients – Summer 2010, Winter 2011
Channel 7 News – July 2012
Radio 6PR – 11 July 2012
Artbeat with Mr Johnny Hooper, Radio RTR FM, 15 March 2013
Subiaco Post, 22 March 2013
UniNews, The University of Western Australia – Volume 3, No. 3, Spring 2012
MedeFacts, Faculty of Medicine, Dentistry and Health Sciences, The University of Western Australia – Volume 18, No 3, September 2012.

See Appendices I-Q for copies of some of these print articles.

8.7 Presentations
The program has been presented at a number of local, national and international meetings. A key presentation was a poster presentation at a special Academy Research Conference on Noise Induced Hearing Loss at AudiologyNOW, the annual meeting of the American Academy of Audiology, Boston April 2012. The full list of presentations is:

- Eikelboom RH, Leishman N. Implementation and evaluation of a NIHL health promotion program for children, AudiologyNOW 2012, Boston, April 2012. [poster]
8.8 High School Program

A variation of Cheers for Ears was delivered to two High Schools, in 2011 and 2012. The program was delivered in a similar format to the primary school program, with some modifications to make it age-appropriate. For this format, the program was called *Listen up! Keep it down!*

Hearing tests and the Youth Attitude to Noise Survey were administered at one of the schools. 23 teenagers (9 males, 14 females) had their hearing tested. The summary of the findings were:

- Eight reported having tinnitus.
- Eight also reported being exposed to excessive sound.
- Over 50% used their personal music player more than 3 hours per day, and over 60% had the volume set to 75% or over. There was a strong tendency for those who use PMPs more to have them louder than others.
- We compared the YANS data to a group of slightly older young adults in Sweden and in USA. As a group they were more proactive than the others in influencing environmental sounds, and they were less disturbed by sounds around them than those in USA and Sweden.

This activity was a strong confirmation that teenagers are at risk from NIHL from use of PMPs.
9. Conclusions and recommendations

9.1 Conclusions

Cheers for Ears has developed into an immensely successful program that has used a multifaceted approach in its delivery. The core activity of the project has been the school sessions; interest shown by schools was far greater than originally envisioned. Having planned to reach 1,000 students over the three years of the project, these expectations were overwhelmed by the total of over 22,000 students who have participated since the launch in May 2010. Not only did the program manage to reach well over 200 schools in Perth, but three rural trips each visiting four rural schools in the Wheatbelt areas of Western Australia were made.

The website has been accessible throughout the project, and provided a source for program materials, resources and further information. Visitors have been mainly from Australia, although the international relevance of noise induced hearing loss is demonstrated by the visitors from many countries around the world. A large range of international countries were also recorded for downloads of Safe&Sound, although the number of downloads was well below expectations – despite the considerable effort that was put into promotion. However, it is encouraging that analysis of the limited amount of usage data available appears to demonstrate that behaviour can be changed by the use of Safe&Sound.

The Cheers for Ears program was run by a small team, who were rewarded by winning the AMA(WA)/Healthway Healthier WA Award. Immense value was added by a number of initiatives, such as Safe Hearing Suzie, Cheers for Ears Charlie and Epic Ear Defence. Promotion of the program has been successful, through print and media exposure, and also by presentations at national and international conferences.

The success of this program may also provide a model for the implementation and delivery of other health promotion campaigns.

9.2 Recommendations for further work

Action on preventing hearing loss in the community: Cheers for Ears has successfully reached children at their schools. A number of other initiatives are required to extend the reach of this important message into the community:

(i) A public education campaign utilising electronic media should be designed and implemented. Animated television commercials, similar to the SunSmart advertisements, will increase the reach to a broad audience.

(ii) Manufacturers of personal music players should warn users of the dangers of permanent hearing loss resulting from high levels of exposure to sound. Legislation to restrict maximum output levels from personal music players should be put in place.

(iii) Entertainment venues should warn patrons of the dangers of over-exposure to noise, supply quiet zones and offer ear protection devices such as ear plugs.

(iv) Government bodies currently responsible for occupational health and safety that monitor and regulate noise levels at entertainment venues should have their mandate widened to include the protection of patrons.

(v) A health education program on the prevention of hearing loss should be part of the health education curriculum in primary and high schools across Australia.
These recommendations are in line with those made in the Hear Us: Inquiry into Hearing Health in Australia report (Community Affairs Committee, Australian Senate)\textsuperscript{32}, and also with those implemented and legislated in various jurisdictions in Europe\textsuperscript{33}.

Long term evaluation: A long term evaluation of the program is required, to determine if knowledge is retained for a number of years, and that changes in behaviour are carried on into teenage years. The relationship between noise exposure and hearing loss has not been extensively investigated; a longitudinal study of hearing of a young cohort and links to noise exposure will produce valuable data. Including in the assessment of hearing should be tests for early hearing loss using high frequency audiometry\textsuperscript{34} and DPOAE\textsuperscript{35,36}.

Outreach to rural and remote areas and the rest of Australia: This project has conducted most of its activity in the Perth metropolitan area. However, children living in rural and remote areas face the similar risks of NIHL due to over-exposure to noise, and so access to services should not be denied. It is possible that there may be less use of technologies such as personal music players, but there may be more exposure to agricultural noise. Providing equity of access to health promotion programs such as Cheers for Ears to children living in rural and remote areas presents a number of challenges. Not least of these are the time and travel costs to cover large distances. It will be necessary to develop alternative means to deliver the program. This would include the use of multimedia resources that teachers and schools can use, and video-conferencing sessions into the classrooms. Use of social media tools to share information can also be considered.

Similarly, the program is suitable for replication in other areas of Australia and indeed internationally. All resources developed by Cheers for Ears are available for use by other groups. The two primary challenges will be gaining access to schools and funding.

We have shown how access to schools can be managed; although we did not fully explore the motivation of teachers. Our survey of teachers shows that increasing awareness in students of the NIHL issue, recommendations by other staff and our invitations are primary motivations for teachers to invite the program to their class.

Funding: Funding is the most critical matter. The funding from the Department of Health and Ageing meant that the program could be provided free to schools. We estimate that the cost to deliver the program is over $500 per school, which includes the cost for the Cheers for Ears bag, fact sheet and wrist band. However, this is a cost that most schools are not able or willing to cover themselves. Charging schools a minimal fee has been considered, but the cost of administering this may be result in no net benefit.

Alternative funding sources are state governments from health or education budgets, philanthropic bodies or companies in the form of sponsorship. However, for the most part there is a general reluctance to provide core funding for programs such as these.

Generating an income stream from Safe&Sound or Epic Ear Defence is possible, but has not yet been planned or implemented.
10. Program team and Acknowledgements

10.1 Cheers for Ears team
Prof Marcus Atlas – Otolaryngologist, Director - Ear Science Institute Australia
Mrs Rebecca Bennett – Audiologist, Ear Science Institute Australia
Adj Prof Robert Eikelboom – Project Leader
Ms Janet Fountain – Volunteer
Ms Natalie Leishman – Health Promotion Officer/Coordinator (to Oct 2011)
Mrs Nicola Linton – Audiologist, Ear Science Institute Australia
Mr Craig Lowrie – IT Manager, Ear Science Institute Australia
Mr Peter Riggs – Programmer, Ear Science Institute Australia (2011-12)
Dr Brett Robertson – General Manager, Ear Science Institute Australia
Ms Sharon Safstrom – Community Projects Officer, Ear Science Institute Australia
Dr Dunay Taljaard – Audiologist, Ear Science Institute Australia (March 2012-)
Ms Ariel Wang – Student and BioGENEius Entrant, Rossmoyne Senior High School (2012-13)
Mr Brad Webster – Industrial Design Student, Curtin University (2012-13)
Ms Rhiannon West – Health Promotion Officer (Nov 2011-)
Mrs Gemma Upson – Audiologist, Ear Science Institute Australia

10.2 Acknowledgements
Mr Barry Cheeson – Chevron
Brandon D’Silva – videographer, Blaq Magic Innovations
Chris Nixon – artist
Hon Barry McKinnon – Cheers for Ears Patron
Mr Tyler Munro, Games Technology Student, Murdoch University
Mr Bach Nguyen, Games Technology Student, Murdoch University
Mr Shri Rai, Intelligent Systems Research Group, Murdoch University
Mr Peter Riggs, Games Technology Student, Murdoch University
Hon Tony Simpson MP, WA Legislative Assembly
Mr Jonathon Tennant, Games Technology Student, Murdoch University
Mr and Mrs V and J Wheatley

Australian Medical Association (WA)
Commonwealth Bank, Subiaco Branch
FORM
Healthway WA
Lions Hearing Clinics
Office of Hearing Services, Department of Health and Ageing
Subiaco City Council
The University of Western Australia

A special thanks to the thousands of children, and hundreds of teachers and schools that participated in Cheers for Ears.
11. References


5. Gartner says worldwide sales of mobile phones declined 2.3 percent in second quarter of 2012. http://www.gartner.com/it/page.jsp?id=2120015


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12. Appendices

Appendix A – Cheers for Ears fact sheet
Appendix B – Photo: Cheers for Ears bag with sticker, wristband and fact sheet
Appendix C – Cheers for Ears session slide show
Appendix D – Cheers for Ears session outline
Appendix E – Safe&Sound promotional flyer
Appendix F – Cheers for Ears logo design
Appendix G – Cheers for Ears teachers pack
Appendix H – BatchGeo maps: Cheers for Ears participants
Appendix I – Medical Forum article “Education is Key Against Hearing Loss”
Appendix J – The West Australian article “Saving Young Ears” June 2010
Appendix K - The West Australian article “Cheers for Ears” September 2010
Appendix L – The West Australian article “Cheers for Ears” November 2010
Appendix M – The West Australian Back to School Liftout “Hear, Hear” January 2011
Appendix N – The West Australian online “App aims to reduce hearing loss” 2012
Appendix O – School Matters Magazine article “Sound Advice”
Appendix P – Soundwaves Newsletter article “Cheers for Ears: ESIA protecting our children’s hearing”
Appendix Q – Soundwaves Newsletter article “ESIA wins esteemed Australian Medical Association (WA) Awards”
Appendix S – Cheers for Ears external evaluation
GET THE FACTS

Think about how important your ears are. Without them, you wouldn’t be able to hear your favourite songs, your friends talking to you, or even the birds outside.

Hearing is one of our most used senses, so it is very important that we look after it. Did you know that the damage caused to your hearing by noise cannot be reversed? That’s why we need to look after our hearing now to ensure healthy hearing in the future.

How do we hear?

<table>
<thead>
<tr>
<th>Decibel Level (Unit of sound measurement)</th>
<th>How long can you listen without protection?</th>
<th>Noise Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>0</td>
<td>Jet take off</td>
</tr>
<tr>
<td>120</td>
<td>0</td>
<td>Music concert</td>
</tr>
<tr>
<td>115</td>
<td>Less than 1 minute</td>
<td>Sports event</td>
</tr>
<tr>
<td>109</td>
<td>Less than 2 minutes</td>
<td>Car horn</td>
</tr>
<tr>
<td>106</td>
<td>3.75 minutes</td>
<td>Personal music player at maximum volume</td>
</tr>
<tr>
<td>103</td>
<td>7.5 minutes</td>
<td>Belt sander</td>
</tr>
<tr>
<td>100</td>
<td>15 minutes</td>
<td>School dance, machinery</td>
</tr>
<tr>
<td>97</td>
<td>30 minutes</td>
<td>Motorcycle</td>
</tr>
<tr>
<td>94</td>
<td>1 hour</td>
<td>Electric drill</td>
</tr>
<tr>
<td>91</td>
<td>2 hours</td>
<td>Shouting, lawn mower</td>
</tr>
</tbody>
</table>

Level at which damage begins

<table>
<thead>
<tr>
<th>Decibel Level</th>
<th>How long can you listen without protection</th>
<th>Noise Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>8 hours</td>
<td>Vacuum cleaner</td>
</tr>
<tr>
<td>55</td>
<td>Safe</td>
<td>Conversation</td>
</tr>
</tbody>
</table>
GET THE FACTS

WHAT CAUSES NOISE INDUCED HEARING LOSS?

- Playing your PMP at a high volume
- Using earphones that reach into your ear
- Sitting too close to a speaker or TV
- Exposing yourself to a reasonably loud noise for a long time
- Not using ear plugs when you are around loud noise

HOW CAN NOISE INDUCED HEARING LOSS BE PREVENTED?

- Turn the volume down
- Move away from loud noises
- Use ear plugs when you are around loud noise
- Use over-ear headphones to listen to your music
- Avoid places that are very loud
- Avoid earphones that reach into your ear

HOW DO WE LOSE OUR HEARING?

Our hearing is lost or damaged when the tiny hair cells that line the cochlea are damaged. This means that they can no longer send the messages to the brain to be translated into sound.

One way that this can happen is through noise. When we are exposed to a very loud noise, even for a very short period of time, or to a reasonably loud noise over a prolonged period, our hearing is weakened. Once the hair cells are damaged, they cannot be repaired and so the damage is irreversible.

TINNITUS

Tinnitus is a sound that you hear in your head or ears which is not heard by others. Different people hear different types of sounds, but tinnitus is often described as ringing, clicking, or buzzing. It is a very annoying noise that may not go away. Tinnitus often develops as a result of listening to high noise levels for long periods of time.

OUR HEARING IS VERY IMPORTANT, SO LET’S TAKE CARE OF OUR EARS NOW TO KEEP OUR HEARING STRONG.

3 CHEERS FOR EARS!

FOR MORE INFORMATION VISIT CHEERSFOREARS.ORG.AU

The Ear Science Institute of Australia (ESIA) is an independent, not-for-profit organisation. We are a community-focused partnership dedicated to the research and treatment of ear and hearing disorders. The Institute is affiliated with the University of Western Australia and teaching hospitals in Western Australia. For more information, visit www.earscience.org.au
Cheers for Ears bag with sticker, wristband and fact sheet
### Decibel level

<table>
<thead>
<tr>
<th>How long can we listen?</th>
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<tbody>
<tr>
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<td>Safe</td>
</tr>
<tr>
<td>55</td>
<td>Conversation</td>
</tr>
<tr>
<td>55</td>
<td>Safe Conversation</td>
</tr>
</tbody>
</table>
PMP SAFETY

- Volume level – halfway or lower
- Take regular breaks
- Avoid earphones that reach in to the ear
- Use speakers or docking stations

If the people around you can hear your music or if you can’t hear the people around you talk – it’s TOO LOUD!

NOISE AWARENESS

- With your pen/pencil and paper, write down any of the noises you can hear around you at the moment
Hearing Protection

- Turn down the volume
- Ear plugs and ear muffs
- Walk away
- Take regular breaks
- Avoid earphones that reach deep into the ear
- Use a docking station or speakers
Cheers for Ears session outline

<table>
<thead>
<tr>
<th>Program Outline</th>
<th>Running time / equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prior to session</strong></td>
<td></td>
</tr>
<tr>
<td>- Hand out student bags</td>
<td></td>
</tr>
<tr>
<td>- Make sure students have a piece of paper</td>
<td></td>
</tr>
<tr>
<td>and a pen/pencil</td>
<td></td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td>1 minute</td>
</tr>
<tr>
<td>- Presenter and programme</td>
<td></td>
</tr>
<tr>
<td>- Talk about hearing loss</td>
<td></td>
</tr>
<tr>
<td>- Noise/sounds</td>
<td></td>
</tr>
<tr>
<td><strong>Hearing loss activity / Ice breaker</strong></td>
<td>5 minutes</td>
</tr>
<tr>
<td>- This activity will aim to give the class a</td>
<td></td>
</tr>
<tr>
<td>idea of what it is like to experience</td>
<td></td>
</tr>
<tr>
<td>hearing loss or damage. It also serves as</td>
<td></td>
</tr>
<tr>
<td>an ice breaker.</td>
<td></td>
</tr>
<tr>
<td>- Presenter to face the class and say a</td>
<td></td>
</tr>
<tr>
<td>word at a normal volume, the class then</td>
<td></td>
</tr>
<tr>
<td>writes this word down.</td>
<td></td>
</tr>
<tr>
<td>- Class then cover their ears while the</td>
<td></td>
</tr>
<tr>
<td>presenter says another word, the class</td>
<td></td>
</tr>
<tr>
<td>write this word down.</td>
<td></td>
</tr>
<tr>
<td>- Ears covered, presenter covers their</td>
<td></td>
</tr>
<tr>
<td>mouth and says another word, the class</td>
<td></td>
</tr>
<tr>
<td>write this word down.</td>
<td></td>
</tr>
<tr>
<td>- Ears covered, presenter will cover mouth</td>
<td></td>
</tr>
<tr>
<td>again then turn their back to the class</td>
<td></td>
</tr>
<tr>
<td>and say another word, the class write</td>
<td></td>
</tr>
<tr>
<td>this down.</td>
<td></td>
</tr>
<tr>
<td>- Discuss with class how they felt about</td>
<td></td>
</tr>
<tr>
<td>not understanding words clearly etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Educational ear video</strong></td>
<td>10 minutes</td>
</tr>
<tr>
<td>Talk through the different parts of the ear</td>
<td>Equipment: Video on</td>
</tr>
<tr>
<td>and how it works, discussing the hair</td>
<td>laptop</td>
</tr>
<tr>
<td>cells and how NIHL occurs.</td>
<td></td>
</tr>
<tr>
<td>Take questions regarding video.</td>
<td></td>
</tr>
<tr>
<td><strong>Group activity</strong></td>
<td>10 minutes</td>
</tr>
<tr>
<td>- This activity is used to gage class</td>
<td>Equipment: Laminated</td>
</tr>
<tr>
<td>knowledge on noise levels of different</td>
<td>activity cards</td>
</tr>
<tr>
<td>events and activities.</td>
<td></td>
</tr>
<tr>
<td>- Ask students to write down the numbers</td>
<td></td>
</tr>
<tr>
<td>1 to 6 on their page. Display Slide 2 and</td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td></td>
</tr>
</tbody>
</table>
- have students order the 6 pictures (ranging from talking to a jet engine take off) in order from the quietest sound up to number 6 being the loudest.
- Once decided move on to reference later in session.

- **PMP and noise levels session**
  - Ask the class about PMP use:
    - do they own one/listen to one
    - What volume level
  - Refer to fact sheets:
    - First check the order of sounds they had listed in previous activity in reference to the table. Get them to mark them off and discuss.
    - Discuss table and noise levels, focussing on PMP at max volume. Talk about PMP safer listening techniques.
    - Discuss decibels
    - Using sounds level meter, read out decibel level of 4 different volumes on iPod with class having to decide how safe the volume is and how long it would take to begin damage to hearing. Discuss.

- **Noise awareness activity**
  - Students write down every noise they can hear while in classroom.
  - Share answers and discuss awareness of noises around us every day etc.

- **Hearing protection activity**
  - Ask students things they enjoy doing out of school.
  - Refer to pictures on board and have students come up with protection techniques for each, blutacing correct answers on as they are suggested.
  - Discuss how simple they are to do.

- **Discuss dangers of sleeping with earphones in, using example of 14 year old boy**

- **Go over summary of protection techniques on slide show.**

- **Hearing loss simulator**
  - This activity will give students a good idea on how different levels of hearing loss would sound.
- Play Flinstones video; discuss how hearing loss could affect their lives.
- Play hearing loss simulator on Ufit while further discussing the impact it could have on them.

<table>
<thead>
<tr>
<th>Summary questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Allow class to ask any last questions they have.</td>
</tr>
<tr>
<td>- Ask class 5 summary questions, awarding a small prize (such as pen, eraser) for answers.</td>
</tr>
<tr>
<td>- Conclude session.</td>
</tr>
</tbody>
</table>

| Ufit hearing loss simulator program |
| S7 |

| 1 minutes |
| Equipment: 5 prizes |

*Activity may be left out depending on time constraints and class behaviour

S = Slide number
FREE: App to safeguard your ears

Safe&Sound measures your noise exposure

Download this new FREE ‘app’ to measure the sound levels from your Android music player.

Make sure that the music you are listening to is safe and not damaging your hearing.

The app measures the decibel level of the sound emitted from your Android device and sends alerts when the sound is reaching daily recommended exposure limits.

Safe&Sound is suitable for all ages and can be downloaded now to any Android device from the Google App store:

Scan with a QR reader
to be directed to the download
Dear Teacher,

Thank you and your class for being part of the Cheers for Ears program.

In an effort to ensure constant updating and improvement of the program, we would appreciate your feedback. If you are able to complete the evaluation form below and return to us via email rhiannon.west@earscience.org.au, fax 6380 4901, or mail to Rhiannon West at the address at the bottom of the page, it would be appreciated.

Kind regards,
The Cheers for Ears Team

1. School name: __________________________________________________________

2. What attracted you to the Cheers for Ears program?
   __________________________________________________________
   __________________________________________________________

3. Were you happy with the presentation and the information provided?
   ☒ Yes, it was fantastic
   ☒ Yes, it was good
   ☒ Satisfied
   ☒ Needs improvement
   ☒ Not satisfied

4. In which ways, if any, would you improve any of the activities or the program as a whole?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

5. Have your students discussed the program any further since the session?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

6. Do you believe that your students now have the information to make better decisions about their hearing health?
   ☒ Yes
   ☒ No

Please add any feedback or comments that you would like to make.

__________________________________________________________
__________________________________________________________


Classroom Activities

Here are a number of activities that you may like to run in your classroom to follow up on what your students learnt from the ‘Cheers for Ears’ programme.

1. Poster Competition
   Ask your class to design a poster to make people aware of noise induced hearing loss and how to prevent it. Display the posters in the school library and ask other students to vote for their favourite.

2. Create a television or radio advertisement
   In groups, have your class create a television or radio advertisement to alert people about noise induced hearing loss. Each group can then show theirs to the class.

3. Quiz
   Students can create their own quiz questions using their knowledge on the parts of the ear and noise induced hearing loss. They can then share them and swap with each other.

4. Collage
   Using old magazines and newspapers, have your students create a collage about noise induced hearing loss. Ask them to write about the pictures and words they have chosen.

5. Please see attached worksheets that can be photocopied and used for class time activities.
CROSSWORD

Across
1. Small bits of foam that expand in our ears, used for protection against loud noises
4. A common type of personal music player
6. One of the tiny bones located in the middle ear, the ________, malleus and stapes
8. Instead of using headphones, we can plug a personal music player into ________
11. The snail-shaped bone where 15,000 hair cells are found
14. If we are near loud noises, it is a good idea to ________ ________
15. We should never listen to our headphones loudly while we ________ at night.

Down
1. Sounds are directed through the auditory canal to the ________ ________ where it begins to vibrate
2. The outside of our ear where sound is first caught is called the ________
3. All of the things we hear are called ________
5. We can use things such as ear muffs and ear plugs for ________ against loud noises
7. Headphones that go ________ our ________ are better than ones that sit inside our ears
9. Personal music ________ are any music devices that we plug our headphones into
10. When listening to music with our headphones, we should turn the volume ________ to half way or below
12. ________ noises can cause the hair cells in our cochlear to become damaged
13. To give our ears a rest from loud noises it is always important to take a ________
ACROSS
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 Cheers for Ears Quiz

1. What are 2 things we can do to protect our ears from loud noises?
   (1)  
   (2)  

2. What is the name of the bone where the tiny hair cells are found?

3. Approximately, how many hair cells do we have in each ear?

4. If we have our iPod/MP3 volume set to half way, how long can we safely listen for? (Circle) 8mins 40mins 4hours 8hours

5. What is the job of the tiny hair cells in our ear and how do they work?

6. What causes the tiny hair cells in our ear to fall over or become damaged?

7. Explain how the ear drum works?

8. What is the name of the tunnel that leads into our ear?

9. How can we tell if our TV/music is up too loud?

10. At what age can we lose our hearing?
Name the parts of the ear and what they do...

1. Name: Function:
2. Name: Function:
3. Name: Function:
4. Name:
5. Name:
6. Name: Function of 4, 5, and 6:
7. Name: Function:

Source: Maine Academy of Audiology 2012
ANSWERS

**Cheers for Ears Quiz**

1. What are 2 things we can do to protect our ears from loud noises?

(1) (2) Any 2: *Ear plugs, Ear Muffs, Take breaks, Walk away, Use better headphones or speakers if listening to music*

2. What is the name of the bone where the tiny hair cells are found?

*Cochlear*

3. Approximately, how many hair cells do we have in each ear?

*Anywhere between 15,000 and 18,000*

4. If we have our iPod/MP3 volume set to half way, how long can we safely listen for? (Circle) 8mins 40mins 4hours 8hours

5. What is the job of the tiny hair cells in our ear and how do they work?

*To send sound messages on to the brain, they move back and forth with the vibrations and send these messages through nerves to our brain where the sounds are distinguished*

6. What causes the tiny hair cells in our ear to fall over or become damaged?

*Loud noises – The vibrations become too big for the hairs to handle*

7. Explain how the ear drum works?

*The sound comes in from the auditory canal and hits it causing it to vibrate, it then passes these vibrations onto the small bones in our middle ear*

8. What is the name of the tunnel that leads into our ear?

*The auditory canal*

9. How can we tell if our TV/music is up too loud?

*If we need to shout over the top in order for other people in the same room to hear us, or if we can’t hear other people speaking normally to us in the same room*

10. At what age can we lose our hearing?  

*At any age*
Answers - Name the parts of the ear and what they do...

1. Name: Pinna  Function: Collects the sound, directs it further inside
2. Name: Auditory canal  Function: Sound waves travel together to ear drum
3. Name: Ear drum  Function: Sound waves hit it, causing vibrations to start
4. Name: Malleus
5. Name: Incus
6. Name: Stapes

Function of 4, 5, and 6: Pass vibrations on (to cochlear)

7. Name: Cochlear Function: Receive vibrations where tiny hair cells inside send these vibration sound messages onto the brain via nerves
2011 school visits
2010 schools visited
Total schools visited 2010-12
Total schools visited 2010-12
Education is Key Against Hearing Loss

A new education program hopes to prevent hearing damage in young Australians.

Personal music players and earphones could leave children with serious hearing problems in their late teens or early 20s, according to the Cheers for Ears free education initiative from WA’s Ear Science Institute Australia. The aim is to help children and parents prevent permanent noise-related hearing loss by educating primary school children.

Program coordinator Ms Natalie Leishman said noise-related hearing loss threatens a generation of young people.

“They could see the problems from noise within 5-10 years if they continue negative behaviours. It’s becoming more common and research shows personal music players that use small headphones are a major cause of this. Longer battery life means you can listen for hours on end, so it’s becoming more of an issue.”

“If they don’t start turning down the volume we will have a lot of younger people with hearing problems. This will impact on the workforce and a whole lot of other areas in their lives, so it does impact on public health,” she said.

Ms Natalie Leishman

She stressed that the hearing loss was permanent and irreparable and their audiologists were already seeing the effects. Simple things like the adverse impact of earphones that reach inside our ears, need to be part of the education.

Last year Natalie brought the program to 47 schools to educate some 4000 students and this year plans to see at least 37 more primary schools across the state. She conducts classroom presentations to show what damage can be done, and how to avoid it. She is hoping schools will include the information in their health curriculum and parents will take notice.

“Parents don’t always realise that personal music players can do damage – they often say to the kids to put headphones on so they don’t have to listen to their music. So if the kids have information to take home to their parents, it can help educate the parents as well,” she added.

Tuart Hill Primary School Principal Mr Stephan Bevan said his school’s involvement in the last two years was valuable, noting that program coordinators return to assess impact after the first session, which covers a range of ear health matters.

“From what teachers have told me, students have a high interest in it and there’s been a lot of discussion in class, so I think the students are taking the messages on board and I hope it will have a positive impact. It adds to the health curriculum and will hopefully have a positive impact on student behaviour now and into the future,” Stephan said.

See www.cheersforears.org.au for more information.
KIDS + SAFETY

Tracey Roberts

To protect your hearing

- Turn the volume down
- Reduce the time of use
- Take regular breaks
- Move away from loud noises
- Use earplugs when around loud noise
- Use over-ear headphones or noise-cancelling earphones
- Avoid 'bud' earphones and those that reach into your ears
- Avoid loud places

Source: Ear Science Institute Australia

Safely listen:
Listen at a lower volume for less time.

SAVING YOUNG EARS

Personal music players can cause irreparable damage to children's hearing

Hearing experts warn that iPods, MP3 players and personal music players (PMPs) might be damaging the hearing of children as young as seven and leading to long-term deficits. To prevent such irreparable damage, the WA-based Ear Science Institute Australia has developed an interactive program, Chores for Ears, that targets school students aged 10 to 12. Institute health promotion officer Natalie Leishman said the program taught younger children about the risks of PMPs and demonstrated what life was like with limited hearing.

At least half (children surveyed) listen to PMPs for more than two hours a day.

Hearing. It also advised them how to protect themselves while using the device.

The introduction of more sophisticated PMPs with larger storage capacities that encouraged people to listen to music at higher volumes for longer periods of time was a reason behind an increase in noise-induced hearing loss in young people, according to institute research manager Robert Elbourne.

An institute survey of primary school-age children showed at least half were listening to PMPs for more than two hours a day, with parents and teachers saying it was often at louder volumes and for longer periods than they felt was safe.

In addition, their studies also shown that WA young people were also regularly exposing themselves to potentially damaging noise levels at concerts and nightclubs, Dr Elbourne said.

"Capable of pumping out up to 115 decibels — a volume that safety guidelines specify should not be listened to for longer than one minute without risking permanent damage — PMPs were also capable of causing irreparable hearing loss, he said.

Temporary hearing loss and ringing in the ears could indicate immediate hearing problems from prolonged exposure to loud music, and also long-term damage.

International studies indicated noise-induced hearing loss was an increasing problem in children: US research reported up to 15 per cent of school-age children suffered from hearing deficits as a result of noise exposure.
CHEERS FOR EARS

The Woodlands Primary School

Dear Editor,

We are writing to raise awareness about a very important issue affecting children's health. The number of children with hearing loss is on the rise, and it is crucial to educate ourselves and our communities about the importance of early intervention.

Each child requires a thorough screening and hearing test, which helps to identify any hearing loss early on. It is vital for children to have their hearing checked by qualified professionals, such as audiologists, to ensure they receive appropriate treatment and support.

We encourage parents and educators to take proactive steps to prevent hearing loss in children. One effective method is to implement the "HEête" program, which is designed to educate children about the importance of hearing safety.

The HEête program is a comprehensive program that teaches children about the dangers of noise, how to protect their hearing, and how to use earphones safely. By raising awareness and promoting preventative measures, we can help prevent hearing loss in children.

We hope that by spreading this message, we can make a positive impact on the lives of our children and ensure they have a healthy and happy future.

Sincerely,

[Signature]

[Name]

At the Woodlands Primary School, we are committed to ensuring our students have a healthy start in life. With the help of the HEête program, we can make a difference in the lives of our children and provide them with the tools they need for a successful future.

For more information on the HEête program, please visit the website [insert website].
Cheers for ears

You're doing your homework listening to your iPod and your favourite song comes on so you crank up the volume. But before the song is finished you may have irreversibly damaged your ears.

SHARON SZCZECINSKI

It takes less than four minutes of listening to music at a high volume level before damage is likely. Some noises, however, are much worse. A jet taking off and a music concert are two noises that have no safe level of listening. Sound is measured in decibels and once it reaches over 85 decibels (roughly the level of a vacuum cleaner) damage to your hearing may begin. The humming of a fridge is about 45 decibels and normal conversation approximately 60 decibels.

A jet taking off reaches the dangerous level of 130 decibels and most music concerts are around 120 decibels. The louder the sound, the shorter amount of time you can listen before damage might occur.

Exposure to very loud noise, even for a short period of time, weakens our hearing by damaging tiny hair cells that line the ear's cochlea (a spiral tube in the inner ear). These cells can then no longer send messages to the brain that can be translated into sound. Once this happens the damage is permanent.

The Ear Science Institute of Australia promotes healthy listening habits through their Cheers for Ears school visits program and teaches students how to look after their ears. More than 47 metropolitan schools have participated in Cheers for Ears so far.

It is hard to imagine life without being able to chat with your friends (and hear their responses), listen in class or even hear the dialogue in your favourite TV show. Previously thought of as something affecting older people, hearing loss from loud noise is becoming more of an issue for young people as personal music players become more popular.

Preventing noise-induced hearing loss

• Turn the volume down.
• Move away from loud noises.
• Use ear plugs when near loud noise.
• Use over-ear headphones to listen to your music.
• Avoid places that are very loud.

(Source: www.cheersforears.org.au)
Hear, hear

Before starting school it is important for children to have regular check-ups, especially for hearing. According to the Ear Science Institute Australia, 25 per cent of school-starting children have hearing loss or irreversible damage to their ears. Much of this could have been prevented with education and hearing protection.

Hearing loss in children can profoundly affect development, including speech development and the ability to learn in a classroom situation.

Ear Science Institute Australia Audiologist Verona Munic said poor behaviour in class could be linked to hearing difficulties. Not only is academic life affected, but the child's interaction with other children can deteriorate as they may not understand what is happening around them.

"This can impact later in life as well if you haven’t identified the hearing problem or sought treatment," Verona said. "Hearing problems will continue throughout life to affect further education and employment."

At the Ear Science Institute Australia, audiologists recommend children be tested at birth, at nine to 12 months, three years, at entry to primary school and at any point where a problem is suspected.

Venita said middle ear infections could be related to hearing loss, which could cause pain and discharge from the ear and was common during cold and flu season. Signs can be: argumentative behavior, general unhappiness, pulling on the ears, temperature problems sleeping. Intolerance to sounds they may say are loud but are normal levels, becoming upset when the TV or radio are on at full volume, and wanting parents to repeat phrases that are spoken.

In younger children, if speech is not developing it’s often because they are not hearing correctly.

"It is an infection more often than not, a middle ear infection also known as glue ear or otitis media which can be fixed with antibiotics," Verona said. "Depending on the circumstances, leaving the infection untreated can cause further damage."

On the other end of the scale there is also noise-induced hearing loss, brought on because of exposure to loud sounds. Studies have shown noise-induced hearing loss in children is increasing.

The Ear Science Institute Australia runs the ‘Cheers for Ears’ program for upper primary students educating them on the effects of the use of mp3 players (personal music players). This is a big issue for that generation as the popularity of these devices increases exponentially.

While some mp3 players can be sound locked, children are often able to override the settings – education is the only option.

The ‘Cheers for Ears’ program includes a number of interactive activities to engage children and educate them about what they can do to protect their hearing. One activity is the playing of recorded sounds so children can hear the difference between healthy and damaged hearing.

"The program is conducted at schools to teach students about loud noises, loud sounds and the effect on hearing," Ear Science Institute Australia Health Promotion Coordinator Natalie Leishman said.

"We want the children to develop safe practices into daily life, whether it's controlling volume levels of the iPod or TV or wearing ear plugs when seeing drag cars – whatever will protect your hearing.

The ‘Cheers for Ears’ program has been running for nine months, with almost 4000 students between years five and seven at 47 schools taking part.

"Noise-induced hearing loss is irreversible" Natalie said. "You're not going to solve the problem by taking a tablet. A hearing aid may be the only solution."

"When your child has达到 age adulthood and employment seem a long way away but the damage will still be there, it's something you will have forever."

"Music festivals and nightclubs are always loud. We want to prepare children now for what they will be doing in a few years time. With kids it's easier to change bad habits and develop safe ones."

‘Cheers for Ears’ is a free initiative offered by the Ear Science Institute Australia. For further information, visit www.cheersforears.org.au.

Did you know your children could severely damage their hearing in just 4 minutes?

It’s true. With the volume on their MP3 Player cranked up they can irreversibly damage their ears in less time than it takes to listen to one song!

Protecting ears is not just a job for the owners of those little ears though. Schools have a big role to play in educating students in how to take the right precautions, and that is where we at the Ear Science Institute Australia can help.

Cheers for Ears is an educational and interactive program developed for years 5, 6 and 7 by the Ear Science Institute focusing on noise-induced hearing loss (NIHL). As a result of entertainment noise, in particular, MP3s (Personal Music Player). The program provides information on the ear and how we hear, what can cause hearing loss, the effects of hearing loss and strategies to avoid NIHL. The session includes a variety of age appropriate games and fun activities designed to encourage young people to take better care of their hearing.

For more information or to get your school involved in Cheers for Ears, contact Natalie Leishman on 6380 4900 or email natalie.leishman@earscience.org.au or visit our website at www.cheersforears.org.au.

The West Australian, Back to School Liftout, 19th Jan 2011
App aims to reduce hearing loss

A new app released by a Perth based hearing institute aims to help plugged in children and adults from potentially subjecting themselves to harmful levels of noise when listening to their favourite music.

Created by software developer Peter Riggs for the Ear Science Institute Australia, the Safe and Sound app measures the decibel level of the sound emitted from headphones and gives the user a clear indication of how loud their music really is.

It also records the user's listening history and alerts them when they are close to their daily recommended dose of noise exposure.

Mr Riggs said the app took into account the volume setting, waveform of the audio track and the headphone type which users key in when registering to measure levels within five decibels, "if not more accurate".

"It was a real challenge (to design) because there's nothing quite like it," he said.

Health promotion coordinator for the institute, Natalie Leishman said permanent hearing damage was becoming a bigger issue as personal music players grew in popularity, particularly in children unaware of the irreversible damage they were causing.

"The damage that you can get can start from a young age but because it accumulates you may not realise it until you're a little bit older, so it's something that needs to be addressed from a young age," Ms Leishman said.

Less than four minutes of noise from an mp3 player or iPod at maximum volume can be just as damaging as exposure to industrial noise.

Mr Riggs said the app could give parents piece of mind that their children were listening to music at appropriate levels of noise and time.

"It's the duration of how long you listen to music as well as how loud it is that can do the damage," he said.

The app is currently available to be download for Android devices.

Follow thewest.com.au on Twitter
Sound advice

Music is one of the best mood boosters and cranking up the sound can blast the blues away. It can also permanently damage your hearing, particularly if you’re listening to a personal music player through headphones. Priscilla Fournacres reports on the risk-reducing Cheers for Ears program.

Imagine never hearing your favourite song again. Or the sound of the ocean. Or your child playing on your friends’ hearing aids. Would you ever be affected if those things were no longer available to you? The use of portable music players at high volume is contributing to an increased incidence of noise-induced hearing loss. Without proper care it could happen to our children and our students.

While Australian statistics are not yet available, experts believe the situation in America is dire. The National Institute on Deafness and Other Communication Disorders report that 90% of children are exposed to noise that exceeds 85 decibels for periods of time over 8 hours. The effects are varied, but some in-ear headphones can reach over 100 decibels.

A study by the National Institute on Deafness and Other Communication Disorders 90% of children are exposed to noise that exceeds 85 decibels for periods of time over 8 hours. The effects are varied, but some in-ear headphones can reach over 100 decibels.

Access to a personal music player and listening to their device at a volume of 95 decibels is a common thing.

Many of the world’s leading researchers in the field of hearing loss believe that listening to music at levels of loudness above 85 decibels can cause permanent damage.

One of Australia’s leading researchers and experts in the field of hearing loss is Dr. Priscilla Fournacres. She has been researching the effects of listening to music at high volume levels for over 10 years.

During her research, Dr. Fournacres found that listening to music at levels above 85 decibels for more than 4 minutes can cause permanent damage.

She recommends that all students avoid listening to music at high volume levels for more than 4 minutes. This includes headphones and in-ear monitors.

Tips for protecting your hearing during your leisure time:

- Turn down the volume of personal headphones. This reduces the risk of hearing damage.
- Take regular breaks from listening.
- Use over-ear headphones to listen to music.
- Avoid headphones that reach inside the ear.
- Use ear plugs in loud places.

A person’s hearing can be damaged in less than four minutes.

When wearing headphones, noise levels of 100 decibels should be avoided. It is recommended that the volume should be lowered to a level where you can still hear what is happening around you. You should be able to hear the person or person next to you while listening to music.

Cheers for Ears was developed with the funding from the Department of Health and Ageing and was trialed last year in 15 schools in the Greater Melbourne, Bendigo, Ballarat and Clunes areas. Since then, over 1,200 students from 19 schools across the state and country have participated.

Further research and surveys have shown a significant decrease in the number of students able to hear when using their headphones. Additionally, the number of students who have hearing damage has decreased by 40 percent.
Cheers for Ears: ESIA protecting our children’s hearing

Crossing all ages, cultures and continents, music is probably the most universal form of entertainment and an important outlet of self expression, particularly in children and teenagers. And with the latest digital technology, personal music players (PMPs) have become the ‘must have’ item in the school back pack.

But their love of loud music is literally killing off the hearing of an increasing number of children and teenagers – recent studies show almost 20% of children in the US suffering noise induced hearing loss (NIHL) in 2005/6, up from 12-15% in the period up to 1994*.

Many of us understand the dangers of workplace noise but fail to consider how damaging entertainment noise can be. The latest PMPs can store large amounts of music, encouraging people to listen at increasingly higher volumes for longer periods of time. This is believed to be one of the reasons behind the rise of NIHL in young people.

Critically, many people appear to be unaware that NIHL is permanent, the damage irreparable. It is, however, preventable.

‘Cheers for Ears’ is a NIHL prevention program developed by ESIA, targeted at school children in Years 5-7 (10 to 12 year olds). The program has been designed to promote healthy behaviours and encourage children and young people to protect their hearing into the future. Since its commencement in mid May 2010, 47 schools throughout the Perth Metropolitan area have booked ‘Cheers for Ears’ sessions and by the end of November, almost 4,000 children will have participated.

It commences with a 1 hour interactive educational session given in the classroom by ESIA’s Health Promotion Coordinator, Natalie Leishman. Natalie uses a large model ear to show the parts of the ear and demonstrate how we hear. She involves the students in discussions and brainstorming activities that teaches them about the causes of hearing loss and strategies to avoid NIHL. She also has a computer program that simulates hearing loss and allows the students to experience what everyday sounds might be like with hearing damage. The students take home a ‘show bag’ with stickers, wrist band and information leaflets.

Natalie then returns to the school 6 weeks later for a 40 minute follow up session. This includes reminder information and a group activity where the students design NIHL prevention posters.

“Students are very enthusiastic to talk about music so we have a very captive audience. Whilst we’ll be doing formal evaluations of the program, feedback from students and teachers has been extremely positive. I am so encouraged how, in the second session, children have said they have reduced the volume that they listen to music” said Natalie.

To find out more about Cheers for Ears visit www.cheersforears.org.au or contact Natalie Leishman on 6380 4900 or email natalie.leishman@earscience.org.au.

Poster Competition Winners

Following their participation in ‘Cheers for Ears,’ children in Years 4 to 7 at Subiaco Primary School were invited to enter a poster competition highlighting NIHL and how to prevent it. We received an impressive 27 entries which were displayed in Subiaco Library over Hearing Awareness Week in August 2010.

Winners were presented with certificates and prizes of Dymocks gift vouchers and the school also received a gift voucher for participating. ESIA wishes to thank the City of Subiaco for supporting this competition.

*Third National Health and Nutrition Examination Survey (conducted between 1968 and 1994)
ESIA wins esteemed Australian Medical Association (WA) Awards.

ESIA shone at the recent AMA (WA) Awards Night and Gala Dinner, winning two of the four awards presented.

Vintrop Professor Marcus Atlas, Director of ESIA and inaugural Professor of Otolaryngology at the University of Western Australia, was presented with the distinguished AMA (WA) Award for his pioneering work in the field of Otolaryngology.

Professor Atlas said that he was humbled by the honour of receiving the award. “Being a medical practitioner is not as much a profession as a way of life – it reaches into all our parts – our families, our friends, our professional colleagues and a multitude of organisations,” Professor Atlas said. “ESIA and the Chair of Otolaryngology have allowed me to be part of a true community-based non-for-profit organisation.”

The AMA (WA) Award is highly regarded by the medical fraternity, as it distinguishes those who have made a significant impact in advancing the cause of medicine and improving the quality of life for civil society across the world. Past winners include Professors Michael Quinlan, Con Michael, Bryan Stokes, Fiona Wood, Bruce Robinson and Dr Val Lishman. The AMA (WA) and Healthway awarded the Healthier WA Award to ESIA for its Cheers for Ears program, which received $10,000 for its exceptional contribution to the advancement of health and wellbeing outcomes across Western Australia. In 2010, Cheers for Ears reached 4000 year 5 to 7 students. Bookings for 2011 total over 7,000 students at 66 schools. The award was received by ESIA Health Promotions Coordinator Natalie Leishman.

With the rise in popularity of personal music players and other types of entertainment noise, we know that many children are exposing themselves to levels of noise often higher than those in noisy workplaces where hearing protection is mandatory”, Natalie said. “Our research shows that over 90% of year 5-7 children have access to personal music players and only 20% of parents monitor the volume. So we still have a significant challenge ahead of us.”

ESIA holds successful first charity dinner and auction.

On 27th May ESIA held its inaugural charity dinner and auction at the majestic UWA Club, providing guests with a highly memorable evening and contributing valuable funds towards the advancement of medical research and education.

The evening’s speeches focussed on the fascinating and poignant personal journeys of Professor Marcus Atlas, Nobel Laureate Barry Marshall and Mr Danny Clarke, WA’s first simultaneous bilateral cochlear implant recipient.

Entertainment came from Masters of Illusion Adam & Selina Murby, whose mystical skills took them to the final stages of Channel 7’s Australia’s Got Talent show, and pianist Sue Bluck.

The many desirable items kindly donated for the event made for an exciting auction. Penfolds Grange wine, a trip to watch the Ashes at Lords Cricket Ground and the opportunity to be an SAS soldier for a day were some of the items on offer. The evenings raffle winners were drawn by Member of the Order of Australia, WA Citizen of the Year and ESIA Trustee Mr George Jones.

ESIA would like to thank all the donors and guests for their generosity and MC Jeff Newman and auctioneer Ron Farris for giving their time and talent to this unforgettable event. Plans for 2012 are already underway. For table reservations please email Ingrid De Meillon at ingrid@earscience.org.au.

Lions Hearing Clinic and the ESIA Implant Centre operate in association with the Ear Science Institute Australia. All proceeds from these organisations contribute towards the leading edge clinical research activities of the Institute.
Personal Listening Devices and the Prevention of Noise Induced Hearing Loss in Children: The Cheers for Ears Pilot Program

Taljaard D,1,2 Leishman N,1,2 Eikelboom RH1,2,3

Ear Science Institute Australia, Subiaco, Western Australia
Ear Sciences Centre, School of Surgery, The University of Western Australia, Nedlands, Western Australia
Department of Communication Pathology, University of Pretoria, Pretoria, South Africa

Abstract

Purpose: To determine whether the Cheers for Ears Program on noise induced hearing loss prevention was effective in improving current knowledge of noise impact of personal listening devices (PLDs) on hearing, and in changing self-reported listening behaviour of primary school students aged between nine and 13 years.

Method: A survey study was implemented at participating primary schools. Schools represented various levels of socioeconomic status. Informed consent (parents and teachers) and informed assent (pupils) were obtained. All pupils participated in two interactive sessions (the second six weeks after first) and only those who provided assent and consent were surveyed at three points during the study: prior to the first session (baseline), directly post session and at three months post session.

Results: Three-hundred and eighteen pupils were surveyed. The median age of the participants was 11 years (nearly 50% of the total cohort). Significant changes are reported in their knowledge about hearing and in listening behaviour of the participants as measured by pre-and post-measurement. The changes in behaviours were stable and sustained at three months post intervention survey point. The success of the program can be attributed to the multimodal interactive nature of the sessions, the spacing of the sessions and the survey points. Wide-ranging support from schools and departments also played a role.

Conclusions: The pilot Cheers for Ears Program program is effective in increasing knowledge on the harmful effects of noise and therefore it may prevent future noise-induced hearing loss.

Keywords: noise induced hearing loss, personal music players, personal listening devices, prevention, education program, health promotion

According to the United States Centers for Disease Control and Prevention, healthy behaviours are more easily established during childhood compared to adulthood. If childhood is the focus area for establishing lifelong healthy behaviour patterns (n.d:p.2), the educational environment in which the child spends most of their day is, by association, bestowed a significant responsibility in the promotion of health during childhood. One of the Healthy People (1) objectives is the prevention of noise induced hearing loss in children aged seventeen and under. A recent report by Henderson, Testa and Hartnick (2), described an increase in the exposure to loud noise and music through headphones, and a decrease in hearing-protection use in United States youths by comparing data from 1984-1988 to 2005-2006. The prevalence of noise-induced hearing loss in female youths had also increased to statistically significant levels compared to 20 years previously. Similarly, United Kingdom data indicate that 20% of young people regularly expose themselves to excessive levels of loud music (3). Personal listening devices (PLDs) or personal music players (PMPs) in the older vernacular may be a new major cause of hearing loss in children and adolescents. The most well-known of the PLDs, the Apple iPod, have had quite staggering success: over 50 million units have been sold over the past five years, notwithstanding the nearly 260 million units in sales since its launch in 2002 (4). For many, the iPod is a status symbol and an indication of social standing (5). Figures for other PLDs are not as readily available, but between 2004 and 2007 in the EU alone, there was an estimated 184-246 million portable audio devices sold (6). The last decade has witnessed PLDs with improved quality, capability and louder output without sacrificing battery drainage. Individuals can listen to louder music for longer periods of time (5, 7-10). The
maximum sound level for many personal music players ranges between 80 and 115 dB, with different types of earphones potentially increasing the output by 7 to 9 dB. In some cases, it is possible to reach over 120 dB (6). While PLDs are particularly popular with teenagers and young adults, their popularity with younger children and adults is also growing (5, 8). If, in those situations, the listening levels are excessive, it follows that music induced hearing damage in children is a serious and mounting concern (11, 12).

An increase in the number of publications discussing music related hearing loss is noted (13, 14). Recent studies have shown that due to the time spent each day listening to PLDs and the average volume levels, approximately 5-10% of listeners are in danger of developing permanent hearing loss after five or more years of exposure (6). Traditionally, excessive noise exposure in children resulted from activities with loud toys, fireworks and engines (15) and noisy music environments were associated with nightclubs and concert venues (16). The widespread adoption of PLDs, has enabled traditionally “quiet” activities, such as reading, walking or using transport to carry a noise exposure risk (17). Considering the growing market in the pre-teen age group, an entire generation may be at risk for irreversible hearing loss before they reach adulthood. Snowden and Zapala (18) described that more than half of the 58 middle school children in their sample admitted to setting their iPods at unsafe output levels. Middle schoolers also underestimated their listening levels.

Many behaviours and lifestyle choices generally occur during the progression to adolescence (19, 20). Establishing healthy behaviours during childhood, whilst they are in their formative years, is easier and more effective than attempting to change the unhealthy behaviours that have been carried through to our adult life (2, 15). It is therefore practical to target children in the pre-adolescence phase in order to avoid the establishment of bad listening habits. Hearing promotion and loss prevention programs remain lacking from primary and middle school health policy (2, 9, 10, 21).

Listening to music should not be discouraged; it is a vital part of culture. Fligor (22) states that rather than legislation for the use and output limits on the PLDs, education efforts and assisting children with good decision making strategies should be prioritised. One of the greatest challenges for health promoters, however, is to design programs that will motivate, assist and empower young people to change their behaviours (23).

When designing a hearing loss prevention program for the school setting, the following recommendations for inclusions have been made: information about the process of hearing, varieties of hearing loss and what causes these, how noise affects hearing temporarily and permanently, detection of NIHL and prevention strategies for NIHL (23, 24). The success or failure of a program lies less in the information that is available, and more in the opportunities available to deliver, and the methods used in delivering this information to children and young people (23). Interactive, age appropriate programs, which include activities that can be adapted to suit a variety of age groups, have a greater chance of success. The basis for the activities should include education on how hearing loss may affect their life and what activities are potentially dangerous to hearing (2, 23).

A number of programs have been developed in university or research institutes, government departments, or other health initiatives. Some of these programs include some education materials that can be adapted for use in the classroom, whilst others have developed comprehensive programs complete with activities for students, teacher resources and other items, such as videos (23). The Portland-based “Dangerous Decibels” (www.dangerousdecibels.org) is an example of an effective NIHL prevention program. This program is multifaceted, offering on-line resources and lessons for teachers, an informative and interactive website, facilitator training, and a museum exhibit that can be visited by the public. “Dangerous Decibels” has been evaluated (15). In a cohort of 478 fourth graders and 550 seventh graders, baseline questionnaires were distributed noting their knowledge and attitudes on hearing and hearing loss prevention. Half of the cohort received a 35 minute intervention. The questionnaire was repeated directly after the session and three months later. The fourth graders showed increased knowledge and attitudes on hearing and hearing loss
prevention which were maintained at the three month interval. The seventh graders, on the other hand, showed long term improvements on the knowledge portion of the questionnaire but their attitude and behaviours reverted to baseline levels at the three month checkpoint. The study concluded that repeated multimodal intervention should be implemented and the impact of peer pressure further explored (15). Other projects focusing on NIHL information for younger populations are “Sound Sense”, developed by the Hearing Foundation of Canada (www.soundsense.ca) and “It’s How You Listen That Counts” out of the House Research Institute in California (www.earbud.org). Both programs provide curricula and activities for teachers to use in classrooms. “Hear the World.com” has been developed by Phonak and “Listentoyourbud.org” by the American Speech and Hearing Association (ASHA). In New Zealand “Don’t lose the music” focuses on music and tinnitus education for the youth. Many resources from the listed programs are available on-line, allowing the messages of these programs to reach a large audience overcoming geographical isolation in remote areas.

For a greater chance of success, it is important to include program repetition; delivering the message more than once ensures that it is instilled in the participants. By returning to the issue a number of times and reiterating its importance as well as continuing to develop the techniques and strategies with students and hence changing their habits, there will be a greater likelihood of acceptance of the programs recommendations and consequently, behaviour change (15).

The current program
The current study describes results from the “Cheers for Ears” pilot noise induced hearing loss prevention Program. Funded by the Australian Government Department of Health and Aging for a period of three years, schools in the Perth metropolitan area were targeted. Cheers for Ears attempted to address some of the recommendations from the body of research on NIHL in school-aged children by aiming the intervention at pre-teens, 9 to 13 year olds, instead of adolescents. In addition, the children themselves were engaged in multimodal activities, which were educational and interactive in nature. In addition, the Program presenters followed up the first session, six weeks later, with a return visit with additional educational and interactive activities. An evaluation of the program was conducted after it had been implemented.

Method
The study aimed to determine whether the Cheers for Ears Program was effective in improving current knowledge of noise impact on hearing and listening behaviour of primary school students between the ages of nine and 13 years of age. Primary schools, representing a cross-section of Perth (private and public schools in various socioeconomic environments) were targeted through the district offices of the Department of Education Western Australia. School principals were contacted and the purpose and procedures of the project outlined. Upon verbal agreement, copies of an information sheet and informed consent form were delivered to the school for completion by the parents and teachers, and informed assent forms were provided to the Year five, six and seven pupils themselves. Without the informed consent, the children still participated in the activities and sessions, but not in the survey completion. Due to the piloting nature of the project, anonymity was prioritised over tracking data over time and therefore names were excluded from surveys.

The baseline survey was sent out to obtain baseline data before commencement of the first session and completed in the participants’ respective class. The session was conducted and a second (post) survey was completed directly following the session after the instructor departed, referred to as post survey 1. The teachers collected and posted completed data to the authors. A follow-up session was conducted six weeks after the first session. Six weeks after the second session (at the three months point following baseline data collection), a second post survey, referred to as post survey 2, was completed by the participants, collated and sent to the authors by the classroom teachers. The baseline survey consisted of 13 questions and post survey 1 and 2 of 14 questions. The first two questions asked for first names and determined their age group, six were about their experience with
PLDs and remaining five or six questions were about sound in general (Appendix A). Classroom participation rates in the surveys for all the questionnaires were above 80%. The age of the participants range from 9 to 13 years, and the median age were 11 years (Table 1)

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The Cheers for Ears Program
The running time for this first session was approximately 50 to 60 minutes. Prior to the session, goodie bags (Figure 1) containing a Fact Sheet, wristband and stickers were handed out to students who were also instructed to have paper and pencils with them. The information of the two-sided Fact Sheet can be retrieved from www.cheersforears.org.au.

![Figure 1: Cheers for Ears Goodie bag.](image)

The Program was introduced by talking about hearing loss, noise and sounds. Students were asked to think about their favourite sounds and how they would feel if they could not hear them. A hearing loss related activity followed, with the aim of simulating the experience hearing loss or damage. An ear model was shown and each component of the auditory pathway was discussed. In particular, the cochlea and hearing cells were emphasised as the site where noise damage occurs. The session continued with a section on PLDs and noise levels. The class was asked if they owned or listened to a PLD, how often do they listened to it, at which volume setting they listened to the PLD, whether their parents controlled the volume, if they turned it up in a noisy place and used headphones when listening.

The Fact Sheet was used to explain different noise levels and at which noise levels hearing protection was needed. The class was divided into three or four groups. Each group was provided with coloured markers and three pieces of butcher’s paper headed:

- Loud places and activities;
- How hearing can be damaged and what causes hearing damage;
- How hearing loss can be prevented.

Each group shared their answers with the class and the posters were displayed in the classroom.

The presenter played a sample of music and speech at a normal level and then with a simulated hearing loss using computer software. A discussion followed the simulation. The session concluded with summary questions where students were able to win a small prize (such as a pen or eraser) for correct answers. Students completed the post Program survey.

The follow-up session ran for approximately 35 minutes. It started by providing a brief summary of last session. It was followed by a group activity where each group had to select one of the following topics and design a poster around the theme:

- The louder the noise – the shorter the listening time;
- What do you do when you can’t turn it down – at home, concert, event, etc.;
- Peer pressure;
- NIHL prevention;
- NIHL awareness.

The posters were shown to fellow students and discussed in class. The session concluded with summary questions and small prizes for correct answers.

Data Analysis
Survey data were entered into a database and prepared for descriptive statistics. Where appropriate, correlation was determined with the Wilcoxon signed rank test for related ordinal data. For open-ended questions, the
chi-squared test and a one-way Analysis of Variance were used.

Results

Use of PLDs

The majority of participants, 292 of the 318 participants (91.8%), in the baseline survey owned or had access to a PLD. Despite having access to PLDs, the hours of listening per week were low and did not show any statistically significant differences at the survey points (baseline, post survey 1 and post survey 2). If a participant had access to a PLD and opted for listening less than two hours per week, did it imply parental supervision for PLD use? The pilot questionnaire did not ask that question in particular, but participants were asked whether parents controlled the volume of their PLD. 246 (79.1%) of the participants reported that their parents did not control the volume on their PLD. The majority of the participants had limited listening time with their PLD, without any explicit parental supervision.

Table 2 Participant Listening Behaviour with PLDs in percentage: baseline to post survey where **p<0.01, *p<0.05

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</tr>
<tr>
<td>Hours of listening per week</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2 hours</td>
<td>46.2</td>
<td>49.8</td>
<td>44.6</td>
</tr>
<tr>
<td>2-5 hours</td>
<td>27.9</td>
<td>25.4</td>
<td>28.6</td>
</tr>
<tr>
<td>6-8 hours</td>
<td>17.3</td>
<td>12.5</td>
<td>14.1</td>
</tr>
<tr>
<td>9-12 hours</td>
<td>5.6</td>
<td>5.6</td>
<td>2.5</td>
</tr>
<tr>
<td>&gt;12 hours</td>
<td>8</td>
<td>6.6</td>
<td>5.2</td>
</tr>
<tr>
<td>Volume setting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 25%</td>
<td>17.3</td>
<td>20.8**</td>
<td>15*</td>
</tr>
<tr>
<td>25%</td>
<td>31.3</td>
<td>26**</td>
<td>31.3*</td>
</tr>
<tr>
<td>50%</td>
<td>26</td>
<td>29.1**</td>
<td>43.9*</td>
</tr>
<tr>
<td>75%</td>
<td>15.3</td>
<td>13.1**</td>
<td>5.1*</td>
</tr>
<tr>
<td>Over 75%</td>
<td>10</td>
<td>11.1**</td>
<td>4.7*</td>
</tr>
</tbody>
</table>

The next question enquired about the preferred volume setting of the PLD, as the most obvious protective behaviour with regards to NIHL is to decrease the volume to a safer level (10, 24). While it is acknowledged that there may be manufacturer-based variation in the setting ranges on the different PLD devices, there was a statistically significant difference between baseline and the post survey 2 volume settings (p=0.002) as well as the post survey 1 and post survey 2 (p=0.041) suggesting that the Cheers for Ears Program changed their listening behaviours with respect to volume, and that the change remained stable at the post survey 2 point. The proportion of participants who listened to 50% volume level increased from baseline to post survey 1, and baseline to post survey 2. It can be speculated that the lower risk individuals could have enough knowledge to slightly increase their noise-load without causing harm post education.

When combined with the previous findings of limited listening time, it can be surmised that the majority of participants controlled their own PLD use, listened for less than two hours per week and had, after the Cheers for Ear Program, reduced the volume of their PLD. Participants were asked to explain, briefly, their reasons for listening at their selected volume setting. Of the responses, the following were the most prevalent at both the directly post and the three month most session: “to block out background noise”, “it’s not too loud or too quiet”, “so I don’t damage my hearing” and “it sounds better”.

When asked whether sound at this volume was damaging to their hearing, 65.6% of the participants said ‘no’ in post survey 1, and 73.2% answered ‘no’ in the post survey 2. Conversely, the answers indicated that there are still in excess of a third of the participants (34.4%) who acknowledged their selected volume level as damaging. Similarly, at post survey 2, 26.8% of the cohort still felt that the volume setting was damaging to their hearing suggesting lack of awareness and change in listening behaviour.

An encouraging finding can be reported when participants were surveyed on whether they will reduce their listening volume: 90.6% answered in the affirmative at post survey 1, and 87.8% answered affirmative at post survey 2. When asked for the reason why the participants would change their listening behaviour by turning down the volume setting, 88.4 and 86.9% selected that they ‘don’t want to be deaf” as the primary reason at the post survey 1 and post survey 2. The answer suggested that the participants understand the long term consequences of noise induced hearing loss, and the role that listening to a PLD at a too loud setting can have in losing one’s hearing.

Damage by loud sound in general

Participants were asked about sound damage in general. Three yes/no questions were posed:
1) Can sound damage your hearing?  
Using a Wilcoxon rank test, a statistically significant difference were found between the baseline and post survey 1 (p<0.001), and the baseline and post survey 2 answers (p=0.015). The findings suggests that there is a change in the knowledge about damaging sound.

2) Can damaged hearing be fixed?  
Changes were evident in the hearing knowledge, when participants responded to whether damaged hearing can be fixed and whether damage can occur at all ages. Both baseline and post survey 1, and baseline and post survey 2 changes were correlated at p=0.0001 using a Wilcoxon rank test.

3) Can damage occur at all ages?  
A statistically significant difference was evident between the baseline and post survey 1 (p<0.03). Surprisingly, there was no statistically significant difference between the baseline and post survey 2 results; we expected the first pre/post measure to be replicated. Upon closer examination, it was noted that there were slightly less of the post survey 2 questionnaires returned compared to the post survey 1 questionnaires, possibly influencing the second analysis. The questionnaire concluded with open-ended questions. The first of the open ended questions requested participants to list sounds which cause noise damage. A wide variety of answers were provided. Some were from the information provided, but students were able to generalise to other contexts, for example, building sites, even certain classrooms.

Eight-six per cent of the participants could identify two sounds, and 60% could identify three or more sounds which can cause damage. There were no statistically significant increases in the number of sounds identified between the three survey points for this particular question.

The participants were asked to identify sounds that causes damage immediately. A wide variety of noises were identified, of which several were not directly mentioned in the Program. In addition, the number of answers increased over time. Statistically significant differences were evident in the baseline to post survey 1 comparison and in the baseline to post survey 2 comparison. In the baseline survey, 50.3% were able to identify two sounds. The number rose to 84.6% in the post-surveys.

Finally, participants were asked about possible solutions for noise prevention. There were statistically significant differences between the baseline survey and post survey 1 and baseline survey and post survey 2 results. In the baseline survey, less than 50% identified two methods of prevention and 13% could not identify any preventative methods. The post-survey results indicated that 90% could identify one method, and 80% could identify two methods of prevention.

The two most frequently occurring entries were to turn down the volume, use earplugs and limit listening time. These strategies are appropriate for all listening scenarios and suggest that the message of hearing conservation has been well received and that changes in listening behaviour are evident. A graphic summary of the post survey 2 responses, and the frequency of the occurrence of the responses, are presented in Figure 2.

Avoid earphones Avoid Loud Places Don’t scream  
Ear Muffs Education Ear Plugs Hands over ears  
Limit Listening Time Move away Speakers not headphones  
Take a break Turn Volume Down

Figure 2. Prevention strategies and frequency of response occurrence for post survey 2

Discussion
The study piloted a hearing loss prevention Program aimed at primary school aged children in Perth, Australia. Our aim was to investigate whether the Cheers for Ears
Program brought about change in listening behaviour and hearing knowledge with regards to the use of PLDs.

Our initial findings are promising and suggest that a change in knowledge about hearing and in listening behaviour occurred in the participants as measured by baseline and post-measurement. The changes in behaviours were stable and sustained at three months post intervention, which is encouraging as similar studies in seventh graders did not show the sustained change at the three month juncture (15). Our participants were also more alerted to which sounds can cause damage, and were able to offer several practical preventative strategies to prevent noise damage from occurring.

There were no changes in the amount of time spent listening to PLDs in our study. Overall, the listening time was lower with nearly half of the participants listening less than two hours per week. A similar finding was reported by Danhauer et al. (4) in their high school aged cohort who did not perceive themselves as listening for excessive durations of time.

The content of the Program identified risk and protective behaviours and factors, and enabled the participants to develop strategies to aid in the prevention of NIHL. In this regard, the Program was able to provide participants with the information they need to make informed decisions about their health behaviours (7, 25). It seems that the participants assimilated the content and were subsequently able to identify risky behaviours, and preventative strategies to empower them to protect their hearing.

Factors contributing to the Program’s effectiveness:
The factors that contributed to the success of the pilot are multifaceted. Broadly, the Program received administrative support from the State Government, the Department of Education and schools who were included in the sample. This point cannot be overstated.

The lack of bureaucratic awareness and negative attitudes of educational staff (4, 23) have often been cited as one of the major contributing factors behind the unpopularity and sporadic implementation of health conservation programs in school. Our pilot was accepted and supported at every managerial level. By the end of 2012, over 22,000 children at over 220 schools will have been involved over a less than three year period. We concede that widespread implementation is still lacking, as is the case with several of the US-based programs (15).

Another contributing factor is the methodology of the pilot. As with other hearing conservation programs in schools, baseline and post-questionnaires were issued. According to Griest et al. (15), long term evaluations (2-3 months post instruction) are critical in the evaluation of the success of the programs, but remains mostly lacking from the majority of hearing conservation programs. Our study included the long term evaluation questionnaire, and combined with the high return rate of surveys were able to comment on the sustainability of the changes in listening behaviour and hearing knowledge.

The final factors contributing to the successful implementation of the Cheers for Ears Program was the session format, content and spacing. According to Black, Tobler & Sciacca (26) interventions with several components, using several modalities, are more effective than single session endeavours. Overall, long term effectiveness can further be enhanced if a second, separate repetition session is offered (27). The Cheers for Ears Program encompassed all of the above: the participants used eyes, ears, hands in a variety of activities. A follow-up session was scheduled. In addition, the session was interactive (28) and the approach non-threatening. The activities were age-appropriate for primary schoolers. Tangible reminders were also provided in the form of the goodie bags.

Some of the limitations of the study include the following:

a) The classroom Program did not specifically address peer pressure, nor did our questionnaires assess any peer impact. The impact of peer pressure will be further explored in a future iteration of the Program.

b) Attitudes were not assessed specifically, except perhaps to enquire about the reasons behind specific volume settings. Several interpretations can be imputed into the descriptions offered by participants. For example: do comments like “I don’t want to go deaf” or “I have just learnt that it can damage my hearing” suggest attitudinal change? Conversely, do
comments like “I don’t think it is too loud” suggest a sensible attitude? Do comments like “my parents have it at this level” suggest sensible or excessive volume settings? More concerning, however, do comments such as “I enjoy it”, “hearing loss doesn’t bother me”, “I’m not using ear phones” point to a lack of understanding the full implications of excessive volume settings and listening durations on a PLD? More research is clearly indicated.

c) The role of the parent / caregiver in the maintaining of good or poor hearing health has not been investigated. Some of our content responses suggest that this deserves further exploring. The description of the influence of parental supervision and role modelling in the pre-teen age group will also be investigated.

d) The tracking of individual data over a longer time would also benefit the development of a clearer picture of the listening behaviour and hearing knowledge of this cohort. In its current iteration, this option is unavailable.

e) Finally, specifying the type of earphone in use would be essential as the same PLD could have a different output curve when coupled to a certain earphone type.

**Conclusion**

Our study piloted a hearing loss prevention Program aimed at primary school students. We feel our representation of the target population is adequate for piloting purposes, as we sampled schools across the Perth metropolitan area at three points and had a high return rate of surveys. The pilot Cheers for Ears Program is effective in changing the listening behaviour and hearing knowledge of primary school students, as well as improving their knowledge about sound damage. For the next re-iteration, attitudinal measures and parental influence will be further developed. In addition, questions around physical safety, and the danger of so-called iPod oblivion will be considered. Kuntzman (29) reports iPod oblivion was cited as the cause of two fatalities. Danhauer et al. (4) described situations where children and teens became pre-occupied by listening to music as to render them unaware of their immediate environment. While the reports refer to the iPod device in particular, PLD oblivion could be considered a more appropriate term.

Current efforts are also focused on developing an interactive computer-game for students to complete, and Android app for users to measure the sound output from their device, in addition to a teacher survey about the effectiveness of the Program.

**References**

15. Griest SE, Folmer RL, Martin WH. Effectiveness of “Dangerous Decibels,” a school based hearing loss

Appendix - Surveys

Preliminary Survey

The following questions ask you about noise and personal music players (such as iPods and MP3 players). Please answer them as well as you can. Thank you!

1. First name:
2. How old are you? 9/10/11/12/13
3. Do you or anyone else at home own a personal music player? Yes/No
4. Approximately how many hours each week do you listen to it?
   Less than 2/ 2 – 5/ 6 – 8/9 – 12/more than 12
5. What volume do you normally play it on?
   Please tick the correct answer: under 25%/25%/ 50%
   /75%/over 75%
6. Did you know that loud noise/music/sound can damage your hearing? Yes/No
   How does this make you feel?
7. Do your parents control the volume of your personal music player? Yes/No
8. Can you think of any noises or sounds that can damage your ears?
   Please list up to 5.
9. Do you think that noise related hearing loss can be fixed? Yes/No
10. Do you think that hearing loss can happen to people of all ages? Yes/No
11. Name two types of noises that can damage your hearing immediately.
12. Name two ways to prevent noise related hearing loss

Post Survey

The following questions will ask you about noise and personal music players to see what you remember. Please answer them honestly and as well as you can. Thank you!

1. First Name:
2. How old are you? 9/10/11/12/13
3. How many hours each week do you listen to a personal music player (eg; iPod, MP3 player)?
   Less than 2/ 2 – 5/ 6 – 8/9 – 12/more than 12
5. What volume do you normally play it on?
   Please tick the correct answer: under 25%/25%/ 50%
   /75%/over 75%
5. Why do you listen at this volume?
6. Do you think this volume is damaging your hearing? Yes/No
7. If you knew that the volume you are using could cause hearing damage/loss, would you turn it down?
   Why or why not?
8. Can loud noises damage your hearing? Yes/No
9. What noises do you think are too loud for you to safely listen to?
10. Can damage to your hearing caused by noise be fixed? Yes/No
11. Can hearing loss happen at any age? Yes/No
12. Name two noises that can damage your hearing immediately.
13. Name two ways to prevent noise related hearing loss.
21-Mar-2013

Evaluation Report for DoHA ‘Cheers for Ears’ Hearing Loss Prevention Program

Dear Sir/Madam,

This is an external evaluation of the Cheers for Ears Hearing Loss Prevention Program. There were four evaluation criteria chosen:

- Evaluation of the Cheers for Ears website
- Evaluation of the school program
- Evaluation of the Safe and Sound smartphone app
- Evaluation of outcomes and achievements

Evaluation of Cheers for Ears website

Very well designed home page layout with a clear tabbed navigation panel overlay targeted at the different users (students, teachers and parents). Graphics presentation is polished and professionally rendered. Highlights of embedded links is particularly effective. All pages open correctly, all images are rendered properly and all links are active. However the following minor technical changes are recommended:

1. On the About Us where the Program is described the final link should be renamed to “read the fact sheet and access the booking form” since the current “link to media articles” doesn’t convey this.
2. On the Home page the “interactive education session” should link to About Us rather than NIHL.
3. The Epic Ear Defense Game is only mentioned and the download link available from the Home page (which one can only navigate to from the small ‘Home’ link). There should be an additional link to this important educational game under the ‘For Students’ page.

Evaluation of the school program

Very well designed school program and set of activities which engage students actively (rather than passively) to learn about different sound levels in the environment, facts about sound exposure, and experience the effect of impaired hearing. Students are also provided with a 3D visual cast model of the hearing system for them to appreciate the complexity of human hearing and the importance of maintaining its care. The program has also been designed to include mechanisms/procedures for improvements by a teacher evaluation survey form that is used for feedback.
This is an excellent program which all schools should run for their students.

Recommendation:
- The computer hearing loss simulator (Safe Hearing Suzie) is still in the development stage, this important educational aid should be made available to further enhance the school program.

Evaluation of Safe and Sound smartphone app
A very useful app targeting the most common issue with sound exposure by people in their teens: sustained exposure to high levels of sound being played through their portable media player when connected by earphone (e.g. Smartphone MP3 players). The app currently runs on any Android phone and is an un-intrusive background app which monitors sound playback through earphones (including ability to cater for different earphone types) and calculates the allowable level of sound exposure based on playback volume and daily exposure. Users can monitor their usage graphically and upload statistical data to the Ear Institute server. Most importantly, alerts are sent when the sound is reaching the daily recommended exposure limits.

Issues with the current version:
1. The screen lights up every 20 seconds which will impact battery usage, this needs to be fixed.
2. The Upload feature may incur network data usage and/or may pass on confidential information, perhaps a warning / accept dialog which explains this should be included
3. There appears to be no mechanism for user feedback necessary to improve and upgrade the software.

Evaluation of outcomes and achievements
The success of the ‘Cheers for Ears’ can be measured by the following statistics on the usage of the website, smart phone application and the school program:
- Over 22,000 children participated in over 220 schools for the school program
- Over 260 people from over 25 countries have downloaded the Safe and Sound smart phone application.

Furthermore the following were also initially developed and should be considered for additional funding to fully deploy and evaluate:
- Safe Hearing Suzie, a sound level monitor and hearing loss simulator. The development should continue to a final system that can be deployed as part of the school program.
- Epic Ear Defence, an online game that allows players to defend the ear against dangerous levels of sound from earbuds, whistles and speakers. This game should be evaluated by feedback and surveys to gauge improvements in student learning of hearing loss issues.

Finally the practical outcomes of this project are complemented by noteworthy research achievements in clinical education and training:
- A peer reviewed paper which has been accepted for publication in the international Noise and Health journal on ‘Personal Listening Devices and the Prevention of Noise Induced Hearing Loss in Children: The Cheers for Ears Pilot Program’. The article reports on the school program particulars, its acceptance and feedback, to the international community
- National and International conference presentations, with one award of a best poster prize.
To summarise this has been a very successful program, exemplified by the success of the school program which forms the key milestone and for which over 220 schools have already participated. There should be further development and enhancement of the program, especially the apps and aids (e.g. smartphone app, hearing loss simulator and online game), their evaluation and improvement, and also extending the program to more schools in metro and regional areas and possible follow up visits targeting different year levels from primary to lower secondary.

Yours sincerely

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