

# Personal listening devices and the prevention of noise induced hearing loss in children: The cheers for ears pilot program

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## Abstract

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 on hearing, and in changing self-reported listening behavior of primary school students aged between 9 years and 13 years. A survey study was implemented at participating primary schools. Schools represented various levels of socio-economic status. Informed consent (parents and teachers) and informed assent (pupils) were obtained. All pupils participated in two interactive sessions (the second 6 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 3 months post-session. A total of 318 pupils were surveyed. The median age of the participants was 11 years (nearly 50% of the total cohort). Significant changes were reported in their knowledge about hearing and in listening behavior of the participants as measured by pre- and post-measurement. The changes in behaviors were stable and sustained at 3 months post-intervention survey point and 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. The pilot Cheers for Ears Program is effective in increasing knowledge on the harmful effects of noise and therefore, it may prevent future noise-induced hearing loss.

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

## Introduction

According to the United States Centers for Disease Control and Prevention, healthy behaviors are more easily established during childhood compared to adulthood. If childhood is the focus area for establishing lifelong healthy behavior 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<sup>[1]</sup> objectives is the prevention of noise induced hearing loss in children aged seventeen and under. A recent report by Henderson, Testa, and Hartnick,<sup>[2]</sup> 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.<sup>[3]</sup>

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 5 years, notwithstanding the nearly 260 million units in sales since its launch in 2002.<sup>[4]</sup> For many, the iPod is a status symbol and an indication of social standing.<sup>[5]</sup> Figures for other PLDs are not as readily available, but between 2004 and 2007 in the European Union alone, there was an estimated 184-246 million portable audio devices sold.<sup>[6]</sup> The last decade has witnessed PLDs with improved quality, capability and louder output without sacrificing battery

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drainage. Individuals can listen to louder music for longer periods of time.<sup>[5,7-10]</sup> The maximum sound level for many PMPs ranges between 80 dB and 115 dB, with different types of earphones potentially increasing the output by 7 dB to 9 dB. In some cases, it is possible to reach over 120 dB.<sup>[6]</sup>

While PLDs are particularly popular with teenagers and young adults, their popularity with younger children and adults is also growing.<sup>[5,8]</sup> If, in those situations, the listening levels are excessive, it follows that music induced hearing damage in children is a serious and mounting concern.<sup>[11,12]</sup>

An increase in the number of publications discussing music related hearing loss is noted.<sup>[13,14]</sup> 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.<sup>[6]</sup> Traditionally, excessive noise exposure in children resulted from activities with loud toys, fireworks, and engines<sup>[15]</sup> and noisy music environments were associated with nightclubs and concert venues.<sup>[16]</sup> The widespread adoption of PLDs, has enabled traditionally “quiet” activities, such as reading, walking or using transport to carry a noise exposure risk.<sup>[17]</sup>

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<sup>[18]</sup> 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 behaviors and lifestyle choices generally occur during the progression to adolescence.<sup>[19,20]</sup> Establishing healthy behaviors during childhood, whilst they are in their formative years, is easier and more effective than attempting to change the unhealthy behaviors that have been carried through to our adult life.<sup>[2,15]</sup> 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.<sup>[2,9,10,21]</sup>

Listening to music should not be discouraged; it is a vital part of culture. Fligor<sup>[22]</sup> 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 prioritized. One of the greatest challenges for health promoters, however, is to design programs that will motivate, assist and empower young people to change their behaviors.<sup>[23]</sup>

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 Noise Induced Hearing Loss and prevention strategies for NIHL.<sup>[23,24]</sup> 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.<sup>[23]</sup> 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.<sup>[2,23]</sup>

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.<sup>[23]</sup> The Portland-based “Dangerous Decibels” ([www.dangerousdecibels.org](http://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.<sup>[15]</sup> 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 min intervention. The questionnaire was repeated directly after the session and 3 months later. The fourth graders showed increased knowledge and attitudes on hearing and hearing loss prevention, which were maintained at the 3 month interval. The seventh graders, on the other hand, showed long-term improvements on the knowledge portion of the questionnaire but their attitude and behaviors reverted to baseline levels at the 3 month check-point. The study concluded that repeated multimodal intervention should be implemented and the impact of peer pressure further explored.<sup>[15]</sup>

Other projects focusing on NIHL information for younger populations are “Sound Sense,” developed by the Hearing Foundation of Canada ([www.soundsense.ca](http://www.soundsense.ca)) and “It’s How You Listen That Counts” out of the House Research Institute in California ([www.earbud.org](http://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. 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, behavior change.<sup>[15]</sup>

**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 3 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, 9-13 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, 6 weeks later, with a return visit with additional educational and interactive activities. An evaluation of the program was conducted after it had been implemented.

**Methods**

The study aimed to determine whether the Cheers for Ears Program was effective in improving current knowledge of noise impact on hearing and listening behavior of primary school students between the ages of 9 years 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 5, 6 and 7 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 prioritized 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 6 weeks after the first session. Six weeks after the second session (at the 3 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 years to 13 years, and the median age were 11 years [Table 1].

**The cheers for ears program**

The running time for this first session was approximately, 50-60 min. 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](http://www.cheersforears.org.au).

The program was introduced by talking about hearing loss, noise and sounds. Students were asked to think about their favorite sounds and how they would feel if they could not

**Table 1: Distribution of participant age and school year**

Age (years)	Baseline		Post-survey 1		Post-survey 2	
	Number	Percentage	Number	Percentage	Number	Percentage
9	2	0.6	1	0.3	-	0.0
10	70	22.0	57	19.0	27	11.9
11	149	46.9	145	48.3	118	52.0
12	95	29.9	95	31.7	80	35.2
13	2	0.6	2	0.7	2	0.9
Total	318	100	300	100	227	100



**Figure 1: Cheers for ears goodie bag**

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 emphasized 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 and the class was divided into three or four groups. Each group was provided with colored 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 min. 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 [Table 2]. 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 2 h/week, did it imply parental supervision for PLD use? The pilot questionnaire did not ask that question in particular, however, the participants were asked whether parents controlled the volume of their PLD. A total of 246 (79.1%) 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.

The next question enquired about the preferred volume setting of the PLD, as the most obvious protective behavior with regards to NIHL is to decrease the volume to a safer level.<sup>[10,24]</sup> 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 behaviors 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

**Table 2: Participant listening behavior with personal listening devices in percentage: Baseline to post-survey**

Question	Baseline survey	Post-survey 1	Post-survey 2
Access to PLD?	91.8	-	-
Hours of listening per week			
<2 h	46.2	49.8	44.6
2-5 h	27.9	25.4	28.6
6-8 h	12.3	12.5	14.1
9-12 h	5.6	5.6	7.5
>12 h	8	6.6	5.2
Volume setting %			
Under 25	17.3	20.8**	15*
25	31.3	26**	31.3*
50	26	29.1**	43.9*
75	15.3	13.1**	5.1*
Over 75	10	11.1**	4.7*

\*\* $P < 0.01$  \* $P < 0.05$ , PLD = Personal listening device



participants controlled their own PLD use, listened for less than 2 h/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 3 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 behavior.

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 behavior 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? (2) can damaged hearing be fixed? (3) can damage occur at all ages? [Table 3].

*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.

*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.

*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, however, the students were able to generalize to other contexts, for example, building sites, even certain classrooms.

A total of 86% 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

**Table 3: Questions about sound in general: Baseline to post-survey**

Question	Baseline	Percentage	Post-survey 1	Percentage	Post-survey 2	Percentage
Can sound damage your hearing?						
Yes	294	92.5	300***	100	219*	99.5
No	24	7.5	0	0	1	0.5
Total	318	100	300	100	220	100
Can damaged hearing be fixed?						
Yes	154	49.2	29***	9.67	18***	8.14
No	159	50.8	271	90.33	203	91.86
Total	313	100	300	100	221	100
Can damage occur at all ages?						
Yes	301	95.9	294*	99.3	221	100
No	13	4.1	2	0.7	0	0
Total	314	100	296	100	221	100

\* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$

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 behavior 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.

## 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 behavior 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 behavior occurred in the participants as measured by baseline and post-measurement. The changes in behaviors were stable and sustained at 3 months post-intervention, which is encouraging as similar studies in seventh graders did not show the sustained change at the 3 month juncture.<sup>[15]</sup> 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 2 h/week. A similar finding was reported by Danhauer *et al.*,<sup>[4]</sup> 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 behaviors 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 behaviors.<sup>[7,25]</sup> It seems that the participants assimilated the content and were subsequently able to identify risky behaviors, 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<sup>[4,23]</sup> 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 3 year period. We concede that widespread implementation is still lacking, as is the case with several of the United States-based programs.<sup>[15]</sup>

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.*,<sup>[15]</sup> 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 behavior and hearing knowledge.

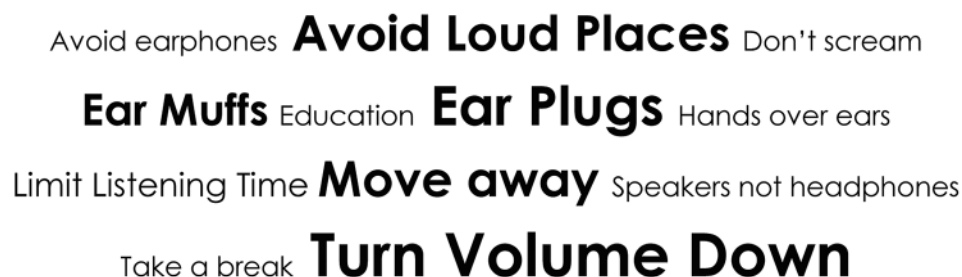


Figure 2: Prevention strategies and frequency of response occurrence for post-survey 2

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 and Sciacca<sup>[26]</sup> interventions with several components, using several modalities, are more effective than single session endeavors. Overall, long-term effectiveness can further be enhanced if a second, separate repetition session is offered.<sup>[27]</sup> 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<sup>[28]</sup> 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:

- 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.
- 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.
- 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 modeling in the pre-teen age group will also be investigated.
- The tracking of individual data over a longer time would also benefit the development of a clearer picture of the listening behavior and hearing knowledge of this cohort. In its current iteration, this option is unavailable.
- 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 behaviors 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<sup>[29]</sup> reports iPod oblivion was cited as the cause of two fatalities. Danhauer *et al.*,<sup>[4]</sup> 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.

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## Appendix A

### 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 (e.g. iPod, MP3 player)?  
 Less than 2/  2 – 5/  6 – 8/  9 – 12/  more than 12
4. 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.