

### **Why Teach Hearing Health?**

This question is a common reaction when the suggestion is made to include hearing health in classroom activities. Teachers want to know (with good reason!) how hearing health is relevant to their students, and why they should include it in their teaching programmes (which are often already crowded with a range of other competing topics). They also want to know the benefits of teaching such a programme, and whether it will be helpful for students in the future.

These are reasonable and, in fact, sensible concerns. The following section aims to explain why hearing health is a relevant programme of study for primary students, and how it can be included as part of (rather than on top of) existing teaching requirements in Australian states and territories. In addition the notes provide some background to the effectiveness of the programme and its grounding in health education theory.

The notes provide a broad overview of the hearing system, information about hearing loss, (in particular, noise induced hearing loss), and noise reduction methods. This information (along with that provided in the module notes and supporting documents) should provide teachers with all that is needed to teach the Hear4Tomorrow programme.

### **Is there a NEED to teach Hearing Health?**

World-wide estimates of hearing loss in school-aged children vary considerably. Population surveys of young adults (aged 17 – 20 yrs) have reported prevalence of high frequency hearing loss at 11.9% (Muhr, Rasmussen, & Rosenhall, 2007) and 16% (Rabinowitz, Slade, Galusha, Dixon-Ernst, & Cullen, 2006). Given that even mild permanent hearing loss can reduce success in communication, leading to poor social interactions and reduced academic performance, it is important to provide and implement appropriate means of educating children about the risks posed by noise, and ways in which they may protect their hearing.

An increase in incidence of hearing loss among school-aged children has been linked to an increase in children's exposure to excessive levels of sound while participating in leisure activities (Lankford & West, 1993; Bess & Poynor, 1974; Katz, Gerstman, Sanderson, & Buhanan, 1982). There has been some discussion about the extent to which such leisure noise currently impacts on the hearing of children and young adults. However, researchers are agreed that many activities in which young people engage involve levels of noise exposure that may be posing a risk to their hearing.

Noise Induced Hearing Loss IS PREVENTABLE if individuals have the necessary information and skills to monitor their noise exposure and take action to look after their hearing health. The consequent impact of noise exposure on hearing is dependent on both the volume of the noise involved, and the amount of time the individual is exposed. In the majority of cases one or both of these factors are under the control of the individual. However, individuals need to be aware of the risk posed by noise, and have knowledge of how to reduce their exposure in order for them to make use of the control they have.

In general, health education is often best introduced via an “inoculation” approach. Research also suggests that risk-reduction programmes are likely to be most effective when they promote not only increased awareness, but also promote changes in attitudes underlying behavioural change (Bruvold, 1993). Programmes should raise awareness of the risks associated with specific activities, with the aim of promoting and strengthening positive attitudes towards appropriate low-risk behaviours. This method can effectively be used with young children to strengthen their beliefs regarding healthy behaviours with the aim of inoculating them against later temptations to participate in harmful activities (Maibach, 1995).

Comprehensive hearing health educational programmes presented to children at an early age (e.g. in primary school) can provide a level of defence against later poor hearing and noise choices. This type of programme can provide an early intervention approach that can also carry subsequent benefits for any later programmes aimed at specific stage-relevant concerns (e.g. MP3 use in young teenagers, club/pub music exposure for older teenagers).

A range of issues on healthy lifestyles have now been included in most modern primary school curricula in Australia. However, despite the high developmental and societal costs associated with hearing impairment, education on the risk of noise exposure and strategies for noise reduction remains lacking in current curricula (see Folmer, 2003 for a discussion of the importance of hearing conservation programmes). The Hear4Tomorrow programme has been developed to fill this significant gap.

### **So, What is the Hear4Tomorrow Programme?**

The Hear4Tomorrow programme is a free resource for Australian schools, made possible as a result of Commonwealth Government funding. The programme was developed by the National Acoustic Laboratories (world leaders in hearing related research). It has been put together and trialled by an experienced teacher in rural and metropolitan schools with positive results.

The aim of the programme is to provide teachers with a resource that enables them to teach hearing health in a way that complements their existing teaching programmes. Hearing loss prevention could easily be seen as part of the science syllabus (it includes information about the hearing system); maths (it includes measurement of sound) or even art (activities may include the development of hearing health messages via paper or A/V mediums). However, we recognise that hearing loss prevention is first and foremost a *health* issue, and thus the programme has been developed to fit within the scope of state-based health-related teaching requirements.

As a health programme, Hear4Tomorrow is based on well-respected health education theory and principles (see shaping healthy behaviours).

<http://hear4tomorrow.nal.gov.au/Shaping.html>

It includes four modules that work together to teach hearing health while engaging and motivating students to participate in noise reduction behaviours. In doing so, the programme keeps a strong focus on significant (state-based) learning objectives from Australian Primary Health-related curriculum. The programme can be used in conjunction with teaching topics such as harm minimisation, risk identification, and health promotion. (A summary of the most relevant teaching outcomes for each state can be found at

[http://hear4tomorrow.nal.gov.au/images/Syllabus\\_outcomes\\_by\\_state.pdf](http://hear4tomorrow.nal.gov.au/images/Syllabus_outcomes_by_state.pdf)

For this reason, the Hear4Tomorrow programme should not be seen as a competitor to the education of other health issues in schools. Rather, many parallels can be drawn between the strategies and behaviours used for identifying and addressing risks to hearing, and those used to address other health threats already often taught in classroom programmes (e.g., sun exposure).

### **How Does the Hear4Tomorrow Programme Work?**

The programme is divided into four distinct modules, each covering a different aspect of hearing health. Based on health education theory, each module is aimed at raising awareness and improving student motivation to engage with hearing health. Details about each of the four modules can be found at:

<http://hear4tomorrow.nal.gov.au/Modules.html>

An overview of the essential aims and components is included in each module.

The Hear4Tomorrow programme acknowledges that many teachers may have little prior knowledge or experience teaching hearing health, and may have limited time in which to acquire the relevant

background. The module -by- module teaching notes provide a general introduction to the topic of hearing health. Used **with** the module notes, they should provide sufficient information from which to teach the Hear4Tomorrow programme.

# Hear4Tomorrow - Teaching Notes

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## Module 1. Understanding Hearing Loss

*Students' motivation to engage in healthy hearing behaviours is significantly influenced by their beliefs about the real life impact of hearing loss on day-to-day life (See "Shaping healthy behaviours" for information about perceived severity). Students are more likely to be interested in protecting their hearing if they understand the difficulties faced by people with a hearing loss.*

**Module Aim:** To raise students' awareness of the real life impacts of hearing loss.

**Students will be able to:**

- Appreciate what it is like to have a high frequency hearing loss. (This is the type of loss that occurs through noise injury).
- Better understand the need to maintain good hearing health.

### Background Reading

#### Why is it important to look after your hearing?

Hearing loss means that some sounds can't be heard. People with mild hearing loss may miss only soft sounds; for those with more severe hearing loss, many sounds may be inaudible. The inability to hear sounds loudly enough is only one of the problems associated with hearing loss. There are other effects of hearing loss which can interfere with listening and communication:

- Loud sounds may cause discomfort (reduced dynamic range)
- Particular speech sounds might not be audible (e.g. high-pitched sounds like "s" or "f") making it harder to understand speech and follow conversations
- Listening in background noise might be difficult (difficulty separating sounds from the surrounding noise)
- It may be hard to know where sounds are coming from

Our hearing ability can affect our quality of life. Hearing difficulties can result in social difficulties or loss of confidence. Difficulties with conversation can leave us feeling embarrassed or left out, or withdrawing from social occasions.

With a hearing loss, listening can be tiring. Hearing loss can also make it difficult to hear important sounds in the environment, the telephone, doorbell, television, or important warnings sounds (e.g. traffic approaching, smoke alarms etc).

For many students (and in fact for many adults) the importance of hearing, and the consequences of hearing loss are difficult to comprehend clearly. The old saying “You don’t know what you’ve got until it’s gone” is very true for hearing, with many people unaware of how much they rely on their hearing, or how delicate their hearing is. As a result, it is easy for students to underestimate the importance of good hearing health.

This module sets the stage for the Hear4Tomorrow programme by providing students with a better understanding of the experience of hearing loss to better appreciate the need to maintain good hearing health.

## **Lesson Components (See also module notes):**

### ***1. Introduction/discussion of hearing loss***

Conducting an early discussion about students’ beliefs is helpful to see what areas may have the greatest impact for them, and thus are most likely to motivate engagement in noise reduction behaviour. Students who have personal knowledge of hearing loss (either themselves or a close friend/family member) may be particularly helpful in discussions aimed at raising classmates’ awareness.

### ***2. Hearing Loss Simulations***

A common belief about hearing loss is that it can be simply equated to a lowered volume of sound. That is, that people experiencing hearing loss just need amplification, or “to turn the volume up”, in order to overcome difficulties. This belief is also reflected in the way people view hearing aids. For many, there is a belief that just as the lenses in eyeglasses can “fix” many visual impairments, amplification in hearing aids will “fix” hearing impairments.

This component aims to provide students with an appreciation of the complexity of hearing and how hearing loss can interfere with the ability to access sound. A particular focus should be on access to speech sounds (as opposed to environmental/incidental sounds), as disruptions to speech sounds have serious consequences for communication, and thus for personal relationships.

For all simulations, it will be helpful to emphasise that simply “turning up” the sound is generally insufficient to allow the sounds to be understood. Rather, the quality/clarity of the sound source has been impaired. (In general terms a conductive hearing loss leads to a loss of loudness while sensorineural hearing loss leads to a loss of loudness *as well as a lack of clarity*).

## Module 2. The Hearing System and Noise

*In order to effectively protect their hearing, students need to have a general understanding of how their hearing works. By understanding how the different parts of the ear function, students are better able to appreciate how noise may threaten to damage their hearing. Ultimately, this knowledge can also help students understand how different hearing protection methods can succeed in removing or decreasing the threat.*

**Module Aim:** To educate students about how their hearing works, and in doing so teach them about how noise can cause damage.

### **Students will understand:**

- How the ear and hearing system function
- How hearing may be damaged by noise

## Background Reading

### How do we hear?

Sound occurs when a moving or vibrating object (e.g., vocal cords) causes the air around it to move. Your ears pick up sound which travels in invisible waves through the air. Sound waves travel down the ear canal and hit the eardrum in the middle ear. This causes the eardrum to vibrate. Three tiny bones in your middle ear link the vibrating eardrum to the cochlea in the inner ear.

The cochlea is filled with liquid that carries the vibrations to thousands of tiny “hair cells” sitting on a membrane that stretches the length of the cochlea. The hair cells on the membrane fire off tiny electrical signals. These electrical signals travel up the cochlea nerves of the auditory pathway to the brain. All this happens in a fraction of a second.

### Introduction to Hearing and Hearing Loss

[Read: Hearing and Hearing Loss – An overview](#) (See Supplementary readings below).

This provides an introduction to the hearing system (including the parts of the ear) and an explanation of how sounds are processed. Also included is information about different types of hearing loss including sensorineural hearing loss (which can be caused by excessive noise exposure) and prevention of hearing loss.



## Why is Noise Hazardous to Hearing?

The hearing system is complex and delicate. The inner part of the ear (or cochlea) contains fluid, and thousands of tiny hair-like cells. These hair cells bend in response to the vibrations caused by sound, creating a signal which is transmitted to the brain. Although they are flexible, repeated or prolonged exposure to high levels of noise can result in the hair cells being permanently bent, or even broken. One way to think about it is to compare the effects of noise on hair cells to that on trees by the wind. Trees will sway with the wind but generally return to an upright position when it is calm. However repeated strong winds can lead to a tree being permanently “bent”, and very strong winds (even over a short time) can cause a tree to bend and break. So too noise can damage the sensitive structures in the ear, permanently bending or breaking the sensitive hair cells. If damaged, these cannot be repaired, leading to hearing loss that is irreversible.

Loud sound does not have to be physically painful to cause hearing damage. If you are in a situation in which you need to raise your voice to be understood by someone 1m away, then the noise is probably too loud. Damage to hearing from noise accumulates, just as the sun can gradually damage our skin. The higher the level of sound, and the longer the exposure, the more damage is likely to occur.

## Lesson Components (see also module notes):

### 1. How do we hear? Introduction to the ear and hearing system, and its functioning.

### 2. How does noise damage hearing? A demonstration of how noise can result in damage.

Understanding how the hearing system works helps students to better understand how damage can be caused by high levels of noise. This module contains resources to provide a general overview of “How we hear”, which can be tailored to suit the level of the students. As a health-based programme Hear4Tomorrow does not require a heavy teaching focus on the science of hearing, although there are many opportunities to extend investigation and knowledge in this area if desired. Rather, teachers are advised to incorporate enough information about sound and hearing to allow students to understand the need to protect their hearing, and how noise reduction methods may benefit (e.g., by blocking harmful levels of noise to the ear).

Students are also given a concrete example of the general effect of noise on the ear’s hair cells. The focus here is on providing students with a visual reminder of how excessive noise can result in damage, and the permanence of this damage.

## Module 3. How Loud is Too Loud?

*Students need to be able to recognise risky environments in order to protect themselves from hearing damage. This module develops students' ability to judge their exposure and identify when it is high enough to potentially threaten hearing health.*

**Module Aim:** To inform students how to recognise risky noise-exposure environments.

**Students will be able to:**

- Understand the relationship between volume, time and risk
- Identify noise environments which might pose a risk to their hearing

### Background Reading

#### When does Noise Pose a Risk?

Noise exposure is measured in relation to the intensity (the loudness or volume measured in decibels; dB) and the duration (the amount of time exposed). It is the cumulative combination of these two factors which determines the risk to hearing. It should be noted that exposure to extremely loud sounds (i.e., those over 140dB) are considered to be dangerous for exposure of any duration. Sounds below 75-80dB are generally considered to pose little to no risk to hearing.

When discussing "safe" noise exposure, the standard usually referred to is that laid down by workplace health and safety regulations. In Australia, an acceptable daily noise dose is the equivalent of exposure to 85dB over an 8 hour period (often denoted 85dB  $L_{Aeq,8h}$ ). This means that a noise with the intensity 85dB is considered to pose a risk to hearing if the exposure duration is greater than 8 hours.

As the intensity/volume of the sound increases, the acceptable exposure duration decreases. The decibel scale is non-linear, which means that as the volume increases by small increments, the acceptable exposure time decreases dramatically. For every 3dB increase in volume, the acceptable exposure duration decreases by half. So for sounds at 88dB, the acceptable exposure time is only 4 hours. For sounds at 91dB, exposure should be restricted to 2 hours, and so on. Thus when noise reaches volumes of 100dB, the acceptable exposure time is only 15 minutes.

## Noise Induced Hearing Loss

[Read: Preventing Noise-Induced Hearing Loss \(NIHL\) \(See Supplementary readings below\)](#). This provides an introduction to the idea of noise exposure and the threat it poses.

### Lesson Components (see also module notes):

#### 1. Defining noise exposure

For students, an understanding of the dB scale does not need to be as detailed or deep as outlined above, although some teachers may wish to discuss this within an extended lesson. The focus should be on the instruction that noise exposure is related to volume and time, and that even small increases in volume have significant impacts for the “safe time”.

It is also important to provide students with a concept of 85dB such that they are better equipped to make judgements about the potential risk of noise environments they may find themselves exposed to. The description “If you need to raise your voice to hold a conversation with someone 1m away” can be a good warning sign for students that the noise environment may be in excess of 85dB and thus pose a risk to their hearing.

Providing students with a visual table of noise levels and their associated acceptable exposure durations (e.g. 85dB for 8 hours, 88dB for 4 hours, 91dB for 2 hours) along with some examples of noises at these volumes can help students orient themselves to the relative risk posed by higher exposure volumes in their environment.

#### 2. Measuring noise exposure

This section aims to familiarise students with an idea of what different volume levels “sound like”. By having a framework of where different noises sit in relation to each other, students can be better informed about when and how to modify their exposure to safe levels.

A number of activity suggestions are provided for this component, and teachers are welcome to select those that best suit their class and classroom. By far, hands-on measurement with a sound level meter is the most popular and the most engaging of these activities. However additional activity ideas are also provided if this is not appropriate.

#### *Do I need a sound level meter?*

The results of our programme evaluations indicate that, where possible, access to a sound level meter improves the understanding and engagement of students with the teaching message. Basic

sound level meters (available online or at electronic stores for less than \$50) are more than adequate for these activities. However, alternate activities are suggested if a sound level meter is not available.

A number of “apps” are now available to enable a smartphone/tablet to measure sound levels. These are not a substitute for a dedicated, properly calibrated sound level meter, and accuracy may vary depending on many factors including the limits of the device’s internal microphone (in particular, they are likely to be less accurate for high volumes). However, they may be used as a tool in conjunction with the other information available to provide access to a hands-on activity in the absence of a dedicated sound level meter.

## Module 4. Protecting Our Hearing

*Students will be more likely to look after their hearing health if they know the different ways to do so. The more comfortable and capable they feel about reducing their noise exposure and carrying out related behaviours, the more likely they are to engage making healthy hearing decisions.*

**Module Aim:** To educate students how to best protect their hearing in different environments.

**Students will be able to:**

- Understand the different methods for reducing their noise exposure in risky situations
- Choose which methods may be most appropriate in different contexts

### Background Reading

#### Prevention Is Best!

There are two ways to reduce noise exposure: reduce the volume, and/or reduce the duration.

For younger students, exposure to noise is not always something they have control over, and thus may not be able to always avoid – even if they wanted to. It is important then to provide students with realistic options for ways they can reduce their noise exposure if they find themselves in a noisy environment.

[Read: Protecting your hearing \(See Supplementary readings below\)](#)

*A note on hearing protection:* There are many forms of hearing protection available including different types of earplugs and earmuffs. Like sunscreen, the protection rating of each can be graded based on the amount of noise they block out. However, unlike sunscreen – the highest rating isn't always the best choice – wearing heavy duty earmuffs to a concert or band practice isn't going to be helpful! At the end of the day, the “best” hearing protection, is the hearing protection that you are comfortable using and have available to use.

### Lesson Components (see also module notes):

#### 1. Noise reduction strategies

#### 2. Choosing the right strategy

The teaching components for this module focus on teaching students to reduce volume at the ear – by walking away, turning down the volume, or using hearing protection. It is important for students to realise that they have different methods at their disposal to protect their hearing health, and be able to think about why different methods may be appropriate for different contexts.

## Supplementary Readings

### Hearing and Hearing Loss – An Overview

*The following sections provide an overview of the hearing system, including the parts of the ear, and types of hearing loss.*

#### The Parts of The Ear

Your ear is made up of a *conductive* pathway which includes the outer and middle ear and the *neural* pathway that includes the inner ear and auditory nerve.

##### The Outer Ear

The outer ear consists of:

- an external flap of skin (pinna) and cartilage
- the ear canal that leads down to the eardrum.

The **pinna** is the external flap of skin that helps you know the direction of sound. Its purpose is to collect or funnel sounds into your ear canal, yet it is not very important for good hearing.

The **ear canal** varies in size and shape from person to person. It runs nearly horizontally toward the centre of the head for about 2.5cm (in adults) and ends at the eardrum.

The skin along the outer part of the canal has tiny hairs and produces a waxy substance called **cerumen**. This earwax discourages foreign objects from entering the ear, and keeps the skin of the canal from drying out.

##### The Middle Ear

The middle ear consists of:

- the eardrum
- an air-filled cavity that includes three middle ear bones
- oval and round window membranes
- the eustachian tube.

##### The eardrum and middle ear bones

The cone-shaped eardrum is stretched across the ear canal and is quite stiff, yet flexible. Behind the eardrum three bones are connected to form the ossicular (pronounced oss-ick-you-lar) chain. They are the:

- hammer (malleus)
- anvil (incus)
- stirrup (stapes).

The **hammer** is connected to the **eardrum** on one end and through the **anvil** to the **stirrup** at the other end. The **stirrup** is the smallest bone in the body, smaller than a grain of rice. It rests against the oval window membrane leading into the inner ear.

The stirrup moves in and out of the **oval window membrane** like a piston as the drum moves in response to sound.

The **round window membrane** is located just below the oval window and is flexible. When the stirrup moves in and out, it pushes the fluid in the cochlea, and the round window allows the fluid to be displaced.

The middle-ear cavity, filled with air, is connected to the back of the nose and throat by the **eustachian tube**. This tube adjusts the air pressure in the middle-ear space to match the air pressure on the outside of the eardrum and is normally closed. In a plane when you take off or land, it helps to yawn or swallow because these actions usually open the eustachian tube to adjust the air pressure in the middle ear space.

### **The Inner Ear**

The inner ear is made up of:

- the cochlea
- semicircular canals.

The **cochlea** is a tiny spiral-shaped structure, about the size of a pea. It is nestled in the bone of the skull and filled with fluid. A thin membrane with around 15,000 microscopic hair cells sits in this fluid. Each cell is tuned to a particular sound or frequency.

The tiny hair cells connect to the cochlea nerve that sends messages to the brain.

The **semicircular canals** are mainly responsible for the sense of balance.

Source: <http://www.hearing.com.au/how-do-we-hear>

## About Hearing Loss

There are three types of hearing loss: conductive hearing loss, sensorineural hearing loss, and mixed hearing loss.

### Conductive Hearing Loss

Conductive hearing loss can be **acquired** or **congenital** and is caused by blockage or damage in the outer and/or middle ear. A conductive hearing loss leads to a loss of loudness and can often be helped by medical or surgical treatment.

Some of the causes of conductive hearing losses are:

- blockages of the ear canal by impacted wax or foreign objects
- outer ear infection (sometimes the result of swimming)
- 'glue ear' (middle ear infection), a common problem in young children
- perforated eardrum, maybe from a bad middle ear infection or an accident
- otosclerosis, a hereditary condition where the bone grows around the tiny stirrup bones in the middle ear
- partial or complete closure of the ear canal.

### Sensorineural Hearing Loss

Sensorineural hearing loss can be **acquired** or **congenital** and is caused by damage to, or malfunction of, the cochlea (sensory part) or the hearing nerve (neural part).

Sensorineural hearing loss leads to a loss of loudness as well as a lack of clarity. The quantity and the quality of sound are affected and sometimes may limit the benefit of a hearing aid.

Causes of acquired sensorineural hearing loss include:

- the ageing process
- excessive noise exposure
- diseases such as meningitis and Meniere's disease
- viruses, such as mumps and measles
- drugs which can damage the hearing system
- head injuries.



In Australia, 20 children per 10,000 live births will be born with a congenital sensorineural hearing impairment. Causes include:

- inherited hearing loss
- premature birth, lack of oxygen at birth, or other birth traumas
- damage to the unborn baby from a virus such as rubella
- jaundice.

### **Mixed hearing loss**

Mixed hearing loss results when there is a problem in both the conductive pathway (in the outer or middle ear) and in the nerve pathway (the inner ear). An example of a mixed hearing loss is a conductive loss due to a middle-ear infection combined with a sensorineural loss due to damage associated with ageing.

Source: <http://www.hearing.com.au/types-of-hearing-loss>

## Tinnitus

Tinnitus is the term for noises which are heard 'in the ears' or 'in the head' - buzzing, ringing, whistling, hissing, pulsing and other sounds which do not come from an external source.

Tinnitus is extremely common. Most people will experience tinnitus at some time in their lives, but it usually only lasts for a short period. Around 10 per cent of the population experience persistent tinnitus and one per cent will be severely bothered by it.

### **What causes tinnitus?**

Although tinnitus is often associated with hearing loss, the presence of tinnitus does not mean the person is going deaf. Nor will the tinnitus itself cause a hearing loss or other illnesses.

There are a number of causes which may provide the initial trigger including:

- middle ear infection
- dental or jaw problems
- some medications
- exposure to loud noises
- inner ear damage.

### **What effect does tinnitus have?**

Around one per cent of people have troublesome tinnitus. Unnecessary fears about damage to the ear or brain, or that one is going to be stuck with the problem for life, can lead to the subconscious focussing on the small tinnitus signals coming from the ear, creating feelings of annoyance, apprehension or even anxiety or depression.

Tinnitus is more common in hearing-impaired people, but not necessarily because the inner ear is damaged. If you are hard of hearing, communication is often a strain, and this 'straining to hear' may focus the subconscious to pick up anything coming from the inner ear.

### **Important Note Regarding Tinnitus:**

Tinnitus can be a useful teaching example of the severity of hearing loss, and the susceptibility of our ears to damage. A personal experience of (or an exposure to) tinnitus can provide a strong motivator for individuals to look after their hearing health. For many people who have little understanding of hearing loss, tinnitus is seen as more intrusive; with larger impacts on everyday life than hearing loss is understood to have. It is also an experience that is may be more familiar (even in a temporary way) than the experience of hearing loss.

For those exposing themselves to high levels of noise tinnitus is not uncommon immediately following exposure. Alongside Temporary Threshold Shift (TTS, a condition usually resulting in a feeling of dull or impaired hearing for a finite time period after high noise exposure) tinnitus can be seen as a warning sign that damage may be occurring.

In teaching however, care must be taken not to unduly exaggerate the difficulties resulting from tinnitus. The experience of tinnitus varies widely across individuals, as does the distress it causes. Focussing on the negative aspects of tinnitus can be counterproductive to managing the condition for those who experience it. It is important not to create an environment where students who currently experience tinnitus, or who may later experience it, become so stressed as to not be able to effectively manage their hearing health as a result

## Prevention of Hearing Loss

### Preventing Noise-Induced Hearing Loss (NIHL)

Exposure to noise is the most common cause of preventable hearing loss experienced in the community. The risk of permanent hearing loss from noise is related to the loudness of the noise and the duration of the exposure. One-off exposures to extremely high levels of impulse sound (e.g. sound of a gunshot) can and do cause instantaneous damage to hearing. The following section provides information about NIHL and the nature of the risk posed by noise to hearing.

Noise injury is mostly acquired gradually as the result of exposure to loud noises over an extended period of time. Typically this has been through working in a noisy environment, however, of more recent concern is the trend toward numerous noisy leisure activities that are also capable of causing damage to hearing. The hearing mechanism does not distinguish between “pleasant noise” which we may seek out and “unpleasant noise” which we may wish to avoid for reasons other than hearing conservation.

Repeated or prolonged exposure to loud sounds increases the risk of hearing damage, and the effects are cumulative. The loudness of a sound is measured in decibels which is a non-linear scale used for scientific purposes. For the purposes of looking after your hearing it is important to note is that if you need to use a raised voice to communicate or carry on a normal conversation between two people at a distance of 1m then the noise level is potentially hazardous (around 85-90 dB), and exposure over a significant time could cause problems. If, after experiencing loud noise (for example after a dance party or ‘loud’ event) the world seems a little quieter and/or you have ringing in your ears then the sound level is definitely hazardous. Your ears are giving a warning to be careful.

Sounds below 75 decibels are unlikely to cause hearing damage, regardless of the duration of exposure. As the loudness of the sound increases, the duration of “safe” exposure decreases. For example, exposure to sounds above 85 decibels for more than 8 hours a day significantly increases the risk of subsequent hearing loss.

Hearing damage is caused by too much noise reaching your ears. This noise exposure is a function of loudness and time so to reduce your exposure you must reduce the volume or loudness *and* the time. Noise exposure is cumulative over the life-time, meaning that every exposure adds up – just like too much UV radiation from exposure to the sun. In the short term there may be few apparent effects but it is the long term damage that counts.

Hearing slowly gets damaged in an almost imperceptible way and it can take many years of exposure for the affected individual to actually take notice. Noise injury is painless and bloodless and does not rate high on a scale of physical injury such as a broken arm or leg but it is a real injury nevertheless.

Thus it is important to take a long term perspective and reduce your noise exposure. You can improve your hearing health by,

- avoiding loud noise;
- removing the source of noise;
- removing yourself from the noise; or
- reducing the volume.

Remember "If you lose it, it won't come back".

### **Protecting your hearing**

- Avoid loud sounds and noise if you can.
- Sudden, very intense sounds (e.g, gunshots) are particularly dangerous and can cause immediate, permanent hearing loss.
- If you attend loud music events (concerts, bands), use hearing protection (such as earplugs). Special earplugs can be made for musicians that protect the hearing while preserving the sound quality of the music.
- Limit the time in very noisy places, and take regular breaks in quieter areas.
- If you use a personal stereo, set the volume at a moderate level. Avoid turning up the level of your personal stereo to try and drown out other background noise.
- Be aware that your risk increases if you are occupationally exposed to solvents or toxins or if you are taking certain drugs – your Chemist/Doctor should be able to tell you more.
- If you cannot avoid loud sound, then you should protect your ears with earplugs or ear muffs. Balls of cottonwool or paper tissue offer little protection.
- You should give your ears frequent rest from noise.

See also [http://nal.gov.au/hearing-loss-protection\\_tab\\_noise-exposure.shtml](http://nal.gov.au/hearing-loss-protection_tab_noise-exposure.shtml)

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