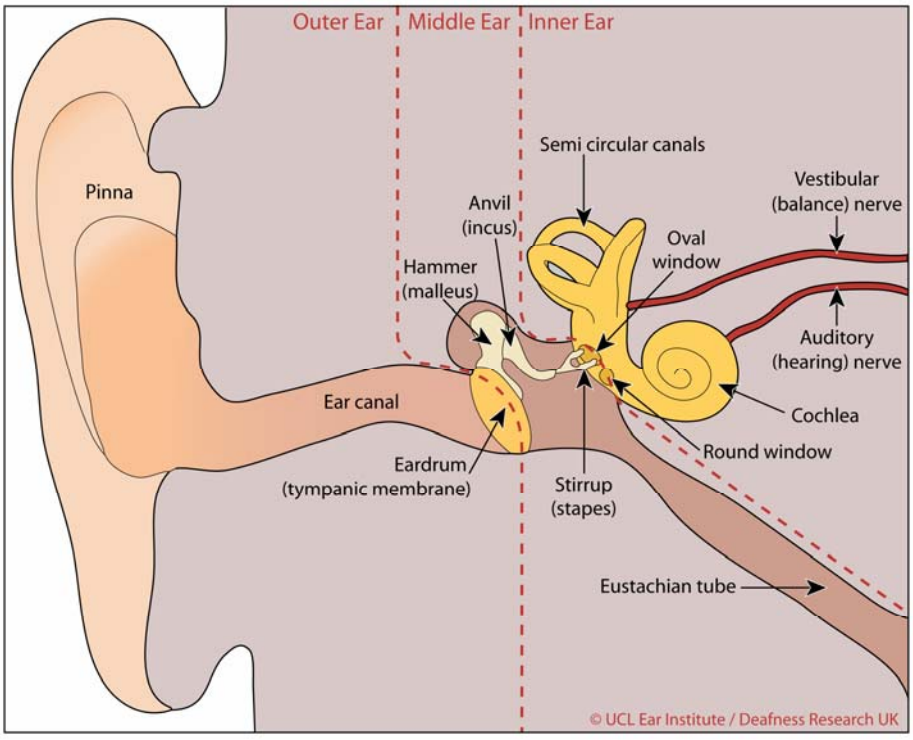
Noise and the Younger Generation

This factsheet has been written for parents or carers who think their children's hearing might be at risk from excessive noise, or whose children have a hearing loss and fear it may become worse due to noise. It may also be useful for anybody with a general interest in the effect of noise on hearing.

This factsheet covers the following topics:

- How do we hear?
- How can I help protect my children's hearing?
- What can they do to protect their hearing?
- How does noise damage hearing?
- Are there different types of noise-induced hearing loss?
- How loud is too loud?
- What research is being conducted into noise-induced hearing loss?
- Where can I find more information?

THE EAR



HOW DO WE HEAR?

- Sounds reach our ears as sound waves.
- As the sound waves move through the ear canal, the eardrum vibrates.
- This in turn causes the three little bones of the middle ear to move backwards and forwards and amplify the vibrations as they pass into the inner ear or cochlea.
- Special sensory cells in the cochlea, known as hair cells, detect the vibrations and convert them to electrical signals that are sent through the hearing (auditory) nerve to the brain, so that we can hear.

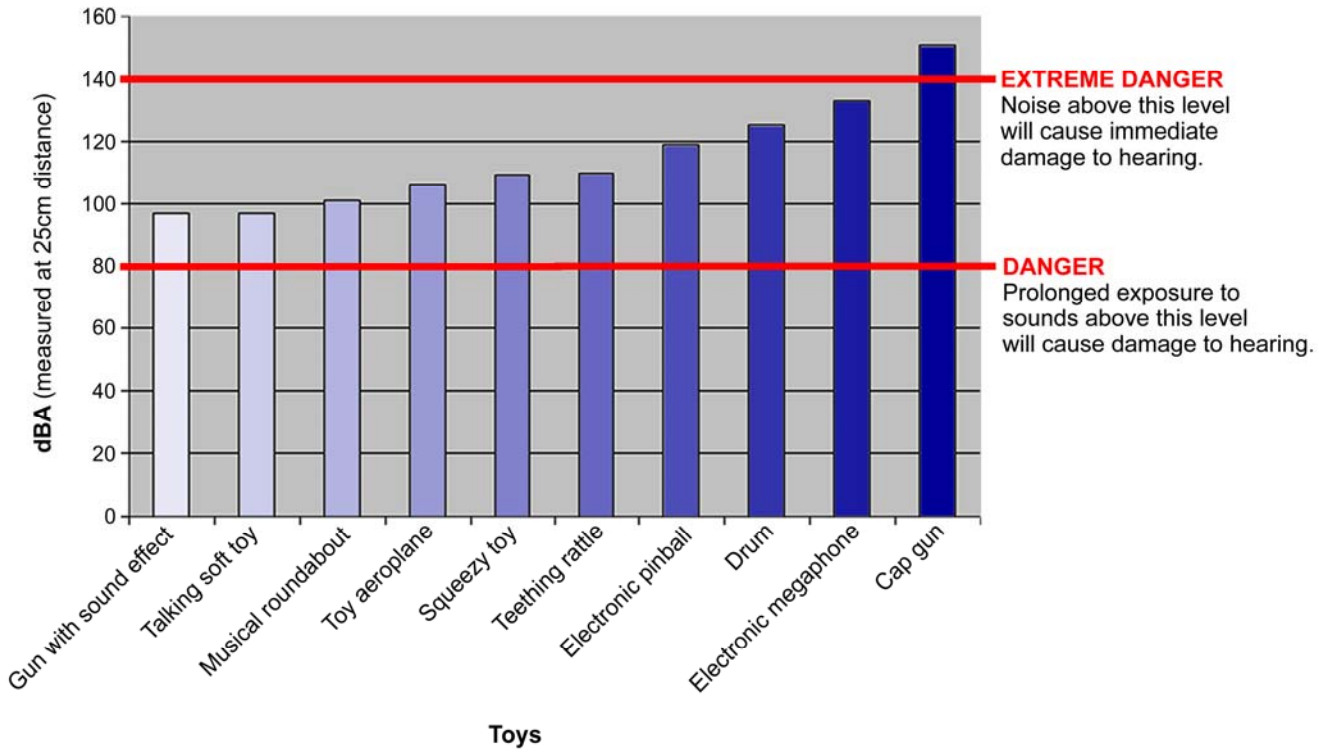
HOW CAN I PROTECT MY CHILD'S HEARING?

Experts agree that toys with a noise level of 85 dBA or above held approximately 25 cm from the ear (about the length of a child's arm) have the potential to cause damage to hearing if used for extended periods of time or held too close to the ear. These were the findings of the largest study on noise from toys commissioned by the Department of Trade and Industry (DTI) in 1997[1]*.

As young children are totally unaware of safety issues, these toys can be harmful in their hands.

McMillan PM and Kileny PR (1994) referred to the case of a 39-month-old child with previously normal hearing who was shown to have a 50 dB hearing loss six days after suffering 'acoustic trauma' (an immediate loss of hearing after a sudden exceptionally loud noise) from a bicycle horn that had been brought as a toy. The horn produced a peak sound of 143 dBA.[2]

The DTI study[1] found that toys measured from 25 cm away emitted the following noise levels:



*These are different from the British and European Standard for toys (BS EN71-1: 2005) which measure noise levels at 50 cm from the ear.

[1] Lower M C, Lawton B W, Lutman M E, Davis R A, *Noise from toys and its effect on hearing*, Report C/CSU/4754, Department of Trade and Industry, London, 1997.
[2] McMillan and Kileny, *Journal of the American Academy of Audiology,* Jan 1994 Vol 5 Issue 1, pp 7-9

However, damage to hearing is not caused by sound levels alone. To prevent damage it is important to take into account both the loudness of the sounds and the amount of time the child is exposed to them. Although short blasts of sound at very high levels can cause damage straight away, most damage will be caused by extended exposure at less extreme levels.

Here are some tips on how to protect your child's hearing:

- **Always listen to toys yourself before buying them**. Remember that children will probably hold the toy close to his/her ears regardless of the 'correct' use of the toy.

- **Remember to protect children's hearing (as well as your own) from household noise such as power tools and other loud everyday items.** Remember, safety around the home is not just about avoiding physical injury.

- **If your child has an iPod, download the volume update (see below) and set the maximum yourself.**

- **Get your children to take responsibility for their hearing from an early age.** Explain the consequences of loud noise.

- **Reduce your child's exposure to loud noise as much as possible.** Don't let your child play with noisy toys or electronic games for more than one hour a day. Follow the play session with ten minutes of quiet time.

- **Encourage the use of earplugs** for excessively noisy periods, such as practising with a school band. Special ear plugs are available for musicians.

WHAT CAN THEY DO TO PROTECT THEIR HEARING?

More and more young people are listening to music through MP3 players, but at high volumes these can cause hearing loss. Current European Union legislation on the power output of 'portable audio equipment' with headphone use, means the maximum volume personal music players can reach is 100 dBA – which, you can see on the graph, is above the danger level.

Apple have produced an update that allows people to set the maximum volume on their iPods. It also comes with a code, so parents can stop their children from undoing it. For more information on the patch and installation help visit http://docs.info.apple.com/article.html?artnum=303414.

Repeated exposure to music from personal music players, through headphones, at, or near to, maximum volume will be sufficient to cause permanent damage to hearing in some people. As a rule, if other people can hear the sound from a personal music player, then it is too loud.

It is recommended that even if the volume on a personal music player is at about 60 percent of maximum (manufacturer's settings), it shouldn't be listened to for more than an hour continuously a day.

Some tips for the younger generation are:

- Turn down the volume on your music players, whether personal or hi-fi
- Take ear plugs when you are going to a club or party
- Be aware of how long you spend playing loud computer games
- Lower the volume of your mobile phone's ringtone

Remember - if you start to feel your hearing is getting dulled or you start to hear noises in your head or ears, take a break from what you are doing and give your ears some much needed rest.

HOW DOES NOISE DAMAGE HEARING?

Repeated exposure to excessive noise can kill the hair cells and damage the hearing nerve making them unable to work properly, resulting in a permanent hearing loss. This is called a 'sensorineural' hearing loss.

Someone with noise-induced hearing loss will first notice a difficulty hearing the high-pitched sounds that are important in being able to hear and understand speech. To start with it may become difficult to have a one to one conversation with someone where there is background noise. However, as the hearing loss gets worse, even following a conversation in quiet will become difficult and frustrating.

Although noise damage in children can pose problems in later life, serious noise-induced hearing loss during childhood is rare. Conditions such as glue ear may be the real cause of a child's hearing loss.

Signs of hearing loss can include:

- Not reacting when called;
- Appearing inattentive or prone to daydreaming;
- Turning up the television or stereo-system;
- Talking too loudly;
- Mispronouncing words;
- Becoming unsettled at school.

Although if your son or daughter is a teenager, they will probably behave like this anyway!

Young people who have difficulty concentrating because of a hearing loss may be particularly grumpy or tired at the end of the day. They may become increasingly frustrated and over-active.

If you do suspect your child's hearing is damaged, make an appointment to see your GP immediately. Usually, s/he will refer you to an audiologist or ENT (ear, nose and throat) specialist who will carry out tests. If your suspicions are confirmed and your child is diagnosed as suffering from a hearing problem, contact Deafness Research UK. We produce a wide range of literature on all aspects of hearing loss and can offer information on the treatments available.

ARE THERE DIFFERENT TYPES OF NOISE-INDUCED HEARING LOSS?

Noise damage to hearing can be divided into two types. Firstly, there is the gradual and increasing loss of hearing which comes from repeated exposure to loud noise, like being in a noisy classroom, then going into a noisy playground, followed by listening to an MP3 player on the way home or frequently going to loud music gigs or nightclubs; also listening to a hi-fi system on a high volume, or playing computer games with the volume turned up while using 'headsets' and frequently going to video arcades. At first, any hearing loss is temporary (a 'temporary threshold shift' of hearing). However, if the exposure continues or the ear is not given enough time to recover, the hearing loss becomes permanent and irreversible. Secondly, there is the more extreme 'acoustic trauma' which is an immediate loss of hearing after a sudden, exceptionally loud noise such as an explosion.

Over the past 10 years, scientists have made a lot of progress in understanding the exact process by which noise-induced hearing loss occurs. Very loud noises are thought to over-stimulate the sensory hair cells leading to the over-production of potentially damaging chemicals called free radicals. While cells can normally cope with a low level of free radicals, too high a level will damage the structure of the cell and eventually lead to its death. Exceptionally loud noise will damage the whole cochlea by stimulating it beyond its natural limits.

HOW LOUD IS TOO LOUD?

Noise is measured in dBA, which is a decibel scale modified to take into account the sensitivity of human ears to different pitches of sound. It is a logarithmic scale, which means that an increase or decrease of 3 dBA represents a doubling or halving of intensity, the energy it contains. So, for example, 73 dBA is twice as intense as 70 dBA. However, due to the way we hear sounds, a person with normal hearing will only think a sound has doubled in loudness when it is ten times more intense. For example: **80dBA will only sound twice as loud as 70dBA despite actually having ten times as much energy!**

An average conversation will reach around 60 dBA while a busy street can peak at 80 to 90 dBA. Generally, exposure to sound levels below 80dBA are unlikely to cause any hearing damage. Prolonged exposure to sounds over 80 dBA can damage your hearing and the risk increases as the sound level increases. So at 140 dBA noise causes immediate injury to almost any unprotected ear.

As a general guide, if you have to shout to make yourself heard by someone two metres away the noise level could be dangerous.

Although there are laws about acceptable levels of noise in different situations, it is impossible to set an objective noise level that is safe for all. Provided the ear is allowed ample rest afterwards, a level of 80 dBA might be tolerated for up to 8 hours, but increase that level by just 3 dBA and the time is reduced to just 4 hours. By 95 dBA the tolerance is less than 15 minutes.

However, no two people will have an identical tolerance to noise. Research suggests that a genetic predisposition towards hearing loss is an important factor in how noise will affect us.

WHAT RESEARCH IS BEING CONDUCTED INTO NOISE-INDUCED HEARING LOSS?

Much research is being carried out to look for drugs that may protect ears from noise-induced hearing loss. One area where researchers are making major breakthroughs is in the use of antioxidants to neutralise free radicals before they can cause lethal damage to hair cells. Other research is looking at whether hair cells can be protected by stopping the pathways that are activated after hair cells are damaged, so preventing their death. Clinical trials of some drugs are now underway.

Despite the fact that noise-induced hearing loss is permanent, scientists are optimistic that it may eventually be possible to reverse damage to hearing by regenerating the sensory hair cells.

When hair cells die they are not replaced in humans or other mammals but it has been shown that birds possess the ability to replace these dead hair cells with new ones. The task now being undertaken by Deafness Research UK scientists is to try and understand why birds are capable of regenerating hair cells and what prevents this occurring in mammals. This will hopefully lead to the future development of treatments to induce hair cell regeneration in humans in order to restore lost hearing.

Our scientists are also looking at identifying the genes involved in the normal development of hair cells. Some of the genes involved in this process have already been identified, and research is continuing with the aim of controlling cell development and looking at ways of triggering the process when damage has occurred to hair cells. The discovery of many of the genes responsible for inherited deafness is also opening up significant new lines of research, enabling scientists to identify and study the precise role of some of the proteins needed for the development and functioning of healthy hair cells.

Deafness Research UK is looking at the potential for using stem cells to grow new hearing cells in the inner ear. Stem cells are cells that are ‘unspecialised’, but given the right conditions and mix of chemicals they can be ‘persuaded’ into becoming any type of cell in the body. Researchers are looking at how these cells can be programmed to become inner ear cells in the hope that they could be used to restore hearing.

In spite of these developments and the significant progress that has been made in recent years, medical answers for deafness and other hearing problems remain some way off. However, with scientific and medical experts increasingly confident that one day they will become a reality, Deafness Research UK is committed to continuing its support for the research needed to bring them about.

Hearing tests for babies

Deafness Research UK has been at the forefront of developing baby hearing screening technology for over a decade, developing the pioneering Otoacoustic Emissions testing methods which have revolutionised screening programmes worldwide.

We are continuing our work to improve neonatal hearing screening, and our researchers are currently developing a test called the Maximum Length Sequence Brainstem Auditory Evoked Response (MLS BAER) test for the early detection of deafness as a result of brain damage caused by oxygen starvation during birth. This form of deafness affects premature babies in particular, and cannot be detected early with conventional hearing tests for babies.

FURTHER INFORMATION

Deafness Research UK also produces information materials on Noise in Everyday Life and Noise at Work.

If any of your questions concerning noise have not been answered by reading this factsheet, contact the Deafness Research UK Information Service for further assistance. Our Information team will either answer your enquiry directly or refer it to one of our scientific or medical advisers.

Open: 9.00 a.m. to 5.00 p.m., Monday to Friday (a message can be left at other times)

Freephone: 0808 808 2222

Textphone: 020 7915 1412

E-mail: info@deafnessresearch.org.uk

or click the 'ask question' option from our website homepage:
www.deafnessresearch.org.uk

Deafness Research UK is the only national medical research charity dedicated to helping people with deafness, tinnitus or other hearing problems.

Scientists are now predicting that within the next ten to fifteen years there could be a cure for some forms of deafness and much more effective treatments for tinnitus. Deafness Research UK is at the forefront of this work.

You can support us by making a donation or joining the Deafness Research UK League of Friends. For more information call us on 0207 833 1733 or write to:

Deafness Research UK, 330-332 Gray's Inn Rd, London WC1X8EE
Charity no. 326915

This factsheet has been produced by Deafness Research UK, in consultation with Professor Andrew Forge, BSc, MSc, PhD, Professor Mark E Lutman PhD, and Mr Andrew McCombe FRCS. No responsibility can be taken on the part of Deafness Research UK or its advisors for any error or omission. You should not act on any advice without first referring to your family doctor or another medically qualified adviser.

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