deafness research uk

Noise in Everyday Life

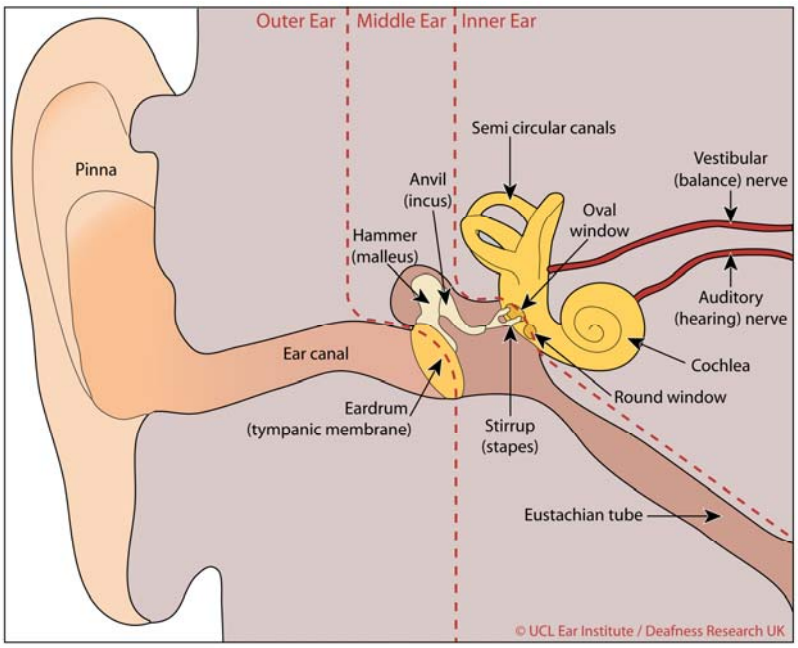
This factsheet has been written for people who think their hearing might be at risk because of excessive noise in their daily lives, or for people who have a hearing loss and fear it will become worse due to daily noise. It may also be useful for anybody with a general interest in the effect of noise on hearing.

It is important to remember that noise-induced hearing loss is often preventable, so be aware of how to minimise the risk to your hearing.

This factsheet covers the following topics:

- How do we hear?
- How can leisure activities damage hearing?
- Can personal music players cause hearing loss?
- 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 LEISURE ACTIVITIES DAMAGE HEARING?

Regular exposure to sound levels over 80 decibels dBA is sufficient to cause tinnitus (ringing in the head or ears). In nightclubs and pop concerts, levels can reach well over 110 dBA and even classical concerts can exceed 100 dBA. For many, tinnitus will be the first sign of damage. Research shows that around 70-80 per cent of people who regularly visit nightclubs will experience tinnitus at least temporarily. However, because we are all unique it is impossible to predict how many times an individual can withstand such temporary hearing impairment before the damage is permanent.

As a result of greater awareness about noise-induced hearing loss, some countries have legislated to reduce noise levels in nightclubs. Switzerland has set a 90 dBA limit for sound levels at the edge of dance floors in clubs and Austria has reduced levels to 85 dBA. The UK has regulations designed to protect the hearing of those working at venues rather than club or concert-goers. From 6th April 2008, the music and entertainment sectors in Great Britain will be covered by the Control of Noise at Work Regulations 2005 which will replace those from 1989. Further details are given in Deafness Research UK's factsheet, *Noise at Work*.

Due to excessive loudness in many everyday activities, it is not just music lovers who are at risk. There is also a danger of noise-induced hearing loss from such pastimes as DIY or riding a motorcycle. A recent American study found that those people who had activities with average noise levels above 90 dBA, increased their chance of hearing loss by 10%.[1]

Some power tools can have noise levels above 90 dBA, which would require ear protection in a work environment. Some motorcycles can reach levels of over 100 dBA, which is as loud as a hydraulic press! Helmets may protect against bumps and crashes, but they offer next to no protection from the noise levels. Limiting the time you are exposed to these levels is very important, but using ear plugs while riding is a way of reducing the noise level your ears are exposed to.[2]

There is also an increase in the noise levels experienced at the cinema. The 1998 film Godzilla peaked at a level of 118 dBA[3], and the trend seems set to continue. Remember to be aware of how long you are being exposed to loud sounds, and give your ears ample time to recover afterwards.

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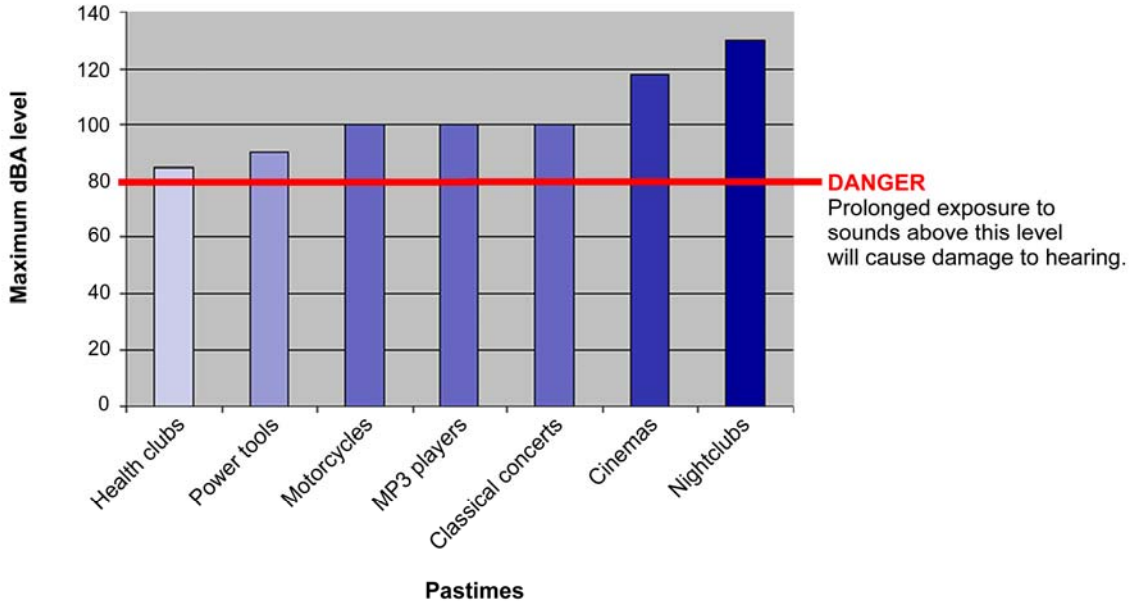
[1] *Audiology* 2001; 40: 1-9
[2] University of Florida, September 2001; *http://news.ufl.edu/2004/09/01/motorcycle-noise/*
[3] www.hear-it.org/page.dsp?page=1613



CAN PERSONAL MUSIC PLAYERS 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 – equivalent to a pneumatic drill from 12 feet! Germany is now pressing for a European limit of 90 dBA.

Apple have produced an update for their iPods that allows the listener to set the maximum volume. 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://support.apple.com/kb/TA38403?viewlocale=en_US#ipod

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.

This is also important for those people who like listening to music while at the gym or heath club, as it can be easy to forget how long you have been listening to a personal music player while exercising.

Remember: Don't increase the volume on your personal music player in order to drown out background noise such as a train or traffic.

HOW CAN HEARING LOSS FROM LEISURE NOISE BE PREVENTED?

In order to minimise noise damage from everyday activities:

- Use earplugs. Earplugs can be unobtrusive and will not block out the sound of music or conversation. In fact, by blocking the excess noise, they can improve your ability to make out conversation and music. If worn correctly, earplugs can reduce sound levels by between 15 and 35 dBA. Special earplugs are available for musicians.
- Take regular breaks from the music or other noise source. Aim for at least ten minutes' break every hour.
- Give your ears time to recover after exposure to excessive noise. Exposure to a 100 dBA sound for around two hours requires at least 16 hours of rest for the ears if the hearing loss is not to become permanent. A minority of people are more sensitive and a longer period of rest may be required.
- Avoid standing too close to the speakers or other noise source.
- Don't go to noisy places too often, and try less noisy pastimes.

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 and 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 people talk. So although some sounds will remain reasonably clear - like people's actual voices - the words they are saying will be distorted. For example, you may be watching a TV programme and be able to hear that the characters are talking, but what they are saying will be hard to understand. Naturally, this makes trying to understand a single person in a noisy background or with other people speaking very difficult and frustrating.

However, it is possible to recognise signs of hearing damage quite early. If you have difficulty hearing people or you suffer tinnitus on leaving a noisy environment, your hearing may well be damaged. Repeated exposure to noise at a high level can leave you with a permanent hearing loss or tinnitus.

If you do suspect your 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 you are diagnosed with either a hearing loss or tinnitus, contact Deafness Research UK. We produce a wide range of literature on many types of hearing loss and can offer information and advice on the options available to you.

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, which can be with us throughout the day: a screeching train, a noisy office, listening to an MP3 player or frequently going to loud music gigs, nightclubs or pubs. 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 burst the ear drum and cause extensive damage to the inner-ear.

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.

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.

FURTHER INFORMATION

Deafness Research UK also produces information materials on Noise and the Younger Generation 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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