HEARING CONSERVATION FOR PERFORMERS

BEST PRACTICE GUIDANCE 2020

Authors
Rob Shepheard, Consultant Audiologist,
Dr. Finola M Ryan, Occupational Health Doctor
Paul Checkley, Audiologist
Claire Cordeaux, Director, BAPAM

March 2020

Contents

SUMMARY OF RECOMMENDATIONS

Healthy hearing is essential for musicians.

Education providers and industry organisations must recognise the risk of sound exposure to performers. Those who manage these institutions have a legal duty to identify hazards to health and take appropriate steps to minimise the risk of causing harm.

To achieve effective hearing conservation, implementation of a complete and cohesive programme should be undertaken. Measures performed in isolation will result in less successful outcomes, and serve more as an exercise in regulatory compliance.

- Full and appropriate risk assessment must be undertaken.
- When sound levels demonstrate that risk to health is evident, If possible, protection is best achieved by reducing the sound at source. If not possible then consider the hierarchy of controls for noise.
- If it is impractical to reduce exposure by any other means then suitable personal hearing protection must be provided. if custom moulded earplugs are employed these should be individually verified to ensure protection.
- Hearing health surveillance tests are an integral part of a hearing conservation programme. Early recognition of changes to musicians' hearing is best identified with a test called 'Otoacoustic Emissions'. Tests must be repeated regularly to ensure risk management strategies in place are adequate.
- Instruction and continuous education for all staff and students must be available and recorded.
- Programmes should be monitored and easily audited to ensure their efficacy and that they are cost-effective

1. BACKGROUND

Sound exposure is inevitable in our society. Prolonged exposure to intense sound is an integral part of a musician's every-day activities, both related to and outside performance. Healthy hearing is vital to performers. Maintaining good function of this delicate sense, through recognition and management of risks to hearing health is essential to a musician's career ("Goldscheider v Royal Opera House," 2019; Sataloff, 1991).

Education providers and industry organisations in the performing arts have legal and moral obligations to their students' health and wellbeing, and this will be reflected in local Health and Safety Policy Statements. On-going research in a sample of over 3000 music students revealed evidence of noise-induced hearing injury in *every* participant (Dance & Shearer, 2017). There is a need for music-specific guidance on an appropriate hearing conservation strategy for music students, teachers, professionals and organisations.

THE LAW

The Control of Noise at Work Regulations 2005 ('The Noise Regulations'), which came into effect for the music and entertainment sector in April 2008, set out the minimum standards required by law aimed at preventing hearing injury in the workplace.

Although the 'Noise Regulations' may not apply directly to students since they are not employees, there is a common law duty of care toward non-employees such as students, as well as the overarching *Health and Safety at Work etc. Act 1974, Section 3* and associated *The Management of Health and Safety at Work Regulations 1999 ('the Management Regulations')* that are applicable. It would be sensible, therefore, on recognition of a risk such as sound exposure, to adhere to the exposure limits set out in the 'Noise Regulations', designed for the conservation of hearing. The Health and Safety Executive (HSE) has issued practical guidance for employers outlining their responsibilities toward their employees and others they may be responsible for.

> *"It shall be the duty of every employer to conduct his undertaking in such a way as to ensure, so far as is reasonably practicable, that persons not in his employment who may be affected thereby are not thereby exposed to risks to their health or safety."*
>
> Health and Safety at Work etc. Act 1974

> *"Every employer shall make a suitable and sufficient assessment of…the risks to the health and safety of persons not in his employment arising out of or in connection with the conduct by him of his undertaking, for the purpose of identifying the measures he needs to take to comply with the requirements and prohibitions imposed upon him by or under the relevant statutory provisions… "*
>
> The Management of Health and Safety at Work Regulations 1999

BEST PRACTICE: THE GOLD STANDARD

This guidance document has been developed by clinicians working with the British Association for Performing Arts Medicine (BAPAM) at the request of the Healthy Conservatoires Network (HCN).

In establishing an effective hearing conservation strategy, the HCN is leading the way internationally. BAPAM guidelines to the sector include *all* aspects of hearing conservation, which are not simply compliant with current regulations but exceed these minimum standards in the prevention of unnecessary injury to health. It provides recommendations on implementation of best practice, cost-effective health conservation strategies to educational institutions, students, performers, teachers, managers and venues on appropriate hearing conservation in a music-rich environment.

These guidelines are intended to assist managers develop and implement health conservation strategies in educational institutions but is expected to be of interest to the wider industry. Aspects which may be particularly useful, for example, to Junior Conservatoires, include the process of risk assessment and risk management.

This guidance refers to aspects of the *Health and Safety at Work etc. Act 1974, The Management of Health and Safety at Work Regulations 1999* and *The Control of Noise at Work Regulations 2005*. Whilst the HSE are able to impose sanctions as a result of criminal liability, both staff and students are also able to undertake civil claims against organisations, if they are able to prove any injury to their hearing health is a result of negligence or failure to take reasonable care to prevent such injury. Before implementation, you may wish to take your own legal advice.

This guidance will be reviewed and updated if necessary in March 2022.

MUSICIANS' HEARING PROBLEMS

Loud sounds are not necessarily unpleasant or classified as noise; they include sounds we enjoy listening to, such as music. Exposure to very loud sounds or prolonged exposure to moderate sounds can injure the vulnerable hair-like structures of the inner ear, *figure 1* and lead to permanent and irreversible hearing loss, known as Noise-Induced Hearing Loss (NIHL) (Zhao, Manchaiah, French, & Price, 2010).

Sound exposure can also cause other hearing problems such as

- tinnitus (ringing in the ears)
- hyperacusis (reduced tolerance to louder sounds)
- diplacusis (problems with pitch perception) (Zhao et al., 2010)

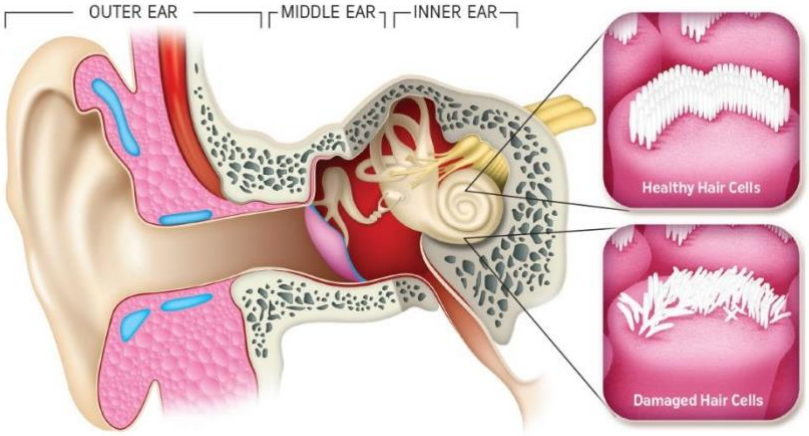

Figure 1: Vulnerable Hair-Like Structures In The Inner Ear

NOISE-INDUCED INJURY IS AVOIDABLE AND 100% PREVENTABLE

Preparing Students for their future career

Conservatoires and educational establishments have an ideal opportunity to prepare students for their future healthy practices to protect and preserve their hearing at the start of their professional journey. These institutions are well placed to address this issue while in the educational setting, and lead by example using protective scheduling, balanced repertoire choices and healthy practice and performance environments.

Students enrolled in Conservatoires may go on to become an employed musician or a freelance musician. Those who go on to work as freelance musicians will not have employer protection and have more individual responsibility to preserve their own hearing health. They may be reliant on external organisations' decisions about environment and scheduling with little opportunity to influence these decisions. Employers, on the other hand, will be required to have risk reduction strategies in place to protect their employees. Freelance performers, therefore, will not be able to rely as heavily on this and must be aware and prepared to engage in appropriate risk reduction strategies. These avoidable problems can seriously threaten a performer's career in music (Di Stadio et al., 2018), and this guidance outlines how educational institutions, performers and those working in the performance environment can work together to conserve auditory health.

SOUND EXPOSURE LEVELS

Sound exposure is influenced by the duration, intensity and proximity to the sound source. For the purposes of hearing conservation in performers, this should be measured in units called decibels (dB) with an 'A' weighting. This measurement is known as noise dose, when referring to a daily or weekly exposure.

Exposure limits are set out in the HSE publication, Sound Advice (Health and Safety Executive, 2008), and the excerpts on page 7 are taken directly from this guidance. The full document can be viewed online and includes estimates of the representative noise levels of different instruments and ensembles and how much time it might take for a player to reach their exposure limit if playing at the level of a typical symphony performance.

The BBC Musicians' Noise Guides have further worked examples of a musicians' typical noise dose available for musicians and a toolkit for managers.

What about Electronic Audio Devices?

Whilst it is common place for electronic audio devices such as headphones, earphones or in-ear-monitors to be employed by performers, guidance specific to the use of such devices currently exceeds the scope of this document. However the authors of these guidelines would advise that operational diffuse-field sound levels from this type of equipment should at least, be considered in the same way as that of ambient levels of sound and not exceed those set out in European Directive 2003/10/EC, and ideally used as per standards BS EN 13819. If in addition to listening to some form of audio output the use is also to provide hearing protection then they must comply with standard BS EN 352.

NOISE ACTION AND LIMIT VALUES

The noise regulations require employers to take specific action at certain action values. These relate to:

- *The levels of exposure to noise of employees averaged over a working day or week; and*
- *The maximum noise (peak sound pressure) to which employees are exposed in a working day.*

The values are:

- *Lower exposure action values (LEAV):*
  – daily or weekly exposure of 80 dB;
  – peak sound pressure of 135 dB;
- *Upper exposure action values (UEAV):*
  – daily or weekly exposure of 85 dB;
  – peak sound pressure of 137 dB.

There are also levels of noise exposure which must not be exceeded (but take account of any reduction in exposure provided by hearing protection):

- *exposure limit values (ELV):*
  – daily or weekly exposure of 87 dB;
  – peak sound pressure of 140 dB.

Reproduced from Sound Advice, HSE 2008

NOISE EXPOSURE

The noise exposure level (often referred to as the 'noise dose') takes account of both the sound pressure level and how long it lasts. Generally the potential for hearing to be damaged by noise is related to the noise 'dose' a person receives. Being exposed to a noise level of 105 dB (a not unusual sound level for a pub band, or that generated by a brass or woodwind instrument at full blast) for 5 minutes would be the same dose as being exposed to 94 dB (a nightclub bar) for 1 hour, or 88 dB (chamber music) for 4 hours.

Each 3 dB added doubles the sound energy (but this is only just noticeable to a listener). When 10 dB is added, the energy is increased ten-fold, while adding 20 dB is a hundred-fold increase. Therefore:

- *If the sound intensity is doubled, the noise level increases by 3 dB.*
- *Two instruments with the same noise level of 85 dB together produce 88 dB.*
- *A noise level reduction of 3 dB halves the sound intensity (and reduces its propensity to damage).*

Halving the noise dose can be achieved either by halving the exposure time, or by halving the noise level, which corresponds to a reduction of 3 dB. These noise exposures are identical: 80 dB for 8 hours 83 dB for 4 hours 86 dB for 2 hours 89 dB for 1 hour 92 dB for 30 minutes

Average noise level	***Time taken to receive a dose equivalent to the upper exposure action value (85 dB)***
85dB	*8 hours*
95 dB	*45 minutes*
100 dB	*15 minutes*
105 dB	*5 minutes*
110 dB	*Under 2 minutes*
115 dB	*Under 30 seconds*

Reproduced from Sound Advice, HSE 2008

2. HOW TO RECOGNISE HEARING DAMAGE

NIHL is typically diagnosed using a hearing test called Pure Tone Audiometry (PTA). This test is designed to diagnose hearing problems which may cause difficulty interpreting speech. PTA detects changes in hearing levels only after major damage is caused and is irreversible and likely to result in significant symptoms. Musicians are known to be more adept at PTA than the normal population so PTA testing over time may not be an accurate reflection of any impact on their hearing (Dowling & Harwood, 1985; Einhorn, 2009; Jansen, Helleman, Dreschler, & Laat, 2009). PTA is very useful for the assessment and management of hearing loss however the aim of any hearing conservation programme is to prevent hearing loss, not measure it.

In the early stages of damage to the inner ear, a significant proportion of hair cells can be impaired, but without any noticeable symptoms of hearing loss, or associated problems such as tinnitus, diplacusis or hyperacusis. Since these early changes cannot be detected by PTA, this traditional test provides no opportunity to take steps to prevent progressive injury and development of symptoms. Alternative hearing tests, known as 'Otoacoustic Emissions' (OAE) testing, is capable of detecting these early changes (Job et al., 2009). When explained and displayed in an easily understandable format, this allows early recognition of sound-related changes to these vulnerable structures, thus enabling people to alter their individual behaviour and their way of working, to protect themselves from further injury (Mansfield, Baghurst, & Newton, 1999).

3. DEVELOPING A HEARING CONSERVATION STRATEGY

An effective hearing conservation program will involve several simultaneous actions:

- risk assessment,
- proactive intervention with control measures, known as risk management and
- feedback on efficacy of control processes through health surveillance and audit

This dynamic process will motivate participants, allowing them to take shared ownership of how their auditory health is protected (Fligor, 2013; Murray, LePage, & Mikl, 1998).

Those responsible for music environments have a statutory duty to all people using, performing, studying and working in those settings. At a minimum, risk assessment and health surveillance where there is a risk to health identified must be undertaken. The HSE advises employers and managers to *'think about what might cause harm to people in your workplace and decide whether you are taking reasonable steps to prevent or control that harm.'*

RISK ASSESSMENT

Risk assessment is the initial step and involves:

1. **Identification** of potentially hazardous sound source and those at risk
    - *Consider music rehearsal, tuition or performance*
2. **Characterisation** of sound: variation according to the instrument, environment, duration, intensity etc.
    - *Consider all music-related sound exposure: performance, rehearsal and personal practice time.*
    - *For students, this will include both time on-site in conservatoire rehearsal spaces AND exposure outside the structured learning environment*
    - *Sound Advice* (Health and Safety Executive, 2008) and *BBC Musicians Noise Guide (Hansford, 2011)* provide estimates of the representative noise levels of different instruments and ensembles.
3. **Exposure assessment**: document the nature and extent of expected exposure
    - *Measurement of personal sound exposure, known as dosimetry*
    - *Comparison with published Action Values/Limits*
4. **Estimation of risk**: what is the probability of hearing damage due to sound exposure in the identified context?

Once controls are put in place, the risk assessment will need to be repeated on a regular basis to ensure adequate control is being achieved. It is recommended that risk assessments are revised every 2 years at a minimum.

A sample flowchart for risk assessment can be found in Sound Advice (Health and Safety Executive, 2008) and the BBC Musicians Noise Guide (Hansford, 2012) has a useful risk template.

RISK MANAGEMENT

Risk management requires a value judgement to decide between possible courses of action to control the issues identified during risk assessment. Risk management should reflect the interests of all people who may be affected by the decision about what is required to control risks.

When implementing control measures, the hierarchy of control model defines the order to follow when planning to risk reduction and should be considered in the following order:

1. Controlling sound at source
2. Prevent and control transmission of sound to individual
3. Individual protection

The HSE is very clear that management should not skip ahead to the easiest solution, but must reduce risk "as low as reasonably practicable".

1. Controlling sound at source

- Eliminate the risk: this is *unlikely* to be a reasonable solution – music is the desired product rather than an unwanted by-product of sound exposure, therefore evaluation and control of this unavoidable exposure is essential

- Modify the process to reduce sound exposure as low as reasonably practicable. Several worked examples of these processes can be found in the *BBC Noise Guides Part 1 & 2* (Hansford, 2011, 2012) and *Sound Advice (Health and Safety Executive, 2008)*. Consider:
    - Planned rest/quiet time and provision of quiet space for recovery
    - Development of standards on timetable structure with a reduction of risk by
        - awareness of design of playing space
        - avoidance of prolonged exposure
    - Consideration of appropriate design of practice and performance space (i.e. small rooms with untreated walls/mirrors potentially represent more significant risk than large, sound-treated performance areas)
    - Investigation of recent innovations such as noise mapping for orchestras
    - Limit or avoid non- vocational and personal sound exposure (e.g., transport, personal music-players)
- Substitute sound source
    - Careful consideration of repertoire alternating louder, intense pieces with quieter work, allowing time for recovery from exposure
    - Using appropriate instruments (e.g. Baroque instruments for Baroque music, solutions for electronic versus classical instruments)

2. Prevent and control sound exposure

- Adequate distance between musicians. Sound Advice suggests $2m^2$ per musician Be aware that providing space may not always decrease exposure, as discovered by the BBC Singers' Noise Day.

- Record, respond to, and reduce the duration and intensity of exposure
  Consider Informative visual aids/noise levels indicators
  Personal sound level apps can provide useful information

*If not possible/practical to **reduce** exposure to loud sounds then **PROPER** provision of adequate and suitable protection is essential.*

3. Provision of personal hearing protection

If it is not practical for the risk presented by loud sound to be reduced at source then it is vital that all those exposed are adequately protected.

Use hearing protection appropriate to the assessed risk. If potential exposure presents only a marginal risk then suitable protection may be different from that required by someone who will be exposed to higher risk. Examples of the requirements of different instrumentalists can be found in the BBC Musicians Noise Guide (Hansford, 2011)

Published attenuation levels of various types of hearing protectors arrived at in laboratory conditions during the certification process do not adequately predict real world attenuation and often over estimate protective values (HSE RR720 2009; HSE CRR24 1990). This is concerning because musicians may believe they are being protected when they are not.

Verification by fit testing at time of supply is strongly recommended, to ensure the degree of protection is as close to laboratory figures as possible. *When custom moulded hearing protection products designed for musicians are sourced then the fit must be verified when supplied and regularly verified to ensure continued protective levels. Errors can occur during manufacture to affect the fit so although comfortable some samples will not fit properly and this leakage will result in a significant reduction of the real world protective value (British Standards Institution, 2002; Hager, 2011; Schulz, 2011).*

EDUCATION & TRAINING

All staff and students should have training on hearing conservation, the risks presented by the performance environment and on hearing protection. Records of attendance and participation in instruction and education should be maintained and be the responsibility of a designated person, (e.g. manager, Health & Safety co-ordinator or other named member of staff). Refresher training will be required on a 1-2 yearly basis, because new risks will be identified, and new technology available to assist with control. Online modules would be very suitable if completion can be recorded.

HEALTH SURVEILLANCE

Evaluation of prevention and control measures is essential for a successful hearing conservation strategy. Health surveillance is a system of ongoing health checks to

1) detect adverse effects early, and
2) provide information on effectiveness of control processes and to minimise further harm being caused.

> *"health surveillance means assessment of the state of health of an employee, as related to exposure to noise"*
>
> The Control of Noise at Work Regulations 2005

Hearing tests measure the impact of exposure to noise and should be undertaken at regular intervals as part of a health surveillance programme. Health surveillance should provide the earliest indication of effects from exposure to risk. Ideally, changes would be detected *before* hearing loss occurs, and control measures can be revised or increased. Long-term, regular health surveillance in the form of hearing tests will demonstrate the efficacy of control measures.

There are two types of tests used in health surveillance:

- **Pure Tone Audiometry (PTA)** which detects irreversible hearing damage
- **Otoacoustic Emissions (OAE)** which provides early indication of changes in function of the inner ear as a result of exposure. This test shows early damage that is not detected by PTA test.

Initially, a combination of both tests is recommended as a baseline assessment. Comparison of OAEs over time allows performers to detect any deterioration in their auditory health. As previously stated, OAEs are particularly useful for musicians' health surveillance because they give an early warning of irreversible hair-cell damage, re-enforcing vigilant use of control measures and hearing protection.

Health surveillance should include otoscopy (visual inspection of the outer ear with a light) and tympanometry (a test of the middle ear). These hearing tests allow for complete and comprehensive assessment at time of entry and appropriate tests should be repeated on a regular basis. *Table 1* displays a suggested protocol for heath surveillance.

If a hearing health problem is identified by an individual, specialist help should be sought via a GP referral or private self-referral to a hearing specialist and ENT services.

Baseline assessment	Yearly/2-yearly as per risk assessment
Otoscopy	Otoscopy
Baseline PTA	Tympanometry
Tympanometry	OAE (add PTA if significant deterioration observed)
OAE	+/- referral to specialist service

Table 1: Recommended Protocol of health surveillance. This can be applied to student and professional performers

Responsibilities of the individual to protect their own hearing.

The institution is responsible for the risk assessment and consequent management, control measures and health surveillance. The individual working or studying within the institution also has responsibility for their own health, as set out in Section 7 of the *Health and Safety at Work etc Act 1974.* In terms of hearing health, this includes:

- Attending education, instruction and supervision
- Reducing recreational exposure time. (Smartphone Apps can inform daily personal exposure can be helpful for personal monitoring.)
- Having regular hearing tests and engaging in health surveillance
- Obtaining and wearing appropriate hearing protection

A Comprehensive Strategy

Implementation of the recommendations in this guidance, through risk assessment and effective strategies for harm minimisation will significantly impact on hearing conservation for musicians. These Strategies to educate and motivate individuals within an organisation or institution should be offered as part of a complete hearing conservation programme and not in isolation. Historic hearing conservation programmes have generally proved unsuccessful in conserving hearing health, likely, at least in part, to their fragmented approach (O'Brien, Ackermann, & Driscoll, 2014; Royster & Royster, 1990).

A comprehensive and systematic organisational approach comprising risk assessment, risk management, health surveillance and regular audit is strongly recommended. Continuous reassessment over time ensures adequate controls are in place and is essential to both hearing conservation and cost-effectiveness.

A designated manager or responsible person must be identified to ensure the process is fit for purpose. They will also be responsible for keeping records of staff and students' attendance and participation in instruction and education on hearing conservation.

Meaningful change can be brought about by;

- Encouraging access to evidence-based advice
- Fostering individual responsibility for healthy music-making behaviours
- Ensuring education starts early and that educators lead by example
- Building success through a comprehensive and well-resourced programme

In providing truly beneficial, evidence-based advice, we can develop the paradigm and impact musicians' behaviour, which will be the key to achieving the desired outcome. With directive and instructive counselling as part of a programme, we can change behaviour. Musicians who recognise the positive benefits of maintaining healthy hearing and their individual responsibilities are more likely to engage with and accept risk assessment and health surveillance and to embrace the control measures identified as necessary for hearing conservation.

These guidelines will assist organisations in creating a strategy to build a healthy hearing policy for their environments, thereby not only preserving the hearing health of their students, employees and other musicians, but also allowing their programme to be self-monitored and easily audited. This will demonstrate how cost effective, successful, and beneficial their healthy hearing policy proves to be.

DEFINITIONS & ABBREVIATIONS USED

'Management Regulations'	The Management of Health and Safety at Work Regulations 1999 http://www.legislation.gov.uk/uksi/1999/3242/contents/made
'Noise Regulations'	The Control of Noise at Work Regulations 2005 http://www.legislation.gov.uk/uksi/2005/1643/contents/made
BAPAM	*see* British Association for Performing Arts Medicine
British Association for Performing Arts Medicine	A healthcare charity giving medical advice to people working and studying in the performing arts http://bapam.org.uk/
Diplacusis	a difference in hearing by the two ears so that one sound is heard as two
HCN	*see* Healthy Conservatoires Network
Health & Safety Executive	The Health and Safety Executive (HSE) is Britain's national regulator and enforcer for workplace health and safety https://www.hse.gov.uk/
Health surveillance	a system of ongoing health checks. These health checks may be required by law for employees who are exposed to noise http://www.hse.gov.uk/health-surveillance/what/index.htm
Healthy Conservatoires Network	A forum of UK conservatoires aiming to create environments that promote and enhance the health and wellbeing of performing artists, enabling them to achieve their full potential and to build healthy, sustainable careers
HSE	*see* Health & Safety Executive
Hyperacusis	everyday sounds seem much louder than they should
MRHD	*see* Music-related hearing disorders
Music-related hearing disorders	Symptoms experienced by performers including tinnitus, sensitivity to sound, pain and difficulty with pitch perception
NIHL	see Noise-Induced Hearing Loss
Noise-Induced Hearing Loss	Hearing impairment resulting from exposure to sound
OAE	*see* Otoacoustic emission
Otoacoustic emissions	sounds of cochlear origin, which can be recorded by a microphone fitted into the ear canal
Otoscopy	An examination that involves looking into the ear with an instrument
PTA	*see* Pure Tone Audiometry
Pure Tone Audiometry	Hearing test to screen or diagnose hearing impairment
Risk assessment	The process of identifying processes which may cause harm to people in the workplace and decide whether you are taking reasonable steps to prevent or control that harm
Tinnitus	Tinnitus is the name for hearing noises that are not caused by an outside source
Tympanometry	an examination used to test the condition of the middle ear and mobility of the eardrum and the conduction bones by creating variations of air pressure in the ear canal

CONFLICT OF INTEREST

Authors did not receive any financial support for this work.

Rob Shepherd: none declared

Finola Ryan: none declared

Paul Checkley: none declared

Claire Cordeaux: none declared

REFERENCES

British Standards Institution. (2002). *BS EN 352-2:2002 Hearing protectors. Safety requirements and testing. Ear-plugs*. In: BSI.

Dance, S., & Shearer, D. (2017). *Face The Music: A Before and After Study of the HearingvAcuity of Classical Music Students*. Paper presented at the 24th International Congress on Sound & Vibration, London. https://openresearch.lsbu.ac.uk/item/86y77

Di Stadio, A., Dipietro, L., Ricci, G., Antonio, A. D., Minni, A., Greco, A., . . . Ralli, M. (2018). Hearing Loss, Tinnitus, Hyperacusis, and Diplacusis in Professional Musicians: A Systematic Review. *International Journal of Environmental Research and Public Health, 15*(10), 14. doi:10.3390/ijerph15102120

Dowling, W. J., & Harwood, D. L. (1985). *Music cognition*. Orlando; London: Orlando : Academic Press.

Einhorn, K. (2009). The Medical Aspects of Otologic Damage from Noise in Musicians. In M. Chasin (Ed.), *Hearing loss in musicians : prevention and management*. San Diego; Oxford: Plural Publishing.

Fligor, B. (2013). Acceptable strategies for prevention of noise- and music-induced hearing loss. *AudiologyOnline.*

Goldscheider v Royal Opera House, No. [2019] EWCA Civ 711 (Court of Appeal, Civil Division 2019).

Hager, L. D. (2011). Fit-testing hearing protectors: An idea whose time has come. *Noise & Health, 13*(51), 147-151. doi:10.4103/1463-1741.77217

Hansford, R. (2011). Music, Noise & Hearing: How to play your part. I Musicians' Guide. Retrieved from http://downloads.bbc.co.uk/safety/documents/safety-guides/audio-and-music/Safety-Musician_noise_guide_Part_I.pdf website: doi:10.13140/RG.2.1.4936.1680

Hansford, R. (2012). Musicians' Guide to Noise and Hearing: Part II Toolkit for Managers. Retrieved from http://downloads.bbc.co.uk/safety/documents/safety-guides/audio-and-music/Safety-Musician_noise_guide_Part_II.pdf website:

Health and Safety Executive. (2008). *Sound advice*. In Vol. HSG260. *Control of noise at work in music and entertainment*. Retrieved from http://www.hse.gov.uk/pubns/priced/hsg260.pdf

Jansen, E. J. M., Helleman, H. W., Dreschler, W. A., & Laat, J. A. P. M. d. (2009). Noise induced hearing loss and other hearing complaints among musicians of symphony orchestras. *International Archives of Occupational and Environmental Health, 82*(2), 153-164. doi:10.1007/s00420-008-0317-1

Job, A., Raynal, M., Kossowski, M., Studler, M., Ghernaouti, C., Baffioni-Venturi, A., . . . Guelorget, A. (2009). Otoacoustic detection of risk of early hearing loss in ears with normal audiograms: A 3-year follow-up study. *Hearing Research, 251*(1-2), 10-16. doi:10.1016/j.heares.2009.02.008

Mansfield, J. D., Baghurst, P. A., & Newton, V. E. (1999). Otoacoustic emissions in 28 young adults exposed to amplified music. *British Journal of Audiology, 33*(4), 211-222. doi:10.3109/03005369909090102

Murray, N., LePage, E., & Mikl, K. (1998). Inner ear damage in an opera theatre orchestra as detected by otoacoustic emissions, pure tone audiometry and sound levels. *Australian Journal of Audiology, 20*(2), 67-78.

O'Brien, I., Ackermann, B. J., & Driscoll, T. (2014). Hearing and hearing conservation practices among Australias professional orchestral musicians. *Noise & Health, 16*(70), 189-195. doi:10.4103/1463-1741.134920

Royster, L. H., & Royster, J. D. (1990). IMPORTANT ELEMENTS AND CHARACTERISTICS OF HEARING CONSERVATION PROGRAMS AND DETERMINATION OF THEIR EFFECTIVENESS. *Environment International, 16*(4-6), 339-352. doi:10.1016/0160-4120(90)90003-o

Sataloff, R. T. (1991). HEARING-LOSS IN MUSICIANS. *American Journal of Otology, 12*(2), 122-127.

Schulz, T. Y. (2011). Individual fit-testing of earplugs: A review of uses. *Noise & Health, 13*(51), 152-162. doi:10.4103/1463-1741.77216

Zhao, F., Manchaiah, V. K. C., French, D., & Price, S. M. (2010). Music exposure and hearing disorders: An overview. *International Journal of Audiology, 49*(1), 54-64. doi:10.3109/14992020903202520