Occupational Noise Exposure – Challenges, Developments and Future Trends.

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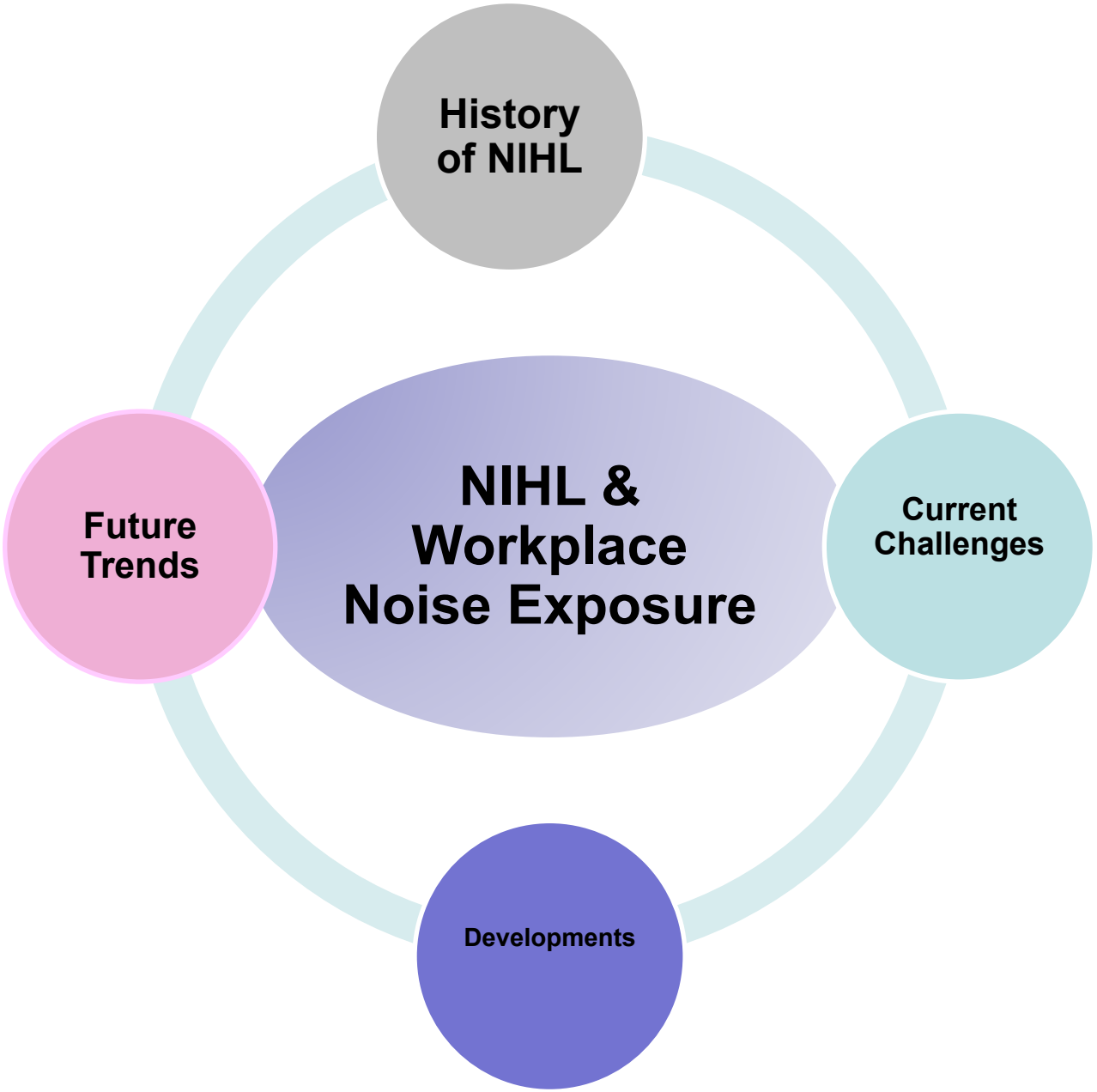
Topics


History of NIHL
Future Trends
NIHL & Workplace Noise Exposure
Current Challenges
Developments

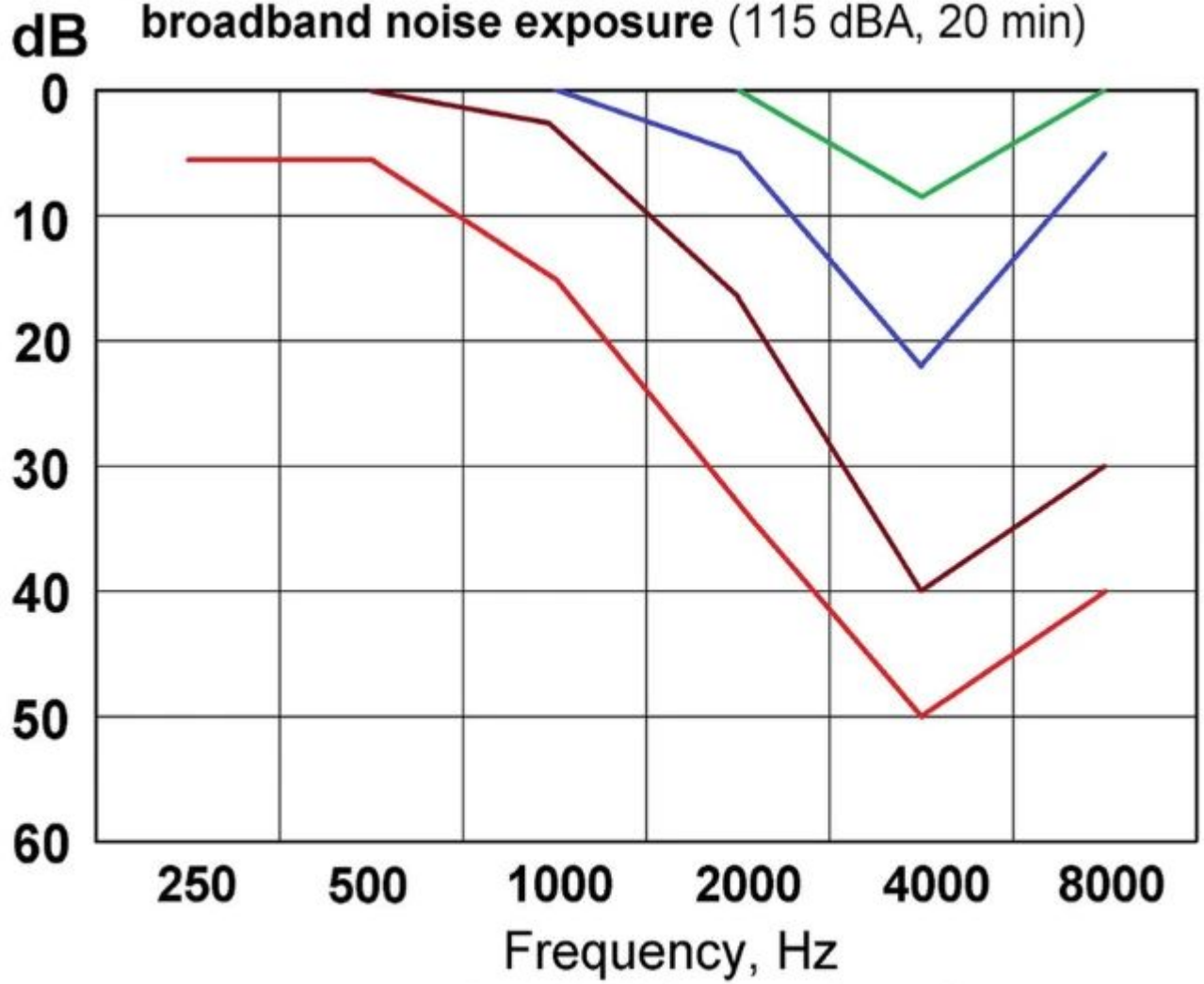
History of Noise Induced Hearing Loss (NIHL)

- NIHL awareness arose more than 2000 years ago

- Ramazzini is credited as the 1st author to accurately describe NIHL among specific trades (1700) recognised that it is irreversible & progressive

- Coppersmiths & corn millers: '…nearly all of them are half-deaf [millers] because they spend all night and day surrounded by the repetitive noise…'

An example of the temporary threshold shift after broadband noise exposure (115 dBA, 20 min)



Temporary threshold shift *(temporary hearing loss)*:

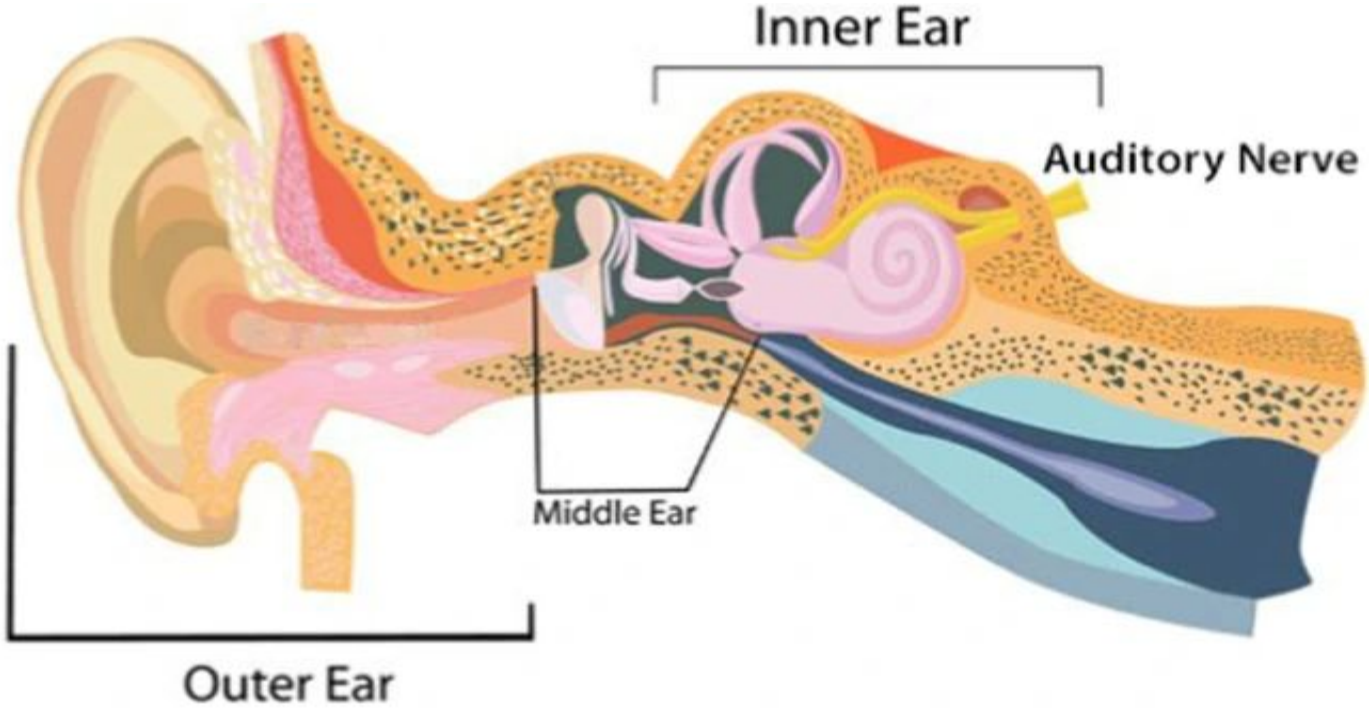
30 seconds after the cessation of the noise exposure;

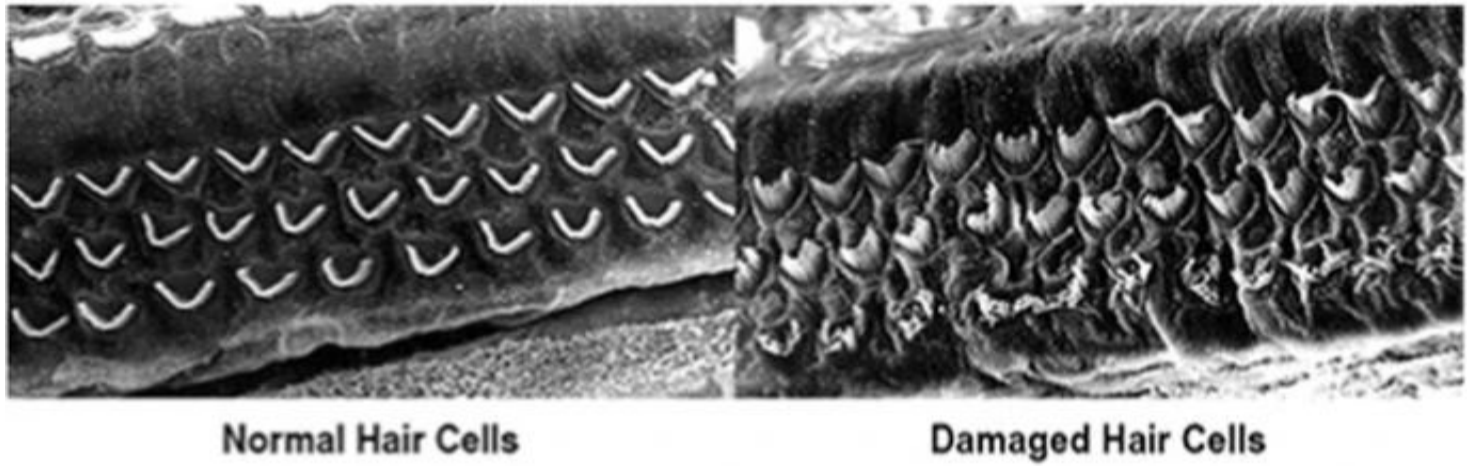
15 minutes; **5 hours;** **24 hours.**

Impulsive Noise

- Levels over 130 dBC likely to cause potential damage
- Industrial examples - cartridge operated tools, hammering > 135 dBC
- Challenges in estimating the likelihood/scale of damage
- Exposure response relationship is evolving

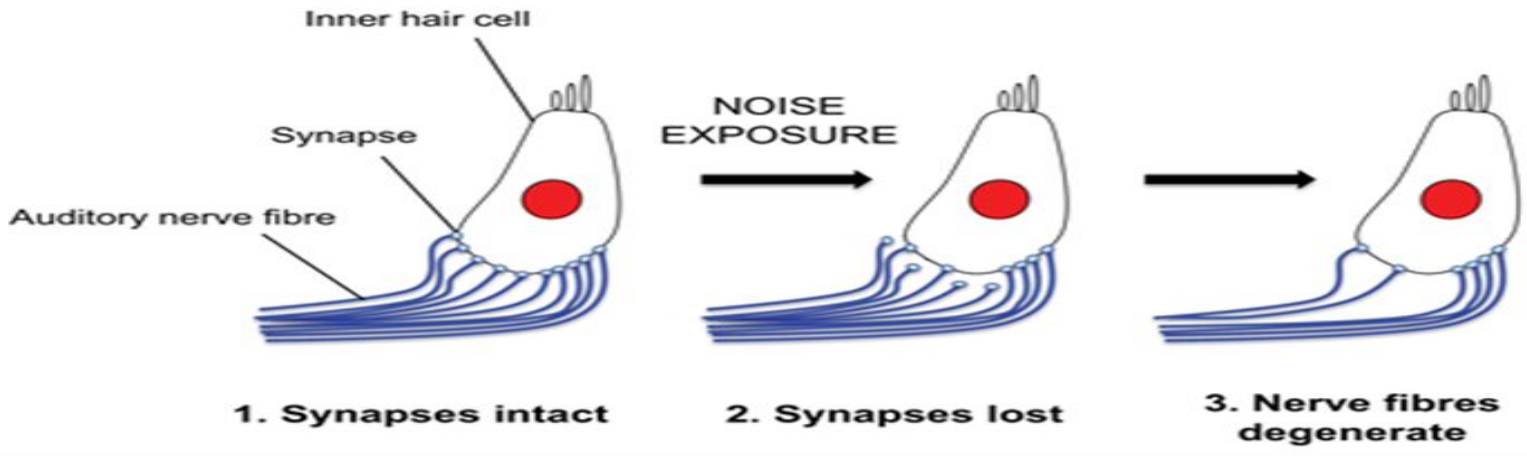
NIHL Mechanisms





Recent & Evolving Science

- Synaptopathy - loss of synapses that connect the inner hair cells of the cochlear to the auditory nerve
- Neuropathy - degeneration of neurons in the auditory nerve
- Oxidative stress, inflammation & genetic predispositions are factors
- Can lead to difficulty in distinguishing speech, even where there is no significant hearing loss as measured by audiogram



Recent & Evolving Science (continued)

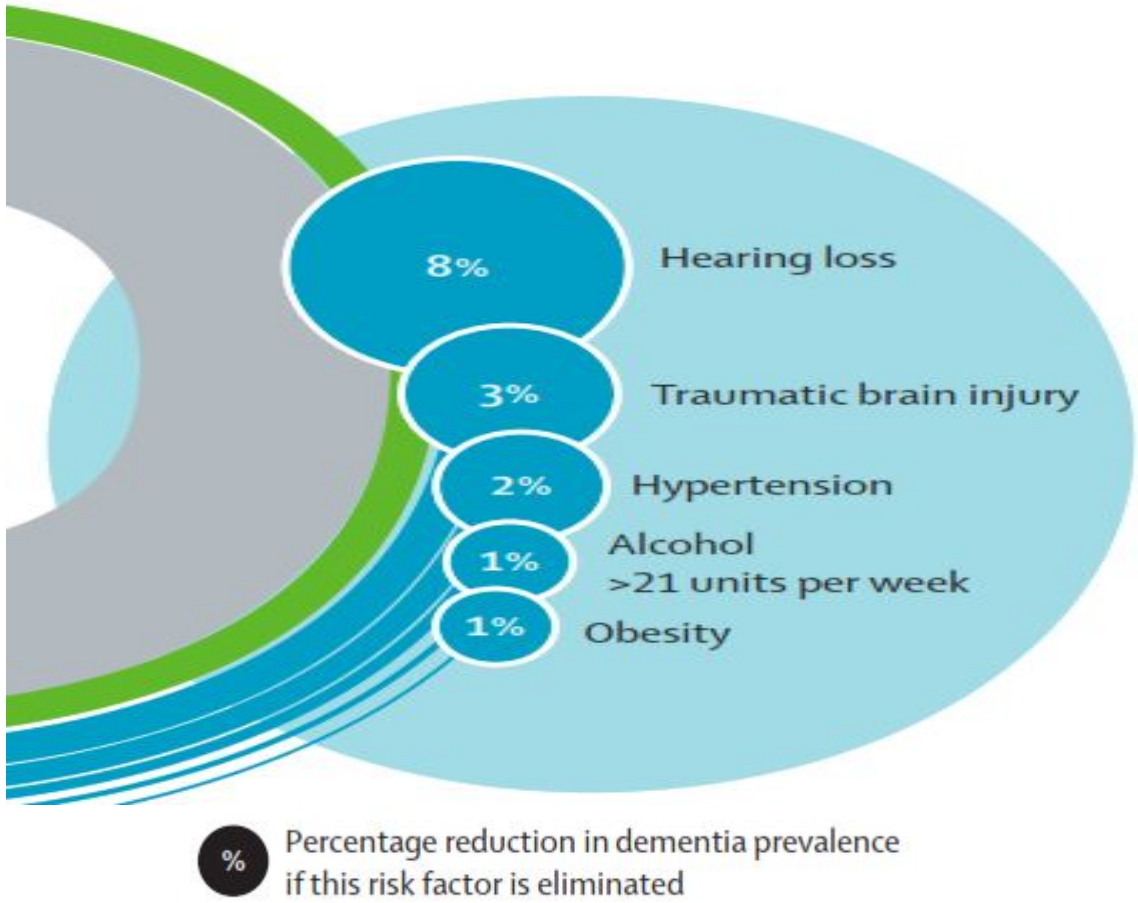
- **Research confirms relationship between auditory & memory circuits**

Compelling evidence now links NIHL with:

- **Workplace accidents**
- **Anxiety & Depression**
- **Stress**
- **Heart disease**
- **High Blood Pressure**
- **Parkinson's (risk increased 57% per 10 dB increase in hearing loss)**
- **Dementia**

Hearing Loss & Dementia Studies

Population attributable fraction of potentially modifiable risk factors for dementia (Livingston, et al. Lancet 2020)



- **Scrutinise the risks for hearing loss to reduce the risk of exposure to this risk factor….**
  (Livingston et al 2020)

- **Mild hearing loss doubles dementia risk**
- **Moderate hearing loss triples risk**
- **Severe hearing loss increases dementia risk by almost five times…**
  (Lin et al 2011)

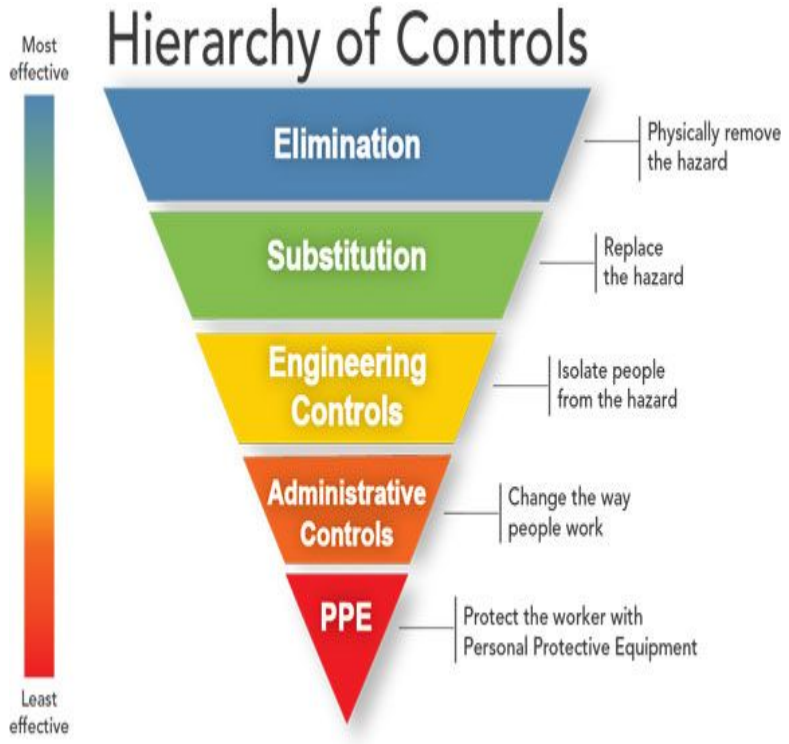
NIHL Exposure

- Occ noise is responsible for 16% of disabling hearing loss
- NIHL is estimated to affect approximately 5% globally
- 22 M US workers exposed to hazardous levels
- Europe – disabling hearing loss affects > 34.4 million

Intended Purpose of Noise Risk Assessments

- Assessments should facilitate an informed decision on the action required to prevent and/or control exposure.
  - Is there a noise exposure issue?
  - Where does it arise & what is causing it?
  - What employees are at risk?
  - Are immediate controls required?
  - How should we prioritise the controls?

Risk Assessment – Key Obligations



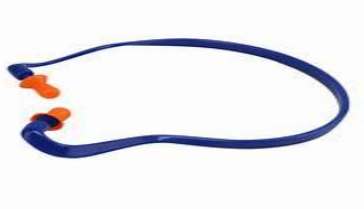
- Make a suitable and appropriate assessment of the risk (Reg 124, of SI No. 299 of 2007 to 2020)
- Consider health surveillance data & published information (Reg 124, e, ix)
- Ensure, so far as is reasonably practicable, that the risk is either eliminated at source or reduced to a minimum (Reg 125)
- Where exposure risks cannot be prevented by other means, make protectors available (Reg 129)

Key Outcomes of RA

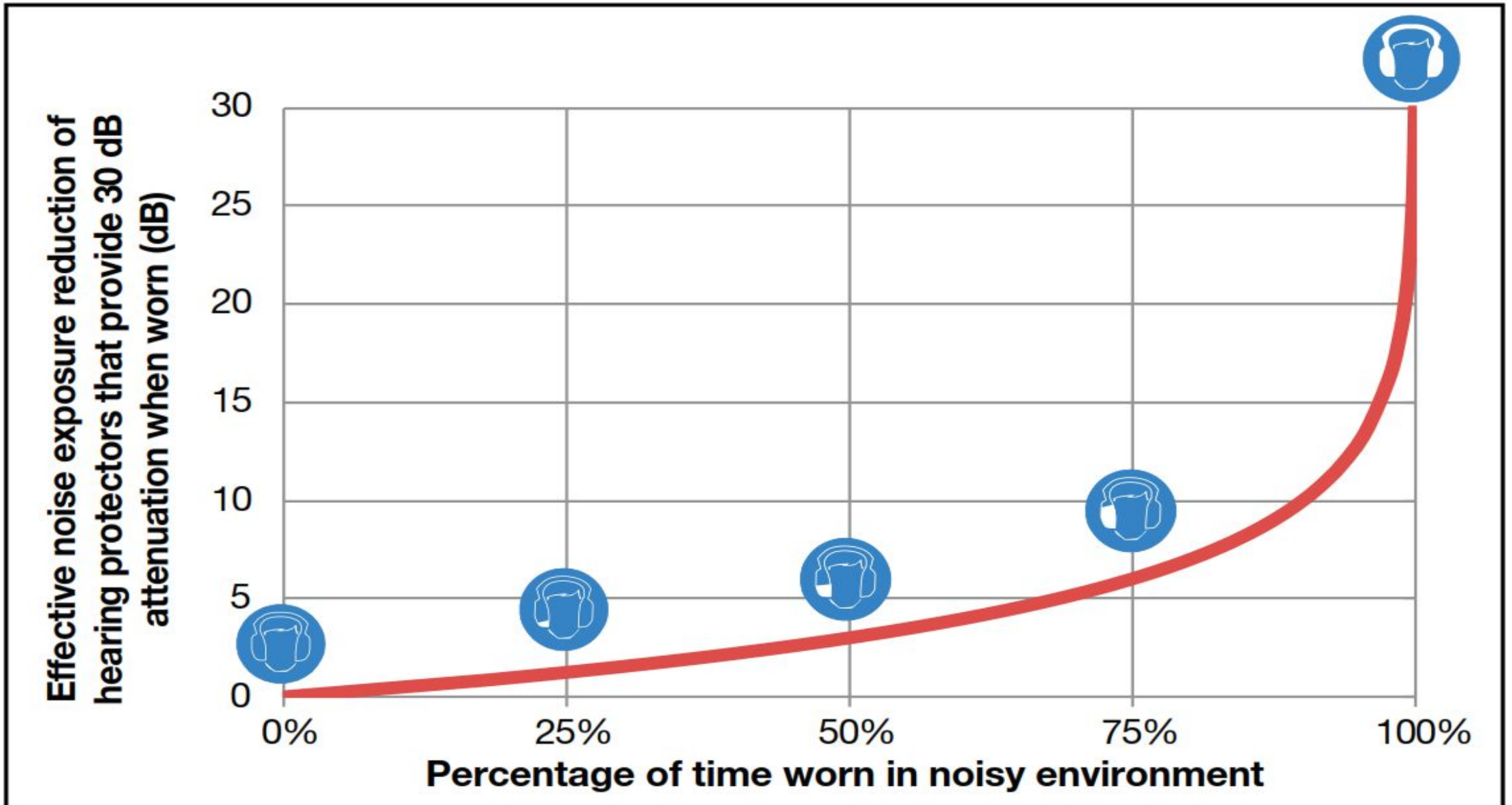
- Are exposed workers identified relative to: LEAV, UEAV and ELV?
- When we exceed UEAV – establish & implement a programme of technical or organisational measures
- Make informed decisions on the action required to protect employees
- A blueprint for action or justification for inaction

Hearing Protection – Key Obligations - Reg 129

- Where the risks arising from exposure to noise cannot be prevented by other means, make protectors available
- Make protectors available when LEAV is exceeded
- Provide suitable and sufficient information and training (Reg, 130)
- Employer shall ensure, so far as is reasonably practicable, that protectors are used & the measures taken under this Reg are effective



Effect of not wearing HPD



Hearing Protection Realities

- Hearing protection is not currently working (Groenewold et al, 2014)
- Poorly fitted protectors severely limits their effectiveness (40% of users) (NIOSH 2024)
- 28% had insufficient protection because their earplugs did not fit well (Gong, et al. 2021)
- Majority were poorly trained & 63% were not told how important it is to wear HPD all the time they are exposed (HSE Data, 2025, Pers Com)
- 95% of employers visited had not checked if workers can hear warning alarms when using hearing protection (HSE Data, 2025, Pers Com)

Hearing Protection Trends

- Widespread recognition of huge & repeated failures
- Need for quality training and employee engagement
- Personal attenuation fit testing/verification
- US Dept of Defense (2023) set requirements for fit testing
- NIOSH recommends use of quantitative fit tests (2025)
- Fit tests are required/mandatory in Argentina, Australia, Brazil, Canada, Germany, Italy, Malaysia, Russia, Uruguay, Venezuela, USA

Some Benefits of Fit Testing

- Personal Attenuation Rating (PAR) - if there is a poor fit more instruction is provided
- Improves training outcomes with real-time feedback
- Match HPDs to meet individual & workplace needs
- Address issues of comfort, fit & appropriate protection
- Identify workers at risk due to inadequate fit

Key Trends in Hearing Conservation

- Technology can help – but not in isolation
- “Smart Protectors” can log exposures and employee compliance
- In noisy workplaces HCP elements can’t be overlooked
- Effective noise control at source is essential
- Health surveillance, information and training are key


Noise Risk Assessment
Eliminate Risk/Establish Controls
Provide Hearing Protection Programme
Information & Training for Workers and their Representatives
Heath Surveillance Audiometric Testing
Review Controls and Risk Assessment
Hearing Conservation Programme

Health Surveillance

- Pure Tone Audiometry (PTA) is traditionally used
- Challenges & weaknesses in PTA
- Otoacoustic emissions (OAEs) predict susceptibility to NIHL
- OAEs are a more suitable tool for early detection
- PTA is relatively insensitive & a lagging indicator
- OAEs are used in clinical practice guidelines for ototoxicity

Ototoxicity & Risk Assessment

RA to give particular attention, as far as technically achievable, to any effects on workers' health and safety resulting from interactions between noise and work-related ototoxic substances….

(Reg 124, Gen Application Regs)

Ototoxicity & Risk Assessment (continued)

- Symptoms - hearing loss, vertigo, and tinnitus
- Guidance on how to manage the risk is evolving
- Reducing chemical exposures is key
- Reducing noise exposure if ototoxic chemicals are used
- Audiograms for workers whose airborne exposures are 50% of OELV, regardless of the noise (Australia) & 20% of TLV (USA)

Ototoxicity - Risk Management

- For an ototoxic chemical to affect the hearing system, it first has to enter the bloodstream, either by being inhaled, swallowed, or absorbed
- Management and workers must be made aware of the combined effects of noise and chemicals
- Increased health surveillance is often warranted

Civil Claims Trends

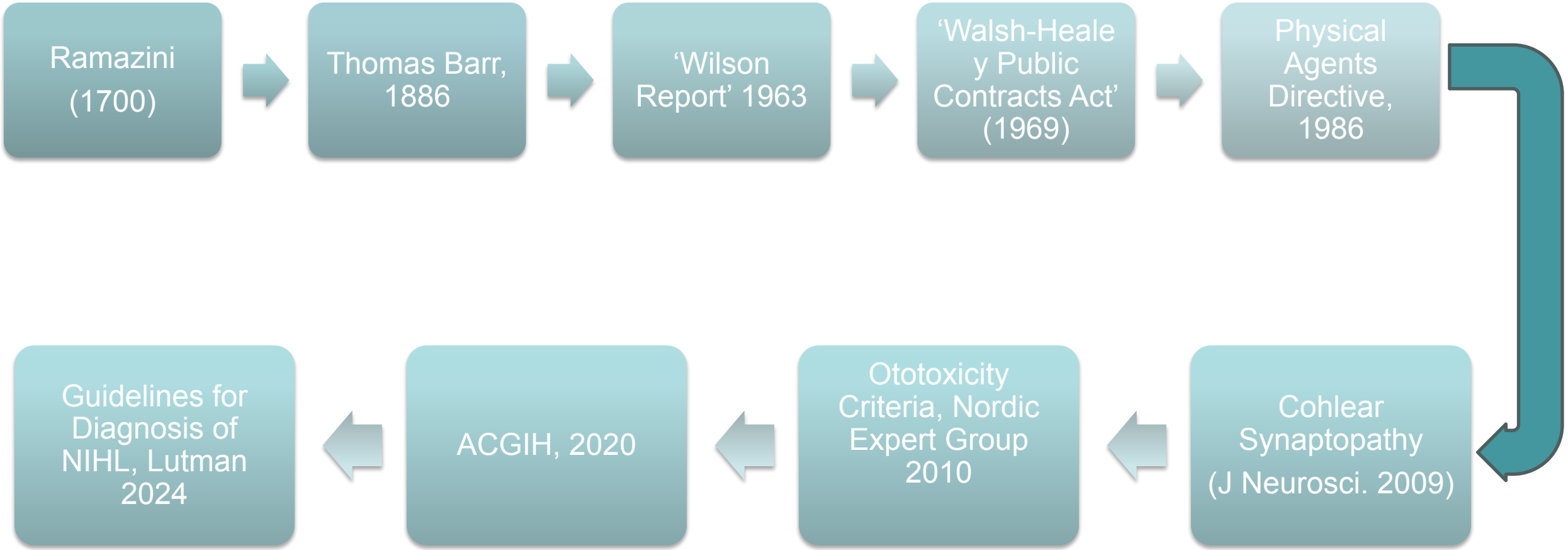
- 3M lawsuit is the largest mass tort in American history
- 250,000 US veterans won **$6 Billion** Settlement (March ‘24)
- UK Severe tinnitus and NIHL – £36,260 to £55,570 UK
  (Judicial College Guidelines, 2024)

Barry v Ministry of Defence

- Mr Barry claimed £1.5M & the MoD valued the claim at around £250,000
- March 2023 – Awarded £713,716

Some Basic Facts

- NIHL is complex but **entirely preventable**
- Preventing NIHL needs to be urgently prioritised
- Hearing protection is a last resort and is prone to failure
- Reducing NIHL requires commitment, cooperation & vigilance
- Despite decades of endeavour we are allowing or at least witnessing another generation suffer needlessly


Ramazini (1700)
Thomas Barr, 1886
'Wilson Report' 1963
'Walsh-Healey Public Contracts Act' (1969)
Physical Agents Directive, 1986
Cohlear Synaptopathy (J Neurosci. 2009)
Ototoxicity Criteria, Nordic Expert Group 2010
ACGIH, 2020
Guidelines for Diagnosis of NIHL, Lutman 2024

Future Trends

- Compensation claims will radially increase
- Preventing exposure & NIHL will be prioritised
- Noise control & enhanced hearing protection will be key
- Smart Protectors and regular training will be the norm
- Health surveillance will be improved & will include OAEs

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