

Workplace Health Expert Committee

The likely prevalence of occupational noise induced hearing loss across British industry

John Cherrie



7th November 2023

Summary...

- What HSE knows about occupational noise induced hearing loss (NIHL)
- Noise, NIHL and the problems in assessing the prevalence of occupational NIHL
- Factors that may influence NIHL
- Estimates of NIHL prevalence from published research
- What can we say from the evidence we have reviewed?
- How should we estimate the prevalence of NIHL?



Current state of knowledge on NIHL

Labour Force Survey (self-reported data):

2018/19 to 2020/21 – **14,000** workers with new or long-standing NIHL [latest LFS figure 11,000]

Industrial Injuries Disablement Benefit:

2019 – **95** new awards for occupational deafness (c.f. 2010 – **195** awards) [2021 figure 10]
Bilateral loss > 50 dB & specified work

Medical Research Council (self-reported survey):

1997/98 – Prevalence estimate of **484,600** with hearing loss / tinnitus attributed to noise at work

Current state of knowledge on NIHL

Personal Injury Claims (ABI):

2014 - > **15,000** claims settled (c.f. 1994 – peak of **30,000** claims settled)

Volatility due to “claims farming”. Most claims (< £25k) made through portal since 2013

Clinical Reporting Schemes (OPRA & OSSA):

1998 to 2006 – **4,774** reports of work-related hearing loss / tinnitus

Estimated incidence. OPRA – 7.9 / 100,000 employees. OSSA – 0.8 / 100,000 employees

OPRA rate dropped for 2012 to 2021 (OSSA ceased in 2006)

Highest incidence in older males working in public administration, defence and metal manufacture

Causes of hearing loss

Age related (Presbycusis):

Extremely common – affects > 25% of people over age 60 (most over 90).

Genetic differences - sex and race.

Bilateral and predominantly high frequency. Deterioration of hair cells and nerve fibres of inner ear.

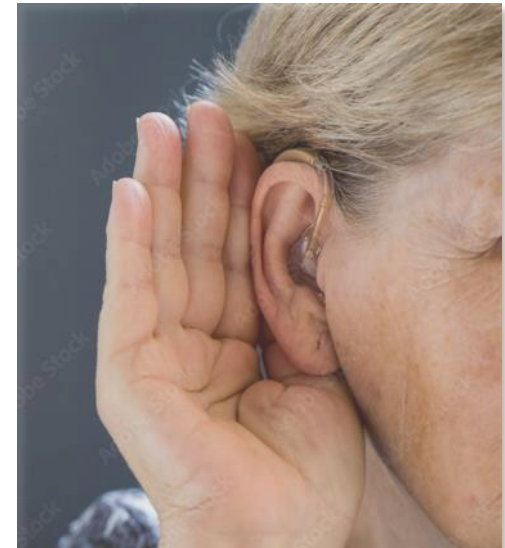
Difficulty in speech discrimination – consonants are higher in pitch.

Illness: Including infections, otosclerosis and Meniere's disease

Medication: Some antibiotics, pain killers and cancer drugs

Ototoxic chemicals: Including some solvents, metals and pesticides

Trauma & tumours: Head injury, ruptured eardrum, barotrauma and acoustic neuroma



Audiometry

Audiometry measures hearing loss not just occupational noise induced hearing loss

Noise induced hearing loss may be due to workplace noise and/or non-occupational noise

Presbycusis affects particularly high frequencies and a mixed picture is common



Noise induced hearing loss

Impulse noise:

Exposure to very high sound level for short period (e.g. explosion)
Rupture of eardrum or damage to bones of middle ear

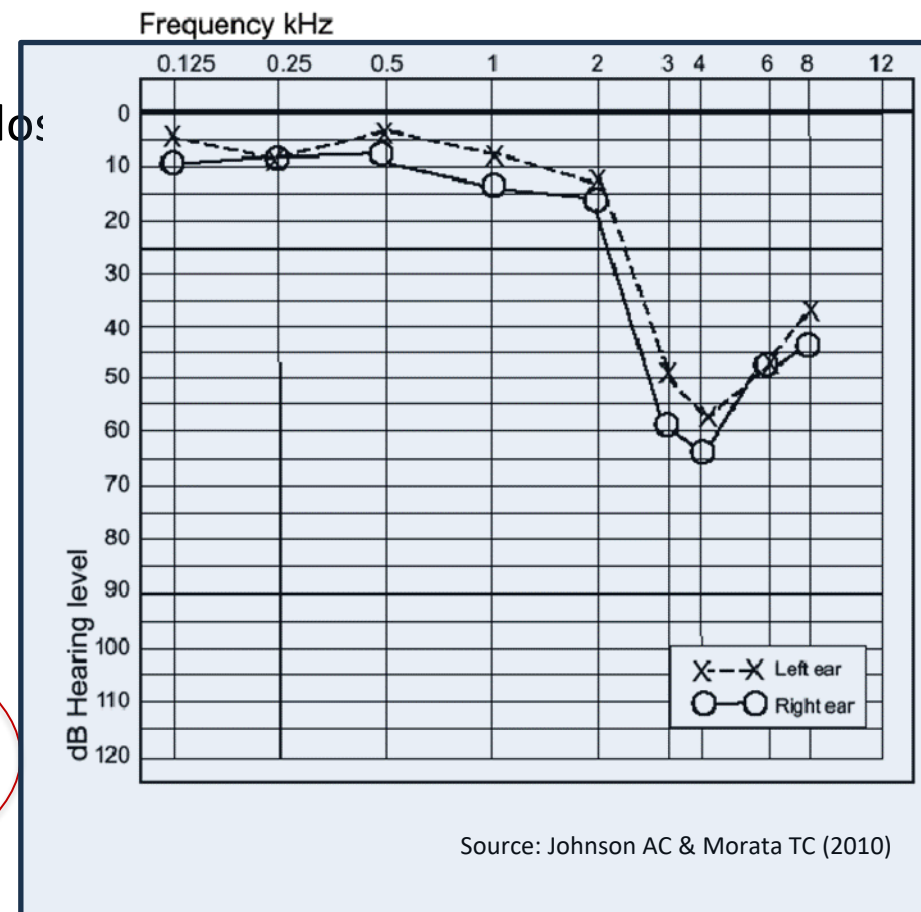
Repeated noise exposure:

Damage and eventual death of hair cells in the inner ear

Temporary threshold shift:

Hearing loss after short term exposure which recovers

Sensorineural deafness
Usually bilateral
Characteristic 4 kHz “notch”



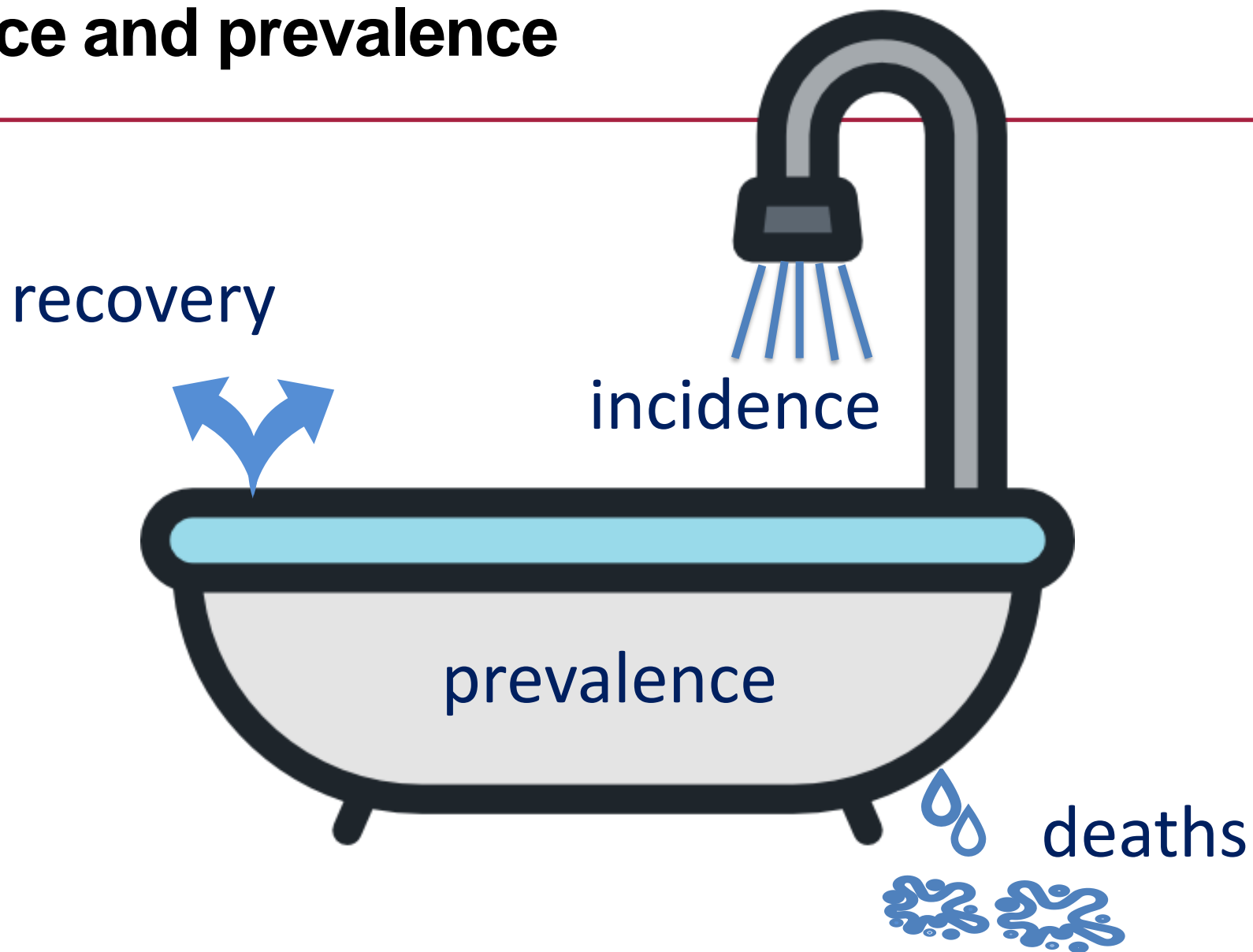
What was the question to WHEC?

HSE want to understand the likely prevalence of occupational NIHL across British industry, both currently and in the future, by industry group and job title.

Also, why is there variation between industries and job groups?



Incidence and prevalence



Noise

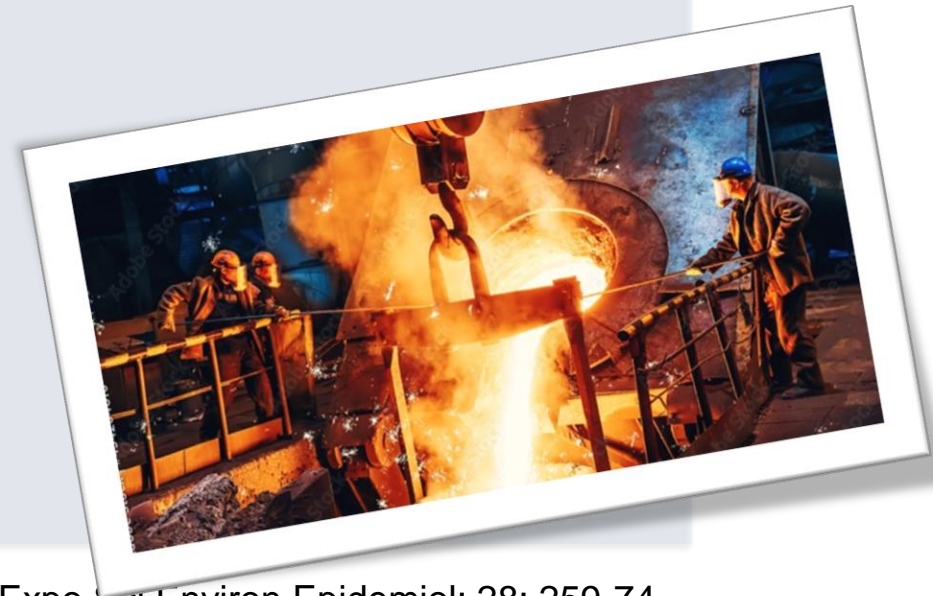
Occupational and non-occupational sources

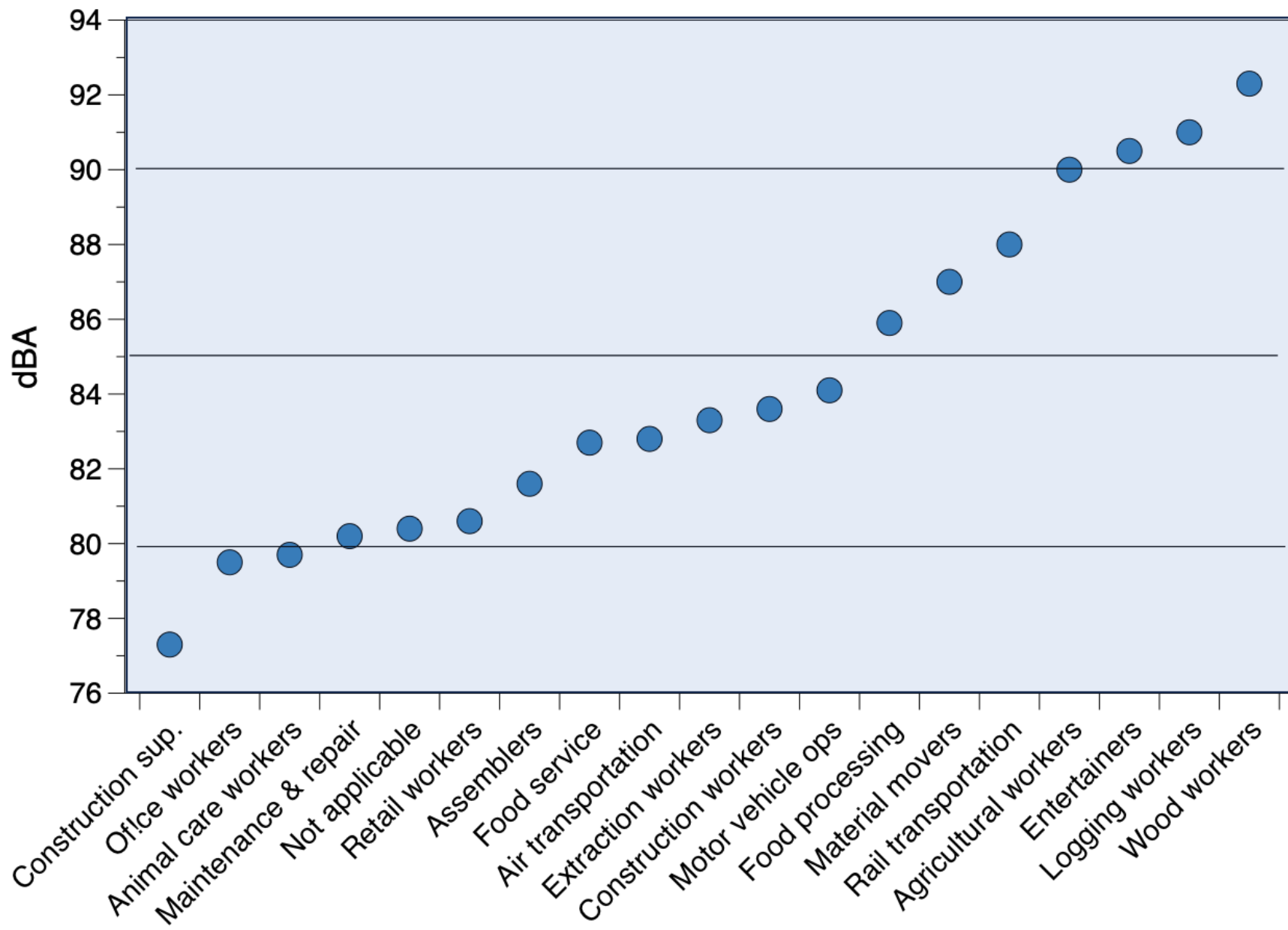
Intensity (dBA), frequency (Hz) and the duration (impulsive sound) characterise the noise, plus years of exposure

Cheng and colleagues analysed 715,867 measurements across 259 occupations from the USA

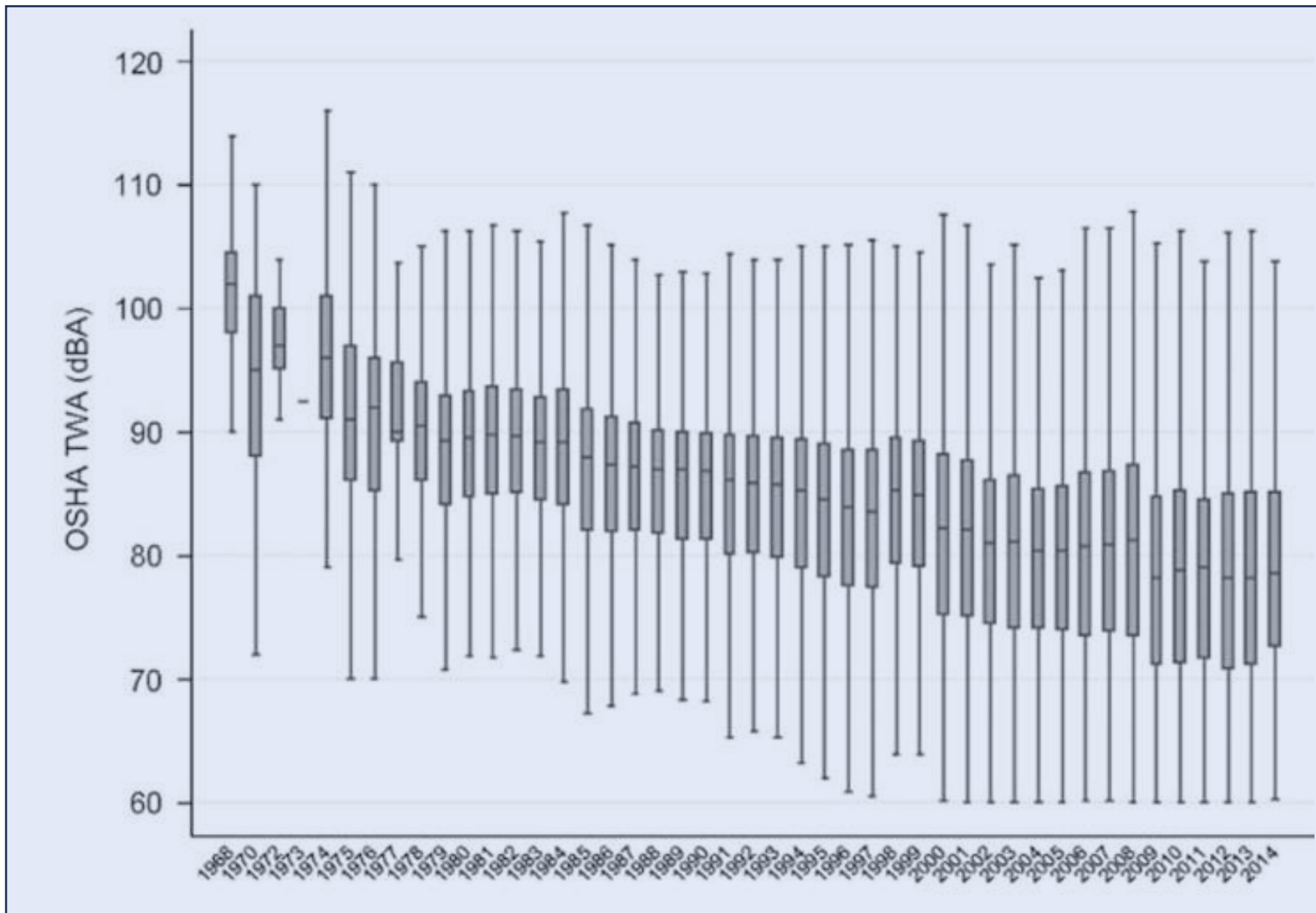
Most occupations (63%) had moderate to high heterogeneity

Around half of occupations had estimated mean exposure > 85 dBA





Estimated
mean
exposure for
USA industry
data from
Cheng et al

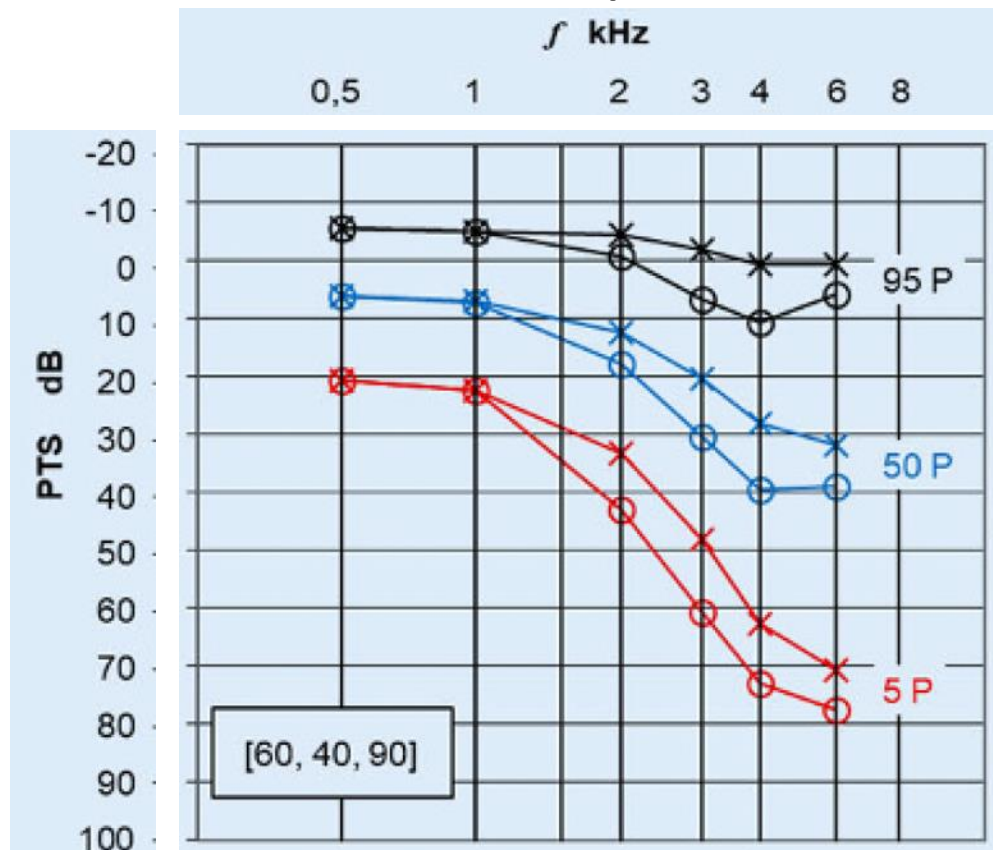


Data from
Cheng et al

On average
they found
noise exposure
decreased by
0.3 dBA each
year

Noise causes hearing loss

The relationship has been characterised in ISO 1999



Data for men, aged 60 years, with 40 years exposure to 90dBA.

95th, 50th and 5th percentiles

x = age-related hearing threshold

o = age plus noise exposure

Michel O, Liedtke M. (2021) [ISO 1999:2013 part 1 : Revised probability model for calculating noise-induced hearing loss]. HNO; 69: 510-16.

Factors that may influence hearing loss prevalence

1. Factors that influence the noise exposure of workers, e.g. more effective control of noise at work
2. Co-exposures that may modify the effect of noise, e.g. cigarette smoking
3. Nonoccupational factors may influence hearing loss in the working population, e.g. recreational noise exposure



Occupational factors that may affect changes in the prevalence of NIHL in the workforce

Factor	Description	Change in prevalence
Noise control measures	Introduction of noise control measures, in part driven by noise legislation	↓
New machinery	Introduction of new quiet machinery	↓
Hearing protectors	Greater use of hearing protection, in part driven by noise legislation	↓
Employment trends	Reduction the number of workers in traditional noisy industries – 90% of workers now employed in the service sector	↓
Employment trends	Fewer people with a history of military service and consequential exposure to gunfire / explosions	↓
Employment trends	More older people in the workforce – longer exposure to noise	↑
Employment trends	More people employed in call centres or using headsets	↑
Impulsive noise	Changes in the prevalence of impulsive noise – old noisy industry being replaced by service sector jobs	↓
Acoustic shock	Acoustic shock from wearing headsets, although modern headsets have noise limiting technology	?
Ototoxic chemicals	Exposure to ototoxic chemicals at work – exposure to most chemicals has decreased substantially over the last 40 years	↓
Cigarette smoking	Decrease in smoking prevalence in the population, particularly smoking at work	↓

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What research has been undertaken into NIHL

Lie et al. (2016) conducted a systematic review of occupational NIHL

- most studies were of poor quality
- concluded noise caused between 7 and 21 % of the hearing loss among workers

US NIOSH describe the prevalence of hearing loss in various sectors of US industry

- only audiometry (25 dB or more in either ear)
- 27% hearing loss in the mining & quarrying to 8.2% for couriers and messengers

Wallhagen et al. (1997) changes in prevalence of hearing loss for 5,108 persons 50 years and older (30-year follow-up)

- self-reported hearing impairment linked to noisy work



Global Burden of Disease

GBD provides estimates of disease burden for a range of risk factors, including hearing loss

In the USA it was estimated that occupational noise exposure caused 11% of hearing loss Years Living with Disease (YLDs).

The UK GBD data is available available at...

<https://vizhub.healthdata.org/gbd-compare/>

Single | Explore | Compare ▾

Settings Use advanced settings

Display Cause | Risk

Risk Occupational noise

Measure Deaths | YLDs | DALYs

Location United Kingdom

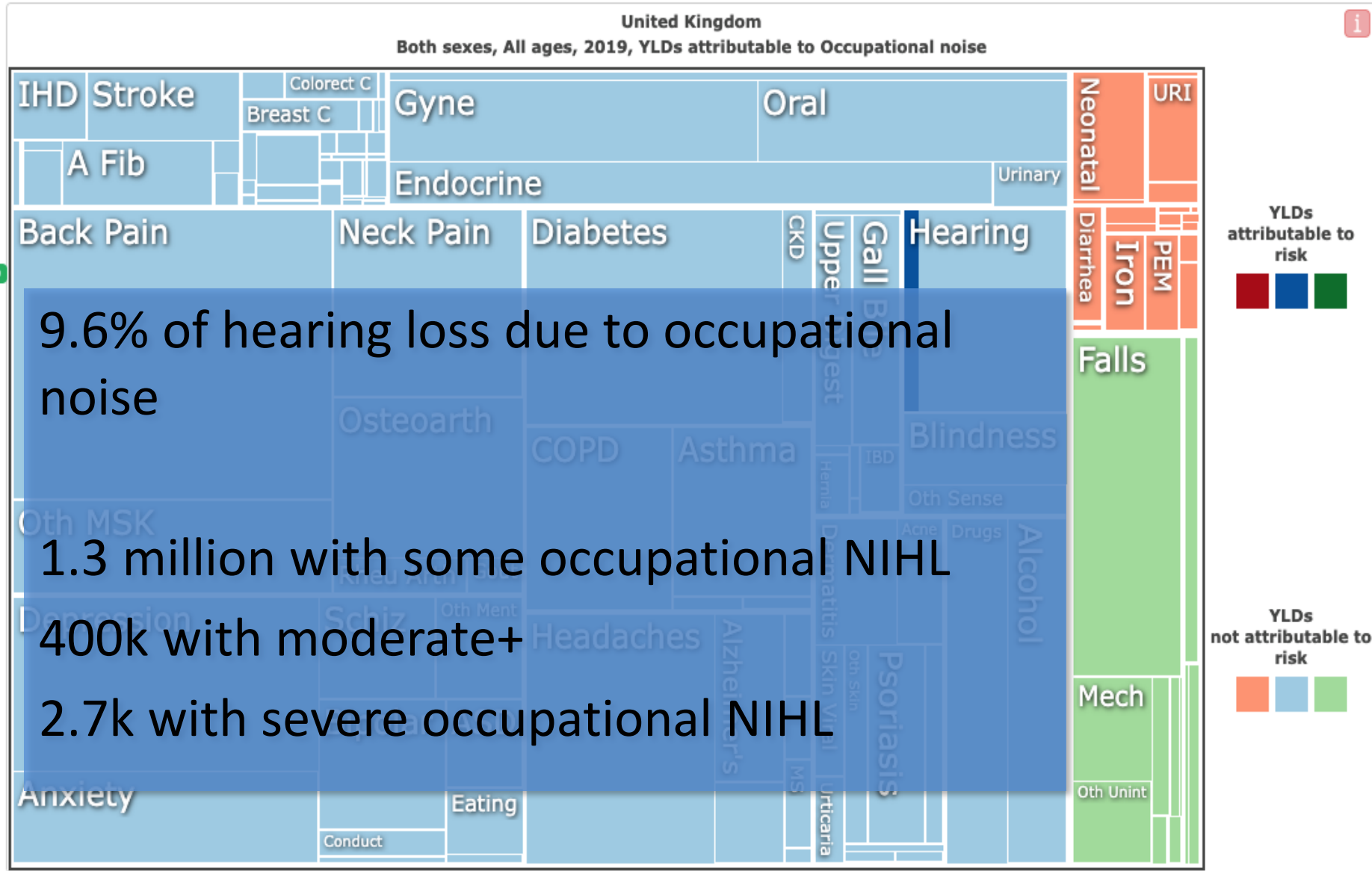
Year

Age All | <5 | 5-14
15-49 | 50-69 | 70+

Sex Male | Female | Both

Take tour ▶

IHME



What can we conclude from this?


Most studies are not directly relevant to British industry

Mostly they are not designed to assess NIHL

They are generally poor quality and it is often difficult to separate occupational NIHL from other causes of hearing loss

Around a fifth of the British working population is probably exposed to high noise levels (>85 dBA) and the prevalence of occupational NIHL is most likely much less than 10%

Prevalence of occupational NIHL has probably decreased over the last forty years



How could HSE estimate the prevalence of NIHL?

WHEC recommended modelling hearing loss and the occupational NIHL of the British population

- use the exposure-response relationship embodied in ISO 1999
- develop a noise JEMs to the British situation
- consider systematically collecting noise exposure data from industry
- Use data on the number of workers in different occupations from the Office for National Statistics (ONS)
- data on hearing loss amongst the British population, by sex and age

Conclusions

HSE do not have good data on the prevalence of occupational NIHL

There are no good published data that can fill this gap

Around a fifth of the British working population is probably exposed to high noise levels (>85 dBA)

The prevalence of occupational NIHL is most likely much less than 10%

The most likely affected groups of workers are those who have been employed in the armed services, shipyards, construction and agriculture

Prevalence of occupational NIHL could be estimated in a modelling study



Questions...

For more information about WHEC and to access their reports go to the WHEC page on the HSE website

<https://www.hse.gov.uk/research/workplace-health-expert-committee.htm>