Section A: CPHE to complete	
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Guidance title:	Dementia, disability and frailty in later life – mid-life approaches to prevention
Committee:	PHAC D
Subject of expert testimony:	Hearing loss
Evidence gaps or uncertainties:	Please address the research questions or uncertainties below
The association between hearing loss and the development of dementia, other chronic non-communicable diseases, other disabilities and frailty	
Impact of hearing loss on the access and uptake of preventative behaviours and services	
Preventing hearing loss in mid-life	
Section B: Expert to complete	
Summary testimony:	[Please use the space below to summarise your testimony in 250 – 1000 words – continue over page if necessary]

1. Background

Causes of age-related hearing loss

Age-related hearing loss results from impairment in cochlear transduction (converting the mechanical energy of sound into neural signals). Damage to this process arises from impairments to the inner and outer hair cells in the cochlea, the stria vascularis and afferent neurons. Injury from multiple pathways (e.g. age-related cell losses within the stria, oxidative stress from noise exposure, toxicity from aminoglycosides or other ototoxic medication, genetic polymorphisms leading to inefficient oxidative pathways or dysfunctional supporting cells, poor cellular repair mechanisms associated with age, or hypertensive miscrovascular disease in the stria vessels) (Lin 2012, Medicine(Baltimore)).

Prevalence

Hearing loss affects 1 in 6 of the UK population (10 million people), and with the increasing ageing society is set to affect 14.1 million by 2030, affecting 14.8% of the population (Action on Hearing Loss 2011, Hearing Matters).

Disease burden

Hearing loss is currently estimated to be the 13th most common disease burden worldwide. By 2031, 14.5 million people in the UK will have hearing loss (Action on Hearing Loss 2011, Hearing Matters) and the World Health Organisation predict that by 2030 adult onset hearing will be the 7th leading disease burdens in the UK, above

diabetes and HIV. Hearing loss is estimated to lead to loss in potential economic output to the UK economy of £24.8bn, rising to £38.6bn in 2030 (Greengross 2014, Commission on Hearing Loss: Final Report).

Research deficit

Although the effects are substantial to the individual, society and the economy, the research evidence on interventions is limited compared to other long-term conditions and treating hearing loss is not a priority for policy makers. For example in the UK funding for research into hearing loss was just £1.34 for every person affected. This compares to £14.21 for sight loss, £21.31 for diabetes, and £49.71 for cardiovascular research (Action on Hearing Loss 2011, Hearing Matters).

2. The association between hearing loss and the development of dementia, other chronic non-communicable diseases, other disabilities and frailty

Evidence shows that hearing loss is independently associated with poorer cognitive functioning, accelerated rates of brain atrophy as measured on MRI, greater cognitive decline and increased risk of developing dementia.

Epidemiological data from the US demonstrate hearing loss is independently associated with dementia. Cohort was older adults: mean age was 64 years old (range 30-90), median follow up was 11.9 years (Lin 2011, Arch Neurol).

From the same authors, hearing loss is independently associated with accelerated cognitive decline and incident cognitive impairment. Cohort was older adults: mean age was 77.4 years old (range 70-79), follow up was 6 years (Lin 2013, JAMA).

Cross-sectional epidemiological data from the UK demonstrate an association between ability to hear speech-in-noise and cognitive ability. Cohort was mid-life adults: mean age 56.5 years old (range 40-69) (Moore 2014, PLoS ONE). Among mid-life adults who do not seek help for their hearing loss, poorer speech-in-noise ability could be a first warning for an intervention need.

Hearing loss is seen by many people to be a communication disorder, but it may have much more wide-ranging consequences. It could increase the risk of falls and injuries, lead to increased functional limitation and subsequent disability, and reduce one's activity and participation, leading to decreased quality of life. These other consequences of hearing loss are not well investigated.

3. Impact of hearing loss on the access and uptake of preventative behaviours and services

Impact of hearing loss on other domains of health and functioning

Cross-sectional epidemiological data from the US examined if age-related hearing loss is associated with an objective metric for social isolation (adjustment for potential medical, demographic, and otologic confounders). Cohort was older adults: age range was 60-84 years (Mick 2014, Otolaryngol Head Neck Surg). Greater hearing loss was associated with increased odds of social isolation *only* in women aged 60 to 69 years (odds ratio = 3.49 per 25 dB of hearing loss).

There is no evidence for whether the use of hearing rehabilitative interventions could help mitigate cognitive decline and development of dementia. An NIH funded intervention study is currently underway in the US.

Treatment for hearing loss

An important consideration is whether the hearing loss is treated or untreated. Hearing loss is often overlooked in its early stages. Typically, those who are referred for hearing assessment recognise that they have had a hearing problem for around 10 years or more, are aged in their mid-seventies and have a substantial hearing problem (Davis 2007, Health Technology Assessment). Hearing aid adoption rate for those over age 74 is generally the highest and it declines with decreasing age (EuroTrak 2009).

Reasons for seeking treatment

Survey data (EuroTrak 2009) indicate that self-perception of hearing getting worse is a main reason, although many mid-life adults believe (incorrectly) that their hearing loss is too mild to benefit from hearing aids. Medical advice (ENTs/ear doctors and GPs/family doctors) also plays a key role in the decision process of getting hearing aids. Yet, of every 100 people with stated hearing loss, 39-45 do not get positive medical advice relative to hearing aids. In the UK, 47% of 55-74 year olds with hearing loss do not get onward GP referral (Davis 2007, Health Technology Assessment).

Benefits of treatment

Survey data (NCOA) indicate that benefits include QoL, mental well-being, physical and psychological functioning and social life.

There is some evidence in a group of 55–74 year olds that those identified *early* gain a greater benefit through additional years of use/better adaptation to use than those of the same age and hearing impairment who were fitted with hearing aids 10 years later (Davis 2007, Health Technology Assessment). The report highlighted a need to examine whether early intervention pays off over the longer term (e.g. more than 10 years after intervention).

4. Preventing hearing loss in mid-life

One of the main risk factors for hearing loss is environmental noise exposure. Noise damage to hearing is cumulative over the lifespan and so preventative behaviours should be adopted as early in life as possible.

A number of tips are provided by the NHS (http://www.nhs.uk/Conditions/Hearing-impairment/Pages/Prevention.aspx). These include positive health behaviours such as: i) d**on't have the television, radio or music on too loud.** This is particularly important with young children in the house because their ears are more sensitive, ii) u**se headphones that block out more outside noise**, rather turning up the volume, iii) u**se ear protection equipment such as ear muffs or ear plugs if working in a noisy environment**, iv) use ear protection at loud concerts and at other social and leisure events where there are high noise levels.

A European directive (2006) has established the minimal security level at the equivalent daily noise exposure limit to 80 dB(A) in the workplace. A report for the UK Health and Safety Executive (Lutman 2008, www.hse.gov.uk/research/rrpdf/rr669.pdf) found no evidence for lack of effectiveness of these noise at work regulations in a cohort of 18-25 year olds followed-up for 3 years. The only significant effects on hearing demonstrated in the occupational noise study were small effects of estimated social noise prior to the study, for example at nightclubs or from personal audio systems.

Outside the workplace, a high risk of hearing impairment arises from exposure to leisure noise. A 2008 report by the EU Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) identified the potential health risks of exposure to noise from personal music players. It is estimated that the numbers of young people with social noise exposure has tripled (to around 19%) since the early 1980s, whilst occupational noise has decreased. The scientific opinion indicated that 5-10% of personal music player listeners risk permanent hearing loss, if they listen to a personal music player for more than one hour per day each week at high volume settings for at least 5 years. Major discrepancies were identified between the results of existing studies on permanent noise induced hearing loss in personal music player users and the report recommended some further research questions.

Suggestions for prevention were: i) precautions that users can take, ii) technical solutions to minimise hearing damage and iii) the need for further regulations or revisions of existing safety standards to protect consumers.

References (if applicable):
References provided in the text.