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Listening Effort and Cognitive Decline: An Exploratory Study Using Pupillometry

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PhD: Listen Care-fully: Healthcare Design on Listening Effort and Cognitive Function
Project period: 2019 March – 2022 February

Background

- Around 50 million people have dementia worldwide with nearly 10 million new cases every year.
- Hearing impairment accounts for 9% of the predictive power of all risk factors associated with the development of dementia.
- Hearing loss is proposed as a potentially modifiable risk factor for dementia in midlife.
- Even mild levels of hearing loss increase the long-term risk of cognitive decline and dementia in individuals who are cognitively intact but hearing impaired at baseline.
- The mechanism underlying cognitive decline associated with peripheral hearing loss is not fully clear.
- Research suggests a potential pathway between hearing and cognitive decline, with listening effort, working memory and cognitive load as principal mediators.

Why measure listening effort?

A growing amount of research is using pupillometry to examine listening effort and indicate the availability or demand on cognitive resources during processing. Results of effortful listening suggest that these difficulties are about more than sounds being too quiet or non-audible. These individuals may need to allocate more cognitive capacity to comprehend, remember and respond to auditory information. The pupil diameter enlarges with this increased mental effort and reflects the processing demands associated with the task in relation to available cognitive resources.

Objectives

- Determine whether increased listening effort is associated with cognitive function
- Investigate the feasibility of integrating listening effort technology as a predictive tool at point-of-care in dementia and hearing care settings

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What is the intervention?

Subjects

- Two groups of healthy, middle-aged and older individuals (1: aged 60-80, 2: aged 40-60)
- One group of older individuals (aged 60-80) with Mild Cognitive Impairment (MCI)

Eligibility

- Pure Tone Audiometry (PTA), age-matched, to rule out significant hearing loss
- Based on the broad Winblad criteria, control participants have a Mini-Mental State Examination (MMSE) score of 28 or higher

Study 1: Clinical research

- Speech intelligibility and pupil dilation will be measured during a Hearing in Noise test (HINT).
- Cognitive function will be measured using a battery of attentional and memory-based cognitive tests.
- Those who demonstrate high levels of listening effort in noise will be fitted with hearing aids and re-tested on cognitive performance after 3 months of use

Study 2: Integrative care research

- Could basic audiological testing be integrated in the management of cognitive impairment?
- Prototyping the integration of listening effort testing with dementia care professionals
- Investigating the impact on the patient journey, and factors such as training, costs and usability

References