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Listening Effort and Cognitive Decline: An Exploratory Study Using Pupilometry

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PhD: Listen Carefully: 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. Reports 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

Study 1 – Clinical research

Subjects

• 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

Eligibility criteria: Aged 60-80, no cognitive impairment (MMSE score of 28 or higher), no significant hearing loss, no other severe medical conditions.

What is the intervention?

• Speech intelligibility and pupil dilation will be measured during a Hearing in Noise test (HINT).

Study 2: Integrative care research

What is the intervention?

• Could basic audiological testing be integrated in the management of cognitive impairment?
• Can the use of hearing aids reduce listening effort, and would this translate to improved performance on cognitive tests?
• Is there an association between listening-effort, assessed by pupillometry, and cognitive function?
• Investigating the impact on the patient journey, and factors such as training, costs and usability

Collaborating partners

Cachet Center for Health Technology

Engineering Systems
Department of Management

References