

# Linguists detect early signs of dementia by studying the natural speech of seniors

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A study led by linguists from the Department of English, Linguistics and Theater Studies (ELTS) at the NUS Faculty of Arts and Social Sciences (FASS) has found that early linguistic signs of dementia can be detected

through the study of the natural speech of senior Singaporeans.

The study was published in the journal [\*Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring\*](#) on 18 April.

This groundbreaking study, conducted together with researchers from the NUS Yong Loo Lin School of Medicine (NUS Medicine), compared the natural speech of cognitively healthy persons with those suffering from [mild cognitive impairment](#) (MCI) to detect linguistic markers of dementia.

It revealed that those with memory-related MCI spoke less and produced fewer, but more abstract, nouns—a speech pattern that is consistent with patients diagnosed with Alzheimer's disease, a specific type of dementia.

The study's principal investigator, NUS Department of ELTS Professor Bao Zhiming, noted that Singapore provides a unique environment for this research given the varied use of languages here, with four official languages and a blend of various dialects.

He added, "Previous studies had analyzed targeted and smaller volumes of language data through word-based fluency tests, structured interviews and picture narrations. Our study has never been done before as it focused on unstructured and spontaneous speech that is easy to collect and analyze."

Team member, Yeo Boon Khim Mind Science Center (YBK MSC) Advisory Board Member and NUS Medicine's psychiatrist Emeritus Professor Kua Ee Heok, said, "There is an urgent need for innovative strategies to combat the rising rate of dementia in Singapore given our rapidly aging population.

"As research data for this study were taken from participants of a

broader YBK MSC research project known as the Community Health Intergenerational (CHI) Study, led by Dr. Rathi Mahendran, the findings will ultimately contribute to the CHI study's goal of identifying at-risk seniors and implementing interventions that can help the elderly age well."

## **Compiling and analyzing natural speech data**

The team obtained natural speech data from 148 elderly Singaporeans in their 60s and 70s—half of them were cognitively healthy (individuals who have the ability to think clearly, learn and remember) while the other half of the participants had MCI.

Out of the 74 subjects with MCI, 38 had been diagnosed with amnesic MCI (MCI that affects the memory) while 36 had been diagnosed with non-amnesic MCI (MCI that affects thinking skills other than memory).

Amnesic MCI carries a higher risk of conversion to Alzheimer's disease while non-amnesic MCI is linked to a higher risk of conversion to other types of dementia such as Lewy Body Dementia. Overall, an estimated 10 to 20% of people aged 65 or older with MCI go on to develop dementia.

Participants were instructed to speak about any topic in English for 20 minutes with minimal involvement from interviewers and these were recorded with simple digital voice recorders in an ordinary office setting. Topics varied freely and widely, ranging from work and retirement to family life and public affairs.

The recordings yielded 267,310 words which were then transcribed and then tagged as noun or verb using a Part-of-Speech tagger software. The team then calculated the per-minute word counts and concreteness scores of all tagged words.

## Early signs of dementia detected in people with amnesic MCI

Findings revealed that participants with amnesic MCI spoke less, produced fewer and more abstract nouns than people with non-amnesic MCI and the healthy controls. Verbs were not affected. A problem with imageability, which is the degree to which a word's meaning evokes a mental image, was detected in natural everyday speech by people with amnesic MCI.

Dr. Luwen Cao, also from the NUS Department of ELTS, said, "Our findings are a significant breakthrough as traditional diagnoses of [dementia](#) are done following a battery of neuropsychological and neurological tests. The study of natural speech to detect linguistic signs of early cognitive decline is a reliable, non-invasive and cost-effective tool that could possibly help medical practitioners in the early diagnosis, intervention and management of the progressive disease."

Moving forward, the team plans to work with the neurologists at the YBK MSC to devise language-based intervention strategies to address the language difficulties experienced by people with amnesic MCI.

Prof Bao said, "Ultimately, our research aims to contribute to healthy aging in Singapore. Singapore is aging fast; a quarter of Singaporeans are over 60 years old.

"By exploring innovative diagnostic tools and intervention strategies, we hope to improve the quality of life for older adults and reduce the burden on health care systems. Our work is one step towards ensuring that our aging population enjoy longer, healthier lives."

**More information:** Luwen Cao et al, Reversal of the concreteness effect can be detected in the natural speech of older adults with amnestic, but not non-amnestic, mild cognitive impairment, *Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring* (2024). DOI: [10.1002/dad2.12588](https://doi.org/10.1002/dad2.12588)

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