SCREENING AN ELDERLY HEARING IMPAIRED POPULATION FOR MILD COGNITIVE IMPAIRMENT (MCI) USING MMSE AND MOCA

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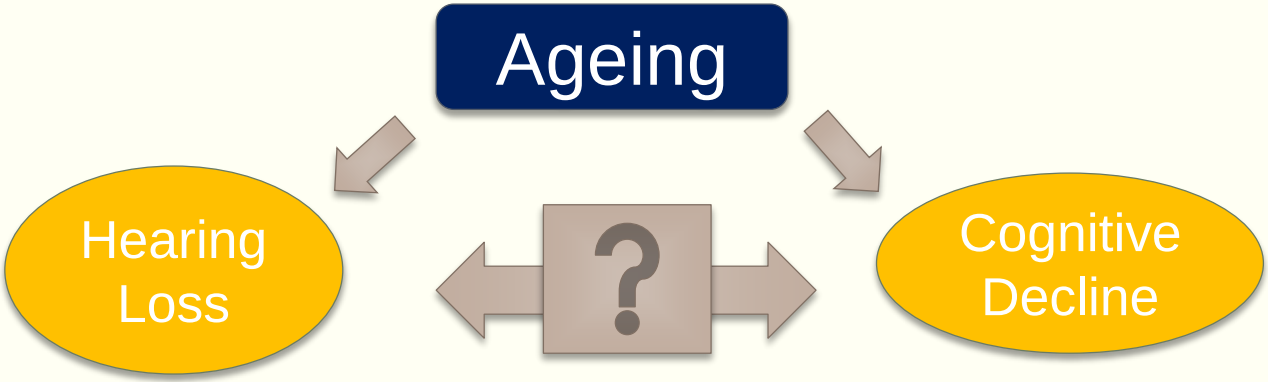
Co-investigator: Magdalene Lim
Principal Investigator: Dr. Jenny Loo

Background



Author	Year	Country	Findings
Uhlmann et al.	1989	USA	Preval… …higher… …patients…
F.R. Lin et al.	2011		…gnitive tests
F.R. Lin, Metter et al.	2011	USA	
F. R. Lin et al.	2013	USA	…ent cognitive impairment
M. Y. Lin et al.	2004	USA	Hearing… …nt was … …iated with cog… …or functional decline
Hong et al.	2016	Australia	HL not as…iated with subsequent cognitive decline

Evidence still controversial

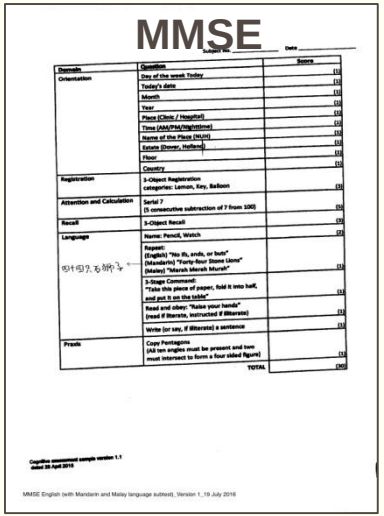
Background

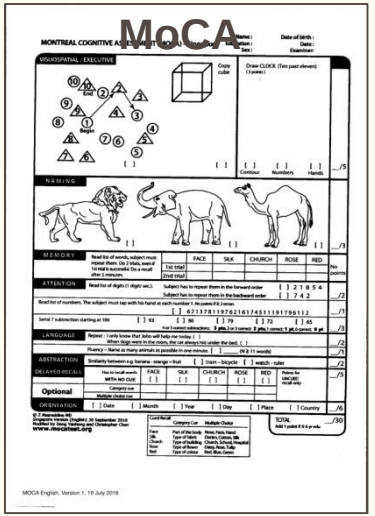
- Mild cognitive impairment (MCI)
  - Mild, reversible state of pathological cognitive decline
  - Predicts conversion to dementia
  - Suitable as a stage for early intervention

- Cognitive screening tests commonly used in clinics in Singapore
  - Mini-mental state examination (MMSE)
  - Montreal Cognitive Assessment (MoCA)
  - Both are verbally administered

    → would hearing affect scoring of items?

No study done in Singapore looking at association between HL and cognitive decline, and on the utility of commonly used cognitive screening tests in screening the elderly hearing impaired population.





Aims

1. To determine the prevalence of mild cognitive impairment (MCI) as measured by MMSE and MoCA in elderly patients referred for a hearing assessment in the NUH ENT clinic
2. To determine if there is an association between hearing loss and poorer cognitive scores
3. To determine if cognitive scores could be affected by poor hearing acuity

Hypothesis

- There is a high prevalence of MCI in the elderly population in the NUH ENT clinic as compared to previous locally published estimates.
- Hearing loss is associated with poorer cognitive scores, which could be partially contributed by poor hearing acuity.

Methodology

- Study population
  - 114 ENT outpatients aged 55 years and above
  - Singaporeans/PRs
  - English/ Mandarin speaking
  - No diagnosis of dementia
  - No experience in wearing HAs in at least the past 5 years
- Procedures

Average thresholds at 0.5, 1, 2, 4 kHz in better ear taken for analysis

- Locally adapted English/ Mandarin versions
- MCI cutoff MMSE: ≤ 25
  MOCA: ≤ 22
- No HAs/ALDs given to participants during testing

(values from Department of Psychological Medicine, NUH)

RESULTS & DISCUSSION

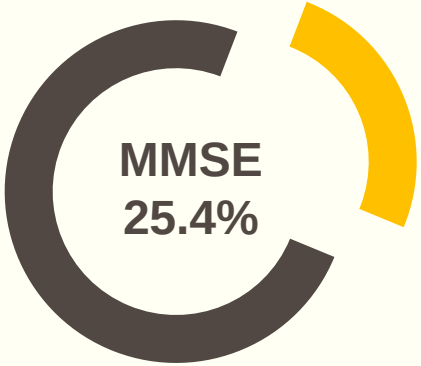
Hearing profile of the study population

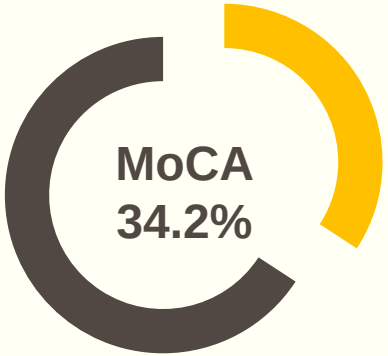
Hearing profile	
Hearing level, dB HL (mean ± SD)	37.4 ± 15.5
Hearing loss category in better ear (average thresholds at 0.5, 1, 2, 4 kHz), *n* (%)	
Normal (<25 dB HL)	28 (24.6)
Mild (26 – 40 dB HL)	44 (38.6)
Moderate (41 – 55 dB HL)	26 (22.8)
Moderately Severe (56 – 70 dB HL)	10 (8.8)
Severe (71 – 90 dB HL)	6 (5.3)

- Normal hearing status: n=28
- Hearing loss: n= 86
- Most participants with hearing loss had hearing levels in the mild-moderate range

Prevalence of MCI

Prevalence of MCI estimated from screen positive in

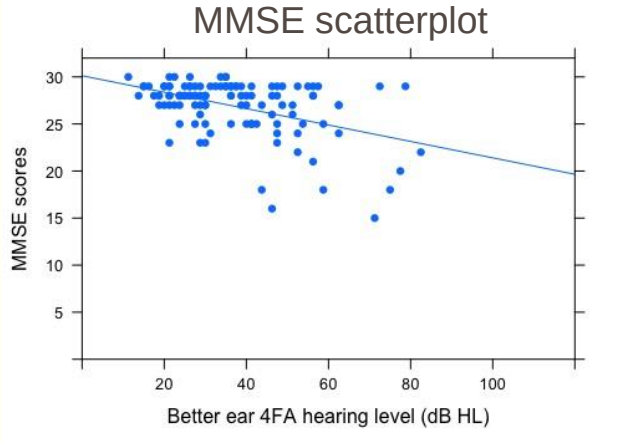


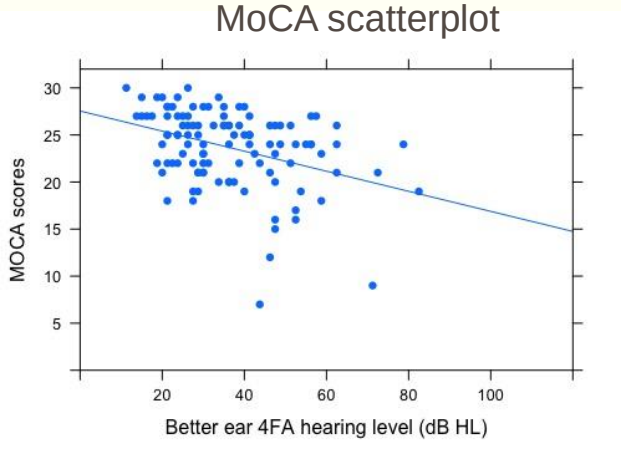


- Relatively high as compared to previous estimates in Singapore at 4.8% (Sachdev et al., 2015) and 17.2% (Ho et al., 2015)
  →Limitation: Unable to get diagnostic data from most participants in this study

- Differing prevalence estimates using MMSE and MoCA shows differing efficacies of both tests in screening for MCI
  → Consensus screen positive in only 17.1% of patients

Hearing loss is related to poorer cognitive scores





Poisson regression models (per 10dB hearing loss)

	Score Ratio (95% CI)	p-value
MMSE (adjusted for Age)	0.972 (0.948, 0.997)	0.029 *
MoCA (adjusted for Age)	0.965 (0.938, 0.993)	0.013 *

For every 10dB of hearing loss, cognitive scores tended to decrease by 2.8% for MMSE, and 3.5% for MoCA in Poisson regression models adjusted for age.

Analysis of hearing-sensitive components

Registration section
-Repeat a series of target words
(3 for MMSE, 5 for MoCA)

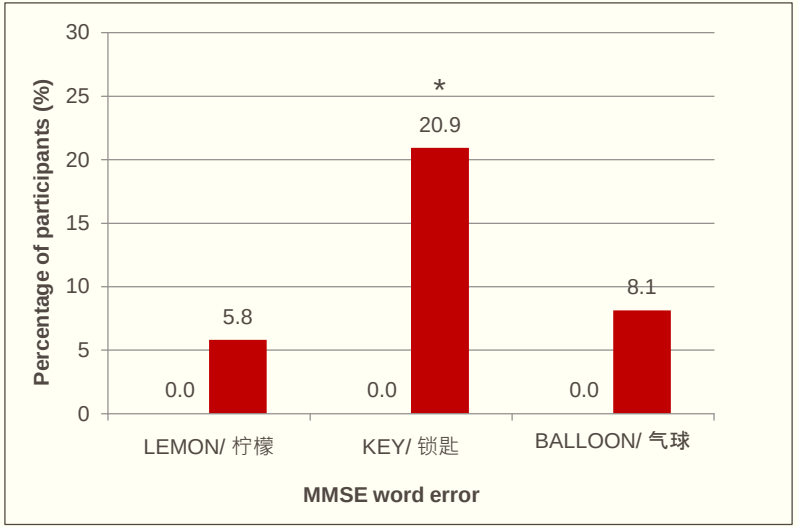
- Cognitive task: Working memory (+ learning trial for recall section)
- Hearing confounder: need to accurately hear words to repeat them, words read out for a set amount of times

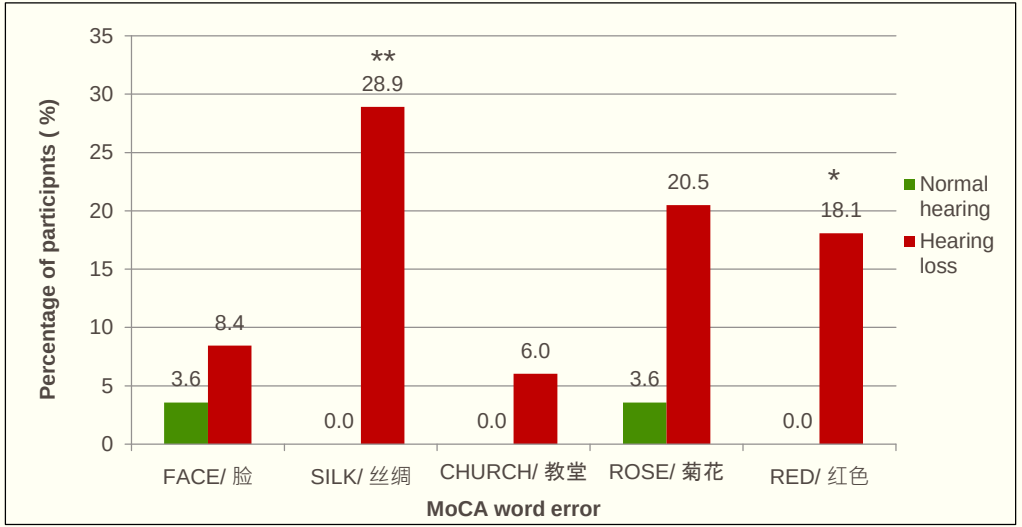
Series of interfering tasks
- eg. calculation, attention, language tasks

Recall section
- Recall target words heard in earlier registration section

- Cognitive task: (Short-term) memory recall task
- Hearing confounder: need to have heard words in Registration section to “recall” them

Registration Section





- Significantly more participants with HL wrongly registered the words “KEY”, “SILK”, and “RED” as compared to those with NH status

Registration section – Hearing effects

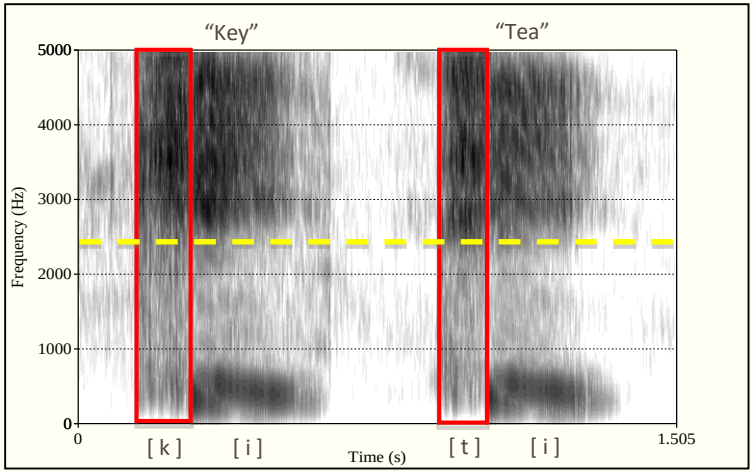
Breakdown of target words with high error rate by language

Word	Number of participants with word registration errors		
	English *n(%)*	Mandarin *n(%)*	Total *n*
KEY	14 (77.8)	4 (22.2)	18
SILK	7 (29.2)	17 (70.8)	24
RED	9 (60.0)	6 (40.0)	15

Commonly misheard words

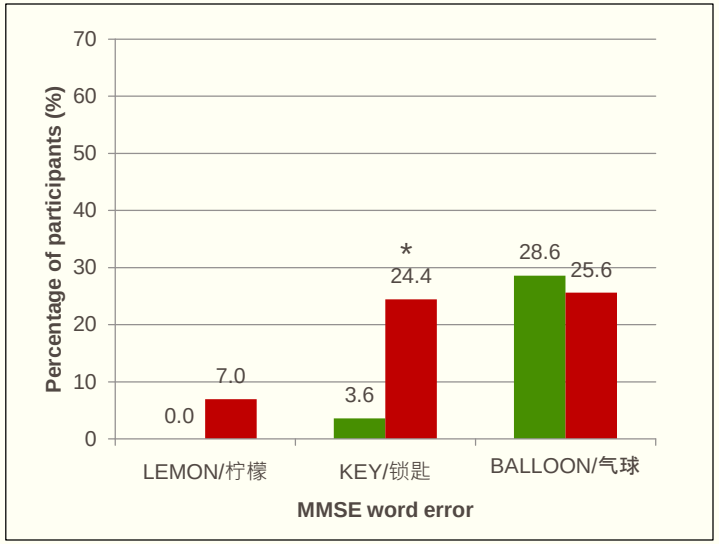
Original word	Substituted word
Key	Tea
Face	Faith
Silk	Silt
Rose	Road
Red	Weight
汽球	地球
丝绸	石头/狮子

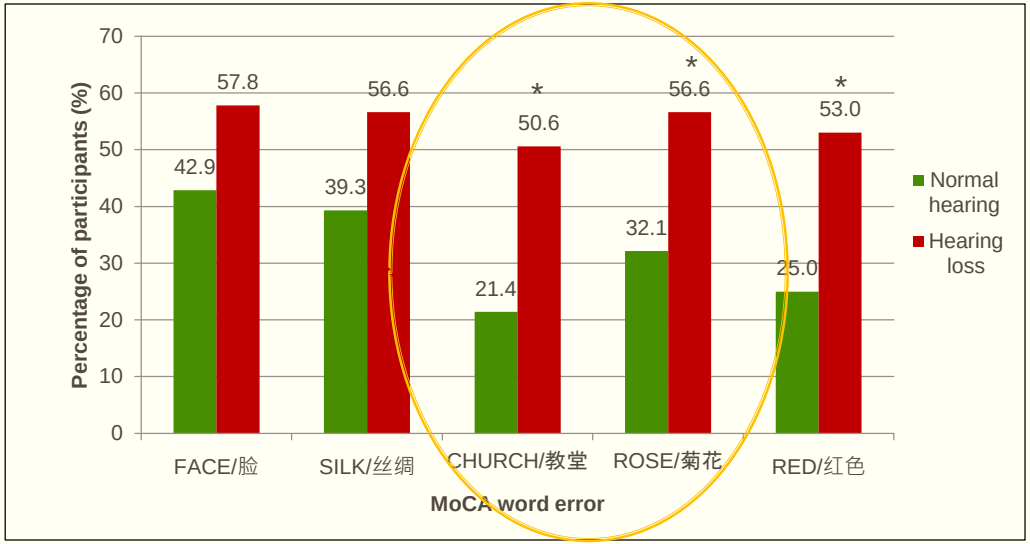
Spectrogram of words “Key” and “Tea”



- Most participants who wrongly registered “KEY” were those who took the tests in English→ most substituted it with English word “Tea”
- “Key” and “Tea” are minimal pair words only differing in their initial consonant /k/ and /t/ which are in the high fq range, commonly affected by presbycusis
- Substituted words are similar sounding to original word→ likely a hearing effect rather than cognition

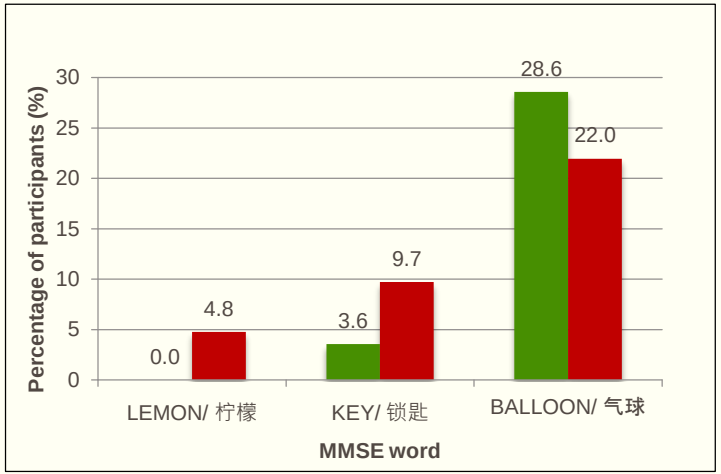
Recall Section

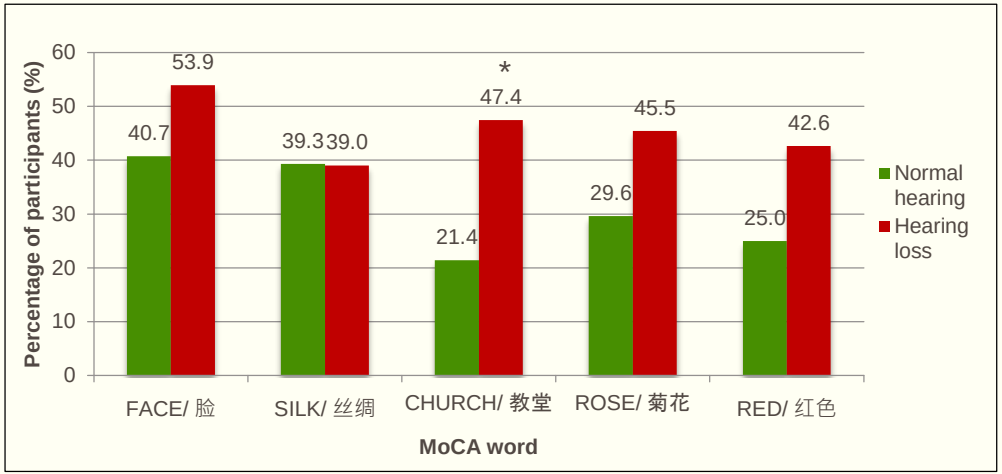




- Significantly more participants with HL had errors in delayed recall of words “KEY”, “CHURCH”, “ROSE”, “RED” as compared to those with NH status
- Hearing effects: Likely error carried forward from Registration section – “KEY”, “RED”
- Cognition effects: HL group had more errors in words “CHURCH” and “ROSE” despite not having significantly more difficulty in registration earlier

Recall given previous registration of target word





- Analysis of subgroup that had accurately registered target word in earlier registration section → removal of hearing effects
- Participants with HL still had significantly more difficulty in registering the word “CHURCH” →possible true deficit in cognition in those with HL

Conclusions

1. Estimated prevalence of MCI in the studied elderly hearing impaired population is higher than previous locally published estimates of MCI prevalence
2. Greater hearing loss is associated with poorer cognitive scores on MMSE and MoCA, likely attributable to:
   - Poor hearing acuity
   - Possible true deficit in cognition in the hearing impaired (Information Degradation Hypothesis)
3. Poor hearing acuity from hearing loss confounds cognitive scoring on MMSE and MoCA, as seen in the Registration and Recall sections.

Clinical Implications

- Provisions should be made to account for hearing impairment during cognitive testing in the elderly
  - Disabling HL affects approximately 1/3 of older persons aged ≥65 years (World Health Organisation, 2012)
  - Many of the elderly may not be aware of an existing hearing loss

    → 22.1% of those labeled with hearing loss in this study did not perceive they had any hearing problems

- Possible methods to account for hearing loss in cognitive screening
  - Simple screening for hearing loss before cognitive testing
  - Use of hearing aids (preferable), or assistive listening devices
  - Ensuring environment is optimal for communication
  - Use of modified testing or scoring methods in MMSE/MoCA (Dupuis et al., 2015)
  - Use of alternative, less auditory-intensive cognitive screening tools

Future Studies

- Future studies
  - Follow-up study on those who acquired hearing aids to see how cognitive scores change
  - Study using non-verbal cognitive tests
    - Eliminate hearing effects in cognitive testing (true cognitive difficulty in hearing impaired?)
    - Evaluate the utility of using such tests in a hearing-impaired population

Acknowledgements

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