# A Pilot Study to Investigate the Hearing Profile of Stroke Patients

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# Why hearing and strokes?

**26.5%** have at least a mild hearing loss in one ear!

(Division of Epidemiology & Disease control, 2010)

**11.9%** suffered from strokes in 2012

(C. S. Tan et al., 2015)

# Singapore Burden of Disease Study 2010

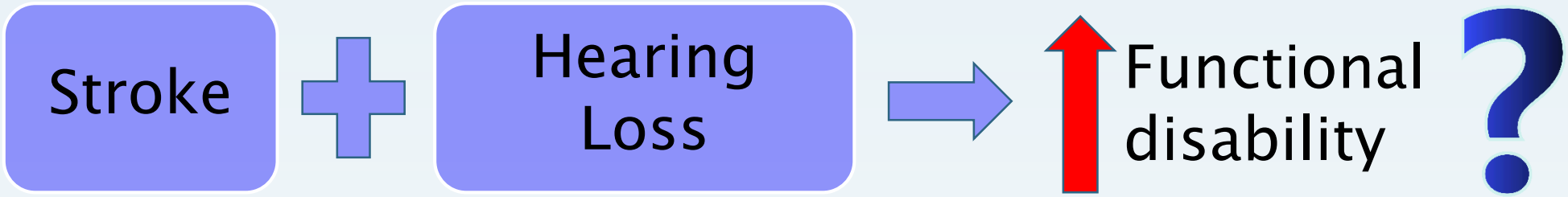
Disease burden

**Table 2.1**: Twenty leading specific causes of DALYs by sex, Singapore 2010

| Rank | Overall (DALYs = 399,675) | % of Total | Males (DALYs = 210,267) | % of Total | Females (DALYs = 189,408) | % of Total |
|---|---|---|---|---|---|---|
| 1 | Ischaemic heart disease | 10.4 | Ischaemic heart disease | 12.6 | Diabetes mellitus | 10.6 |
| 2 | Diabetes mellitus | 10.4 | Diabetes mellitus | 10.1 | Ischaemic heart disease | 8.0 |
| 3 | Stroke | 6.8 | Stroke | 7.4 | Stroke | 6.2 |
| 4 | Vision disorders | 4.4 | Lung cancer | 4.4 | Breast cancer | 5.8 |
| 5 | Alzheimer's & other dementias | 3.9 | Vision disorders | 4.0 | Vision disorders | 4.9 |
| 6 | Lung cancer | 3.4 | Chronic obstructive pulmonary disease | 3.2 | Alzheimer's & other dementias | 4.9 |
| 7 | Adult-onset hearing loss | 3.0 | Alzheimer's & other dementias | 2.9 | Rheumatoid arthritis | 3.3 |
| 8 | Lower respiratory tract infection | 2.8 | Colon & rectum cancer | 2.8 | Adult-onset hearing loss | 3.2 |
| 9 | Breast cancer | 2.7 | Adult-onset hearing loss | 2.7 | Lower respiratory tract infection | 3.0 |
| 10 | Schizophrenia | 2.7 | Lower respiratory tract infection | 2.7 | Schizophrenia | 2.9 |

DALYs: Disability-Adjusted Life Years

## Background




- Higher prevalence of hearing loss among stroke patients (Formby *et al.*, 1987)
- Stroke patients with hearing impairment are 1.83 times as likely to suffer from functional decline compared to controls (Landi *et al.*, 2006)

Yet, in Singapore…

Lack of locally relevant data on hearing and strokes

Evidence to implement hearing screening procedures for stroke patients

Identify and intervene for hearing impairment among stroke patients

# Hypotheses and Aims

**Primary**

High prevalence of hearing loss among stroke patients

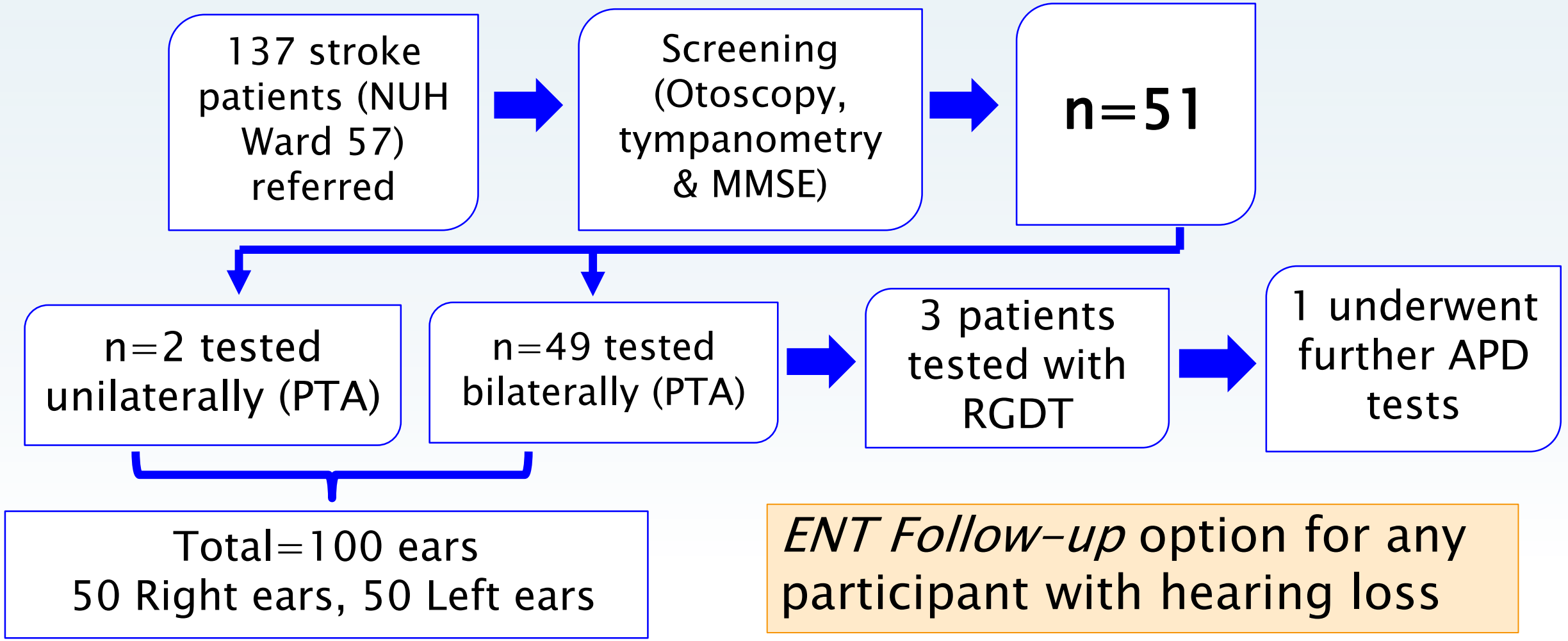
→ To determine the *peripheral hearing levels* of stroke patients

**Secondary**

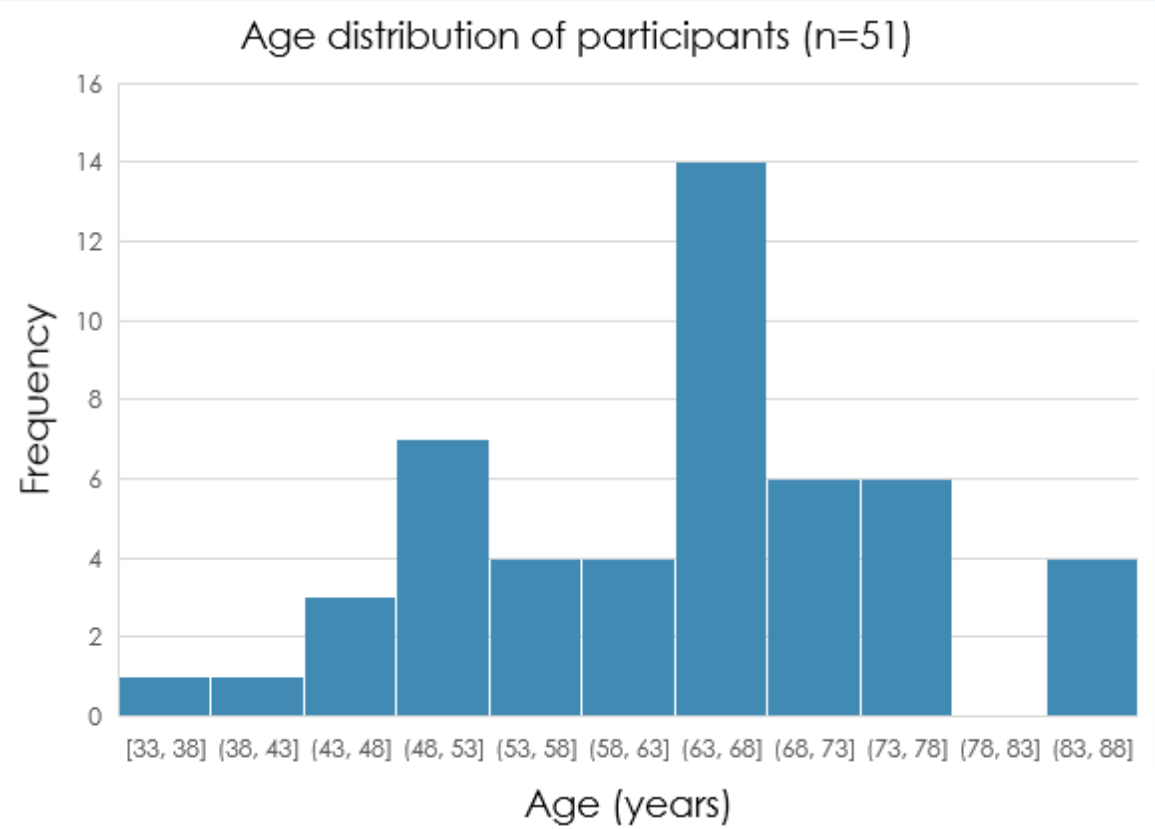
Auditory processing ability of stroke patients with normal hearing is affected

→ To determine the *Auditory Processing ability* of stroke patients with normal hearing

# Methodology

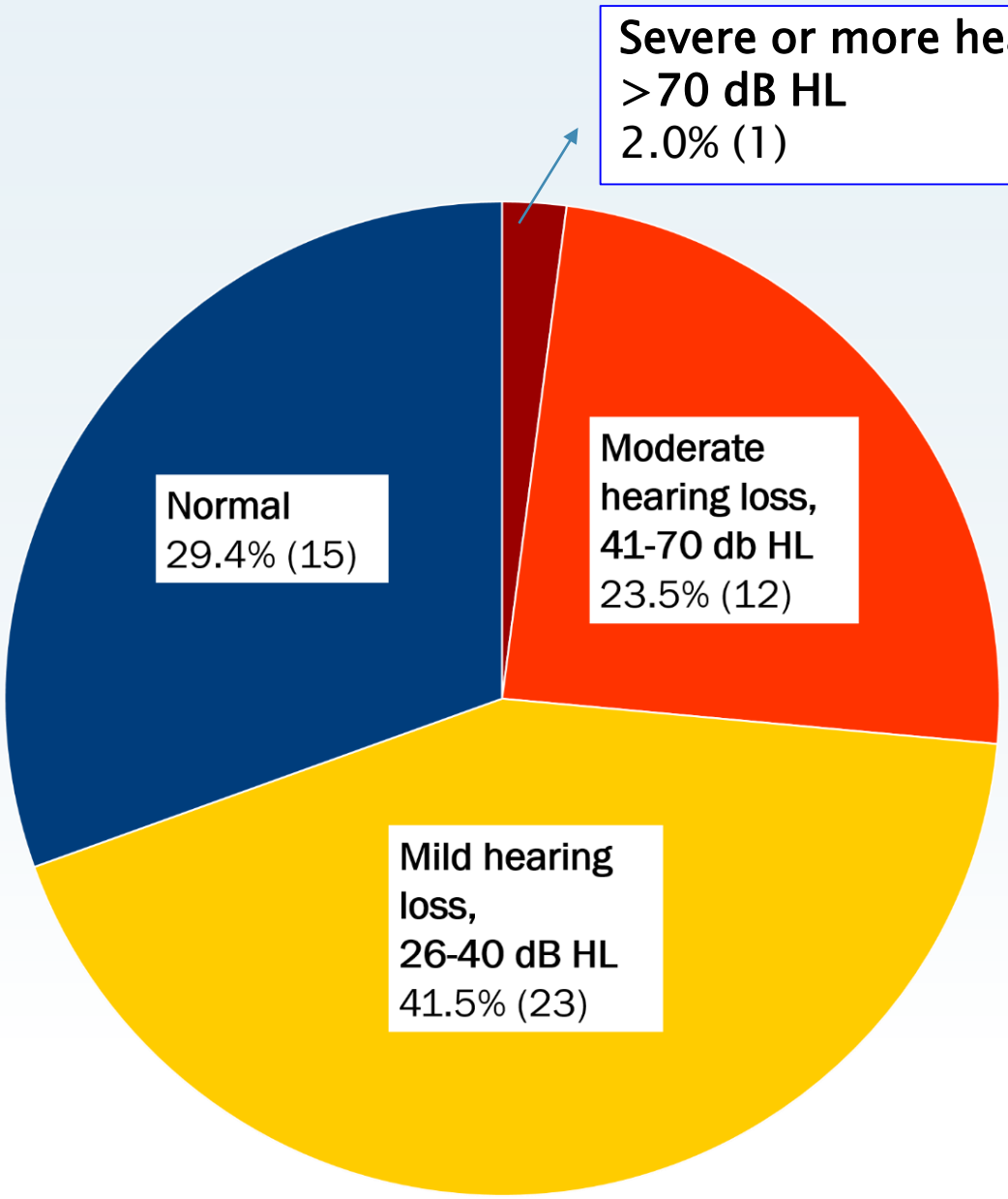


# Participants




- Age range=33 to 86 years old
- Mean age (SD)=63.6 (12.0)
- 38 Males (74.5%)
  13 Females (25.5%)

# Results (1)–PTA



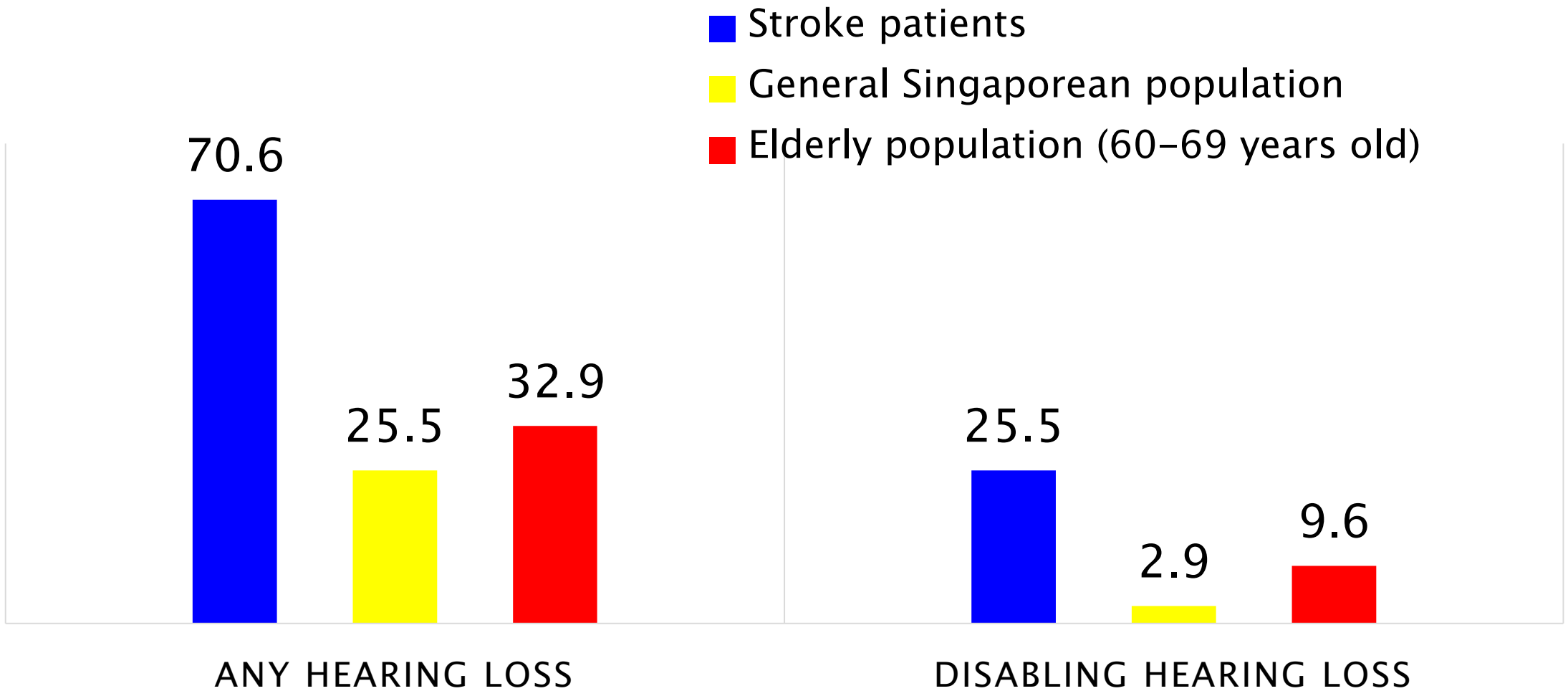

* Classification of hearing loss: Pure tone audiogram average of 0.5, 1, 2, and 4 kHz in better ear

- 70.6% (36) of participants with at least a mild hearing loss
- 25.5% (13) of participants with disabling hearing loss
- 2 wearing hearing aids

**Figure 1.** Peripheral hearing levels of stroke patients.

# Discussion (1)–PTA

## Comparison with general Singaporean and Elderly groups




(Epidemiology & Disease Control Division, Ministry of Health, 2010)

# Results (2)–APD tests

- RGDT: Results within normal limits for 3 patients
- 1 went for further APD tests
  - Deficits in binaural integration and separation (Right ear)

**Table 1.** APD test results for participant 016

| **Test** | **Skill assessed** | **Results (% correct)** | | **P-value**[1] |
|---|---|---|---|---|
| | | Right | Left | |
| **Dichotic Digits** | Binaural integration | 57.5 | 92.5 | <0.001 |
| **Competing Sentences** | Binaural separation | 20 | 97.5 | <0.001 |
| **Frequency patterns** | Temporal patterning | 100 | 100 | – |

# Discussion (2)– APD tests

- Patient complained of unclear speech on the right ear
- Dichotic speech test results suggest damage to the left auditory area

(Niccum & Rubens, 1983; Tervaniemi & Hugdahl, 2003)

- Left Middle Cerebral Artery (MCA) stroke
- BUT, normal results bilaterally on frequency pattern test and random gap detection test:
  - Suggest that both brain hemispheres are unaffected by stroke
- Postulated that higher order auditory attention affected by stroke resulting in right spatial neglect

(Blini et al., 2016)

# Results (3)- ENT follow-up

- 23 out of 46 participants identified with any hearing loss declined ENT follow-up

- Main reason:

> *"I do not find hearing loss an issue."*

# Discussion (3)- ENT follow-up

- Other reasons given:
  - ‘Mild hearing loss.’
  - ‘Would like to focus on other health problems’

- Possibly due to poor awareness of hearing loss among patients and attending doctors

(Milstein and Weinstein, 2002; Chou, Dana, Bougatsos, Fleming, & Beil, 2011; Matthews, 2014)

# Limitations & Future work

- Small sample size especially for APD testing
  - Cautious interpretation of results
  - **Future work**: Focus on AP in stroke patients

- Only acute stroke patients included
  - Cannot generalize results to chronic stroke patients
  - **Future work**: Study recruiting chronic stroke patients

# Please remember…

Stroke patients can have hearing loss and many of them do

Even with normal hearing, auditory processing ability may be affected

# Recommendations

- Healthcare providers need to be mindful of hearing impairment as an issue in patients
  - Can use personal sound amplifiers to ensure better communication
- Need to increase awareness of hearing impairment among patients and doctors
  - Public outreach events
  - Workshops for doctors

# Acknowledgements

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**Collaborator**: Dr Raymond Seet

**Faculty members**: Edmund Choo, Sebastian Ser

All my classmates ☺

# The End ☺
# Thank you!

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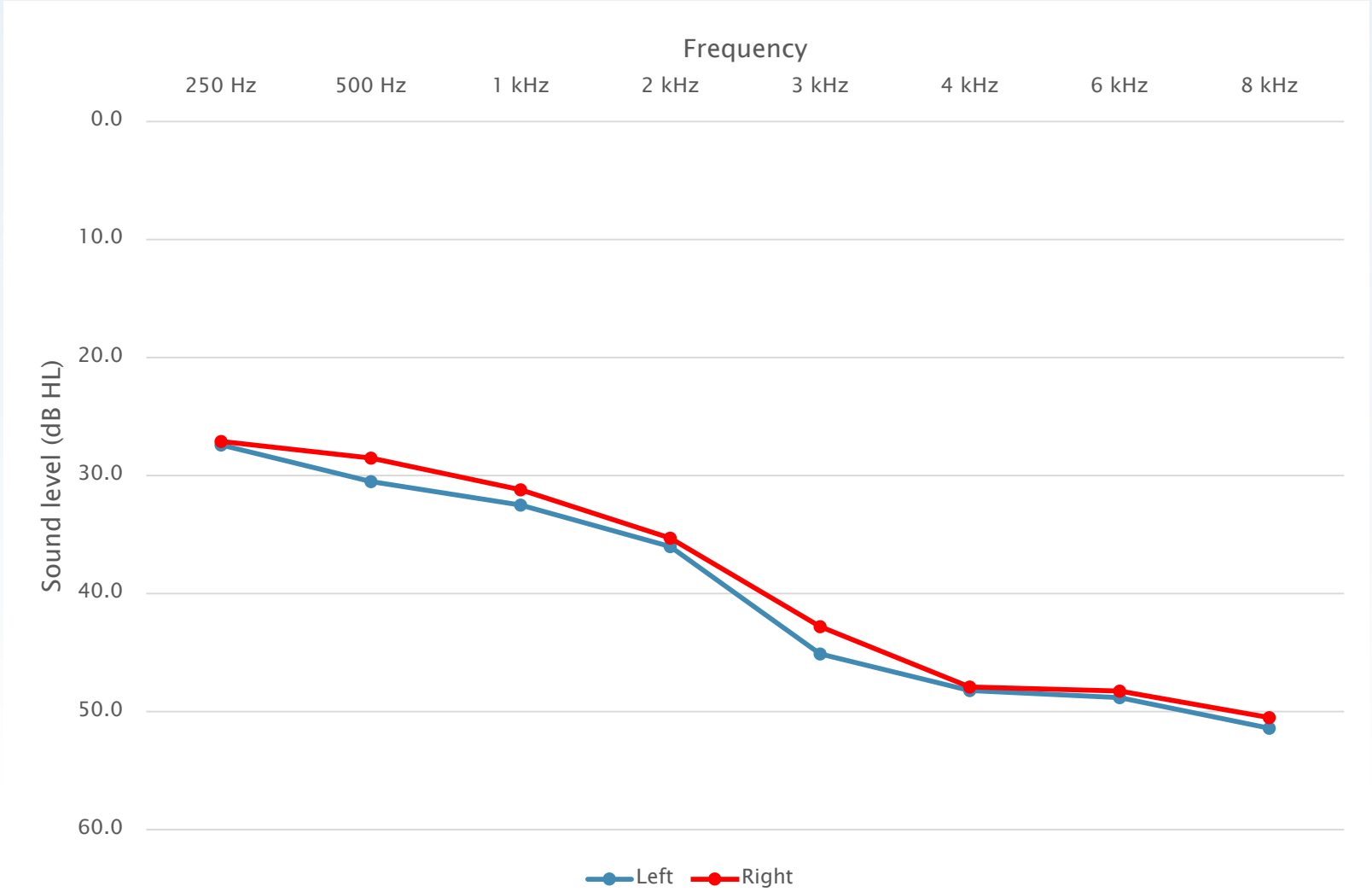
# Additional slides

Table 2. Reasons given for declining ENT referral (n=14)

| Reason | Number of respondents |
|---|---|
| Do not find hearing loss an issue | 7 |
| Mild hearing loss | 4 |
| Would like to focus on other medical conditions E.g. stroke rehabilitation | 3 |
| Already on ENT (hospital/private) follow-up for other issues | 3 |
| Already seen ENT previously | 2 |
| Inconvenient to go for ENT follow-up | 1 |
| No reason given | 3 |

# Additional slides-PTA




- Downward sloping hearing configuration

**Figure 2.** Average hearing thresholds in dB HL at each frequency for each ear