

Reduced Amygdala Function Associated with Age-related Hearing Loss in the UK Biobank

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Take home message

Age-related hearing loss associated with reduced activity in medial temporal regions;
possible mechanism linking it to increased dementia risk

INTRODUCTION

Background:

- Hearing loss is highly prevalent in older adults¹
- Recently recognized as a significant, modifiable risk factor for dementia²
- Theorized that reduced sensory inputs negatively affects brain structure and function³
- Medial temporal brain regions are indirectly connected to auditory cortex⁴

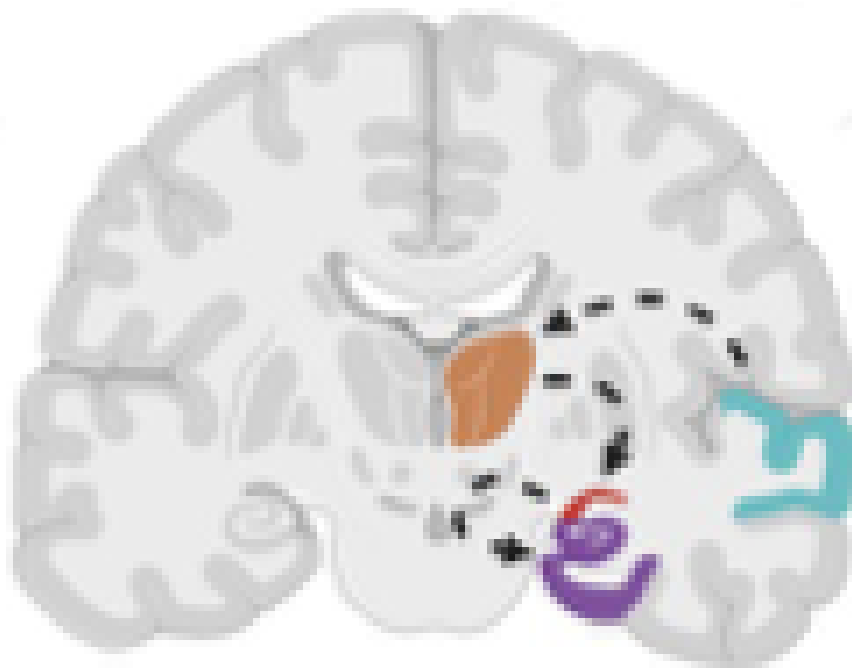


Fig 1. Indirect pathways connecting auditory and medial temporal brain regions

- Evidence for hearing associations with brain volume, but no studies on brain function

Purpose:

- Investigate associations between hearing ability and fMRI brain activity
- Examine mediating effect of brain function on association between hearing and memory performance

REFERENCES

- Lin et al., 2011, Arch Intern Med
- Livingston et al., 2017, Lancet
- Griffiths et al., 2020, Neuron
- Kraus & Canlon, 2012, Hearin Res.

METHODS

IMPORTANT NOTE

The UK Biobank suspended all access to their online data and analysis platform in April 2026 due to a data breach. The participant descriptives, results, and figures reflect preliminary work completed prior to the suspension.

UK Biobank cohort:

Table 1. UK Biobank participant characteristics (N=1,200)

Age, mean (SD), years	68.0 (5.0)
Sex, % female	50
Education (% university degree)*	48.5
Townsend deprivation index, mean (SD)*	-1.3 (3.1)
Speech-reception threshold, mean (SD), dB	-5.4 (1.9)
Hearing Impairment (% yes)	50

*means of entire UK Biobank cohort, did not obtain statistics specific to this study before platform suspension

- Hearing assessed with speech-reception threshold (SRT) test, where larger scores indicate poorer hearing
- ~50,000 participants with available MRI, random sample of 1,200 chosen with equal sex and hearing group distribution

MRI:

- 3T fMRI, Faces/Shapes emotion task
- Pre-processed data used
- Faces-Shapes primary contrast of interest
- Extracted activation in left and right ROIs:
 - Amygdala, hippocampus, anterior parahippocampus, and posterior parahippocampus

RESULTS

- Several regions suggest reduced activation between medial temporal lobe and hearing ability, particularly the left amygdala (Table 2, Fig. 2)

Table 2. Pearson correlations between SRT scores and mean ROI activation

ROI	R	p
L Hippocampus	-0.08	.009
R Hippocampus	-0.04	.212
L Ant. Parahippocampus	-0.05	.063
R Ant. Parahippocampus	-0.04	.197
L Post. Parahippocampus	-0.08	.008
R Post. Parahippocampus	-0.04	.178
L Amygdala	-0.11	<.001
R Amygdala	-0.07	.022

Table 3. Regression model predicting Left Amygdala ROI activation

Predictor	beta	p
Intercept	1.42	<.001
Age	-0.01	.316
Sex (ref. = male)	0.05	.401
Deprivation Index	0.03	.041
Smoking History	0.11	.063
Cardiovascular Disease	-0.01	.898
Mean fMRI Motion	-2.69	<.001
SRT Score	-0.04	.003

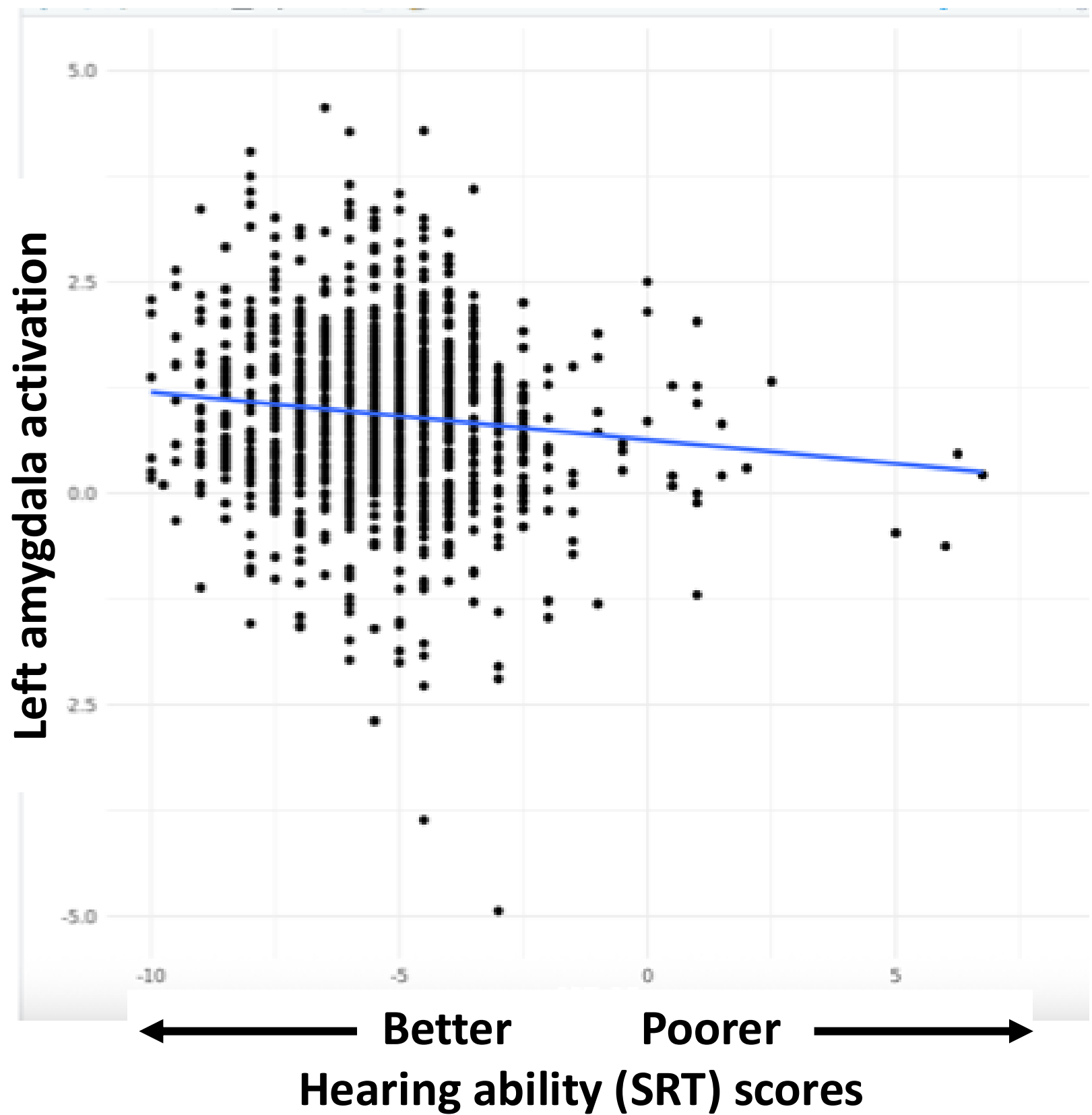


Fig 2. Negative association between fMRI activation in left amygdala and hearing ability scores, showing reduced activation with poorer hearing.

- Association with left amygdala remains after removing outliers and accounting for covariates (Table 3)
- Unable to perform mediation analysis due to platform suspension

CONCLUSIONS

- In a task designed to elicit amygdala activity, poorer hearing was associated with lower amygdala activation
- Suggestive evidence linking hearing loss to dementia risk via reduced medial temporal lobe activity
- Will next examine mediating association with memory

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