

When The Right Ear Matters: Peripheral Hearing Differences in Cognitive Superaging

Deepashri Agrawal*, Palash Kumar Malo, Thomas Gregor Issac, TLSA Team
Centre for Brain Research, Indian Institute of Science, Bangalore, India

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Superagers showed three converging auditory signals: stronger auditory-verbal cognition, selective right-ear hearing sensitivity, and a right-ear hearing–language link.

INTRODUCTION

Peripheral auditory function has been linked to cognitive aging and Alzheimer's disease risk, yet whether cognitive resilience in Superagers is accompanied by specific patterns of peripheral hearing remains insufficiently characterized.

Reverse-resilience question:

What sensory-auditory features accompany preserved cognition in late life?

AIM

To test whether cognitive superaging is accompanied by a distinctive peripheral hearing and auditory-cognitive profile, and whether hearing sensitivity relates to ACE-III language.

Core question: does resilience have sensory edges?

METHODOLOGY

Urban Indian aging cohort: N=190 participants.

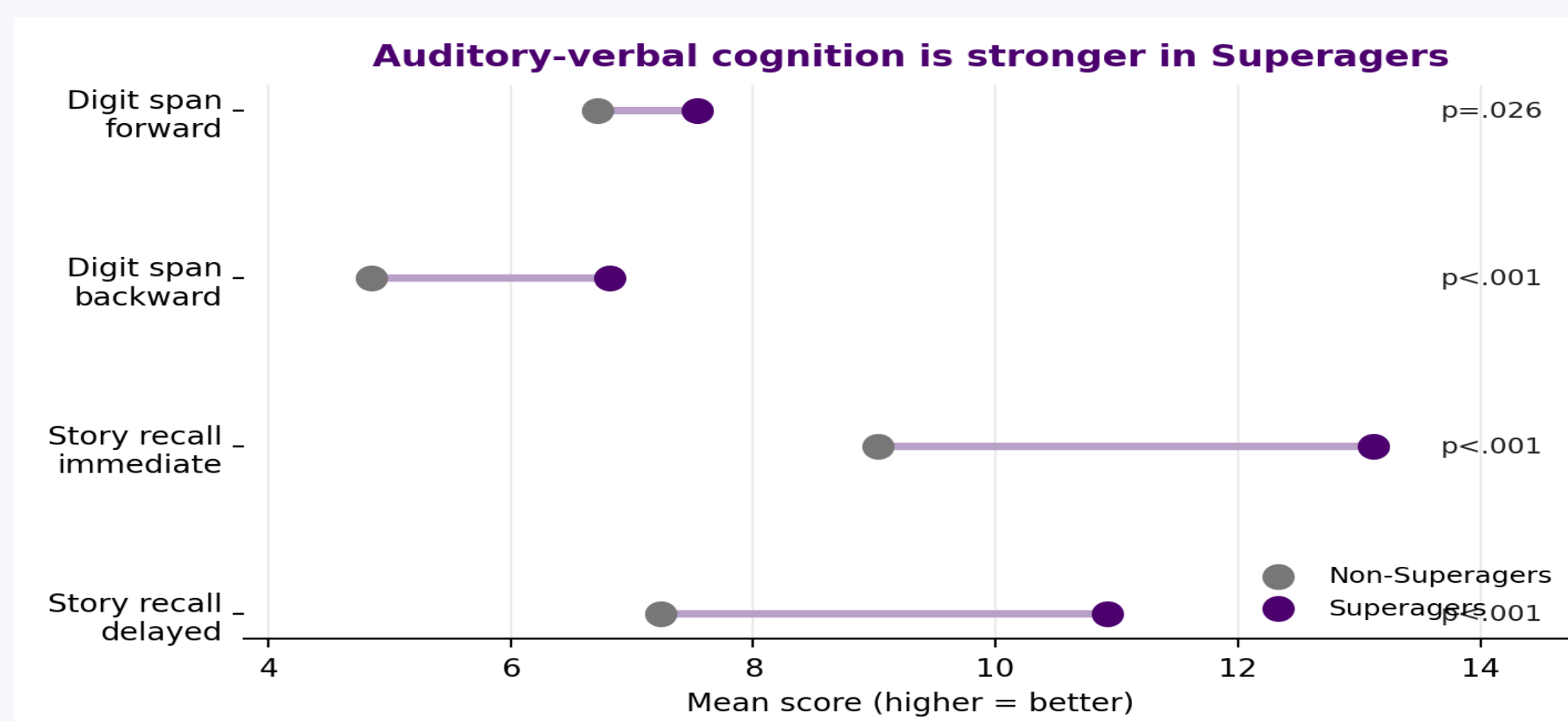
- Superagers: n=97; comparison participants: n=93.
- Superagers: age ≥75 years, CDR=0, and preserved global cognition on ACE-III (>87 in the operational final definition).

MEASURES

- Pure-tone audiometry: 250 Hz–8 kHz; 3PTA and 4PTA composites.
- Extended high-frequency audiometry: 10–12.5 kHz.
- TEN-HL testing to screen for cochlear dead-region patterns.
- Digit span forward/backward and story recall to capture auditory working memory and auditory-verbal recall.

RESULT 1: AUDITORY-VERBAL COGNITION

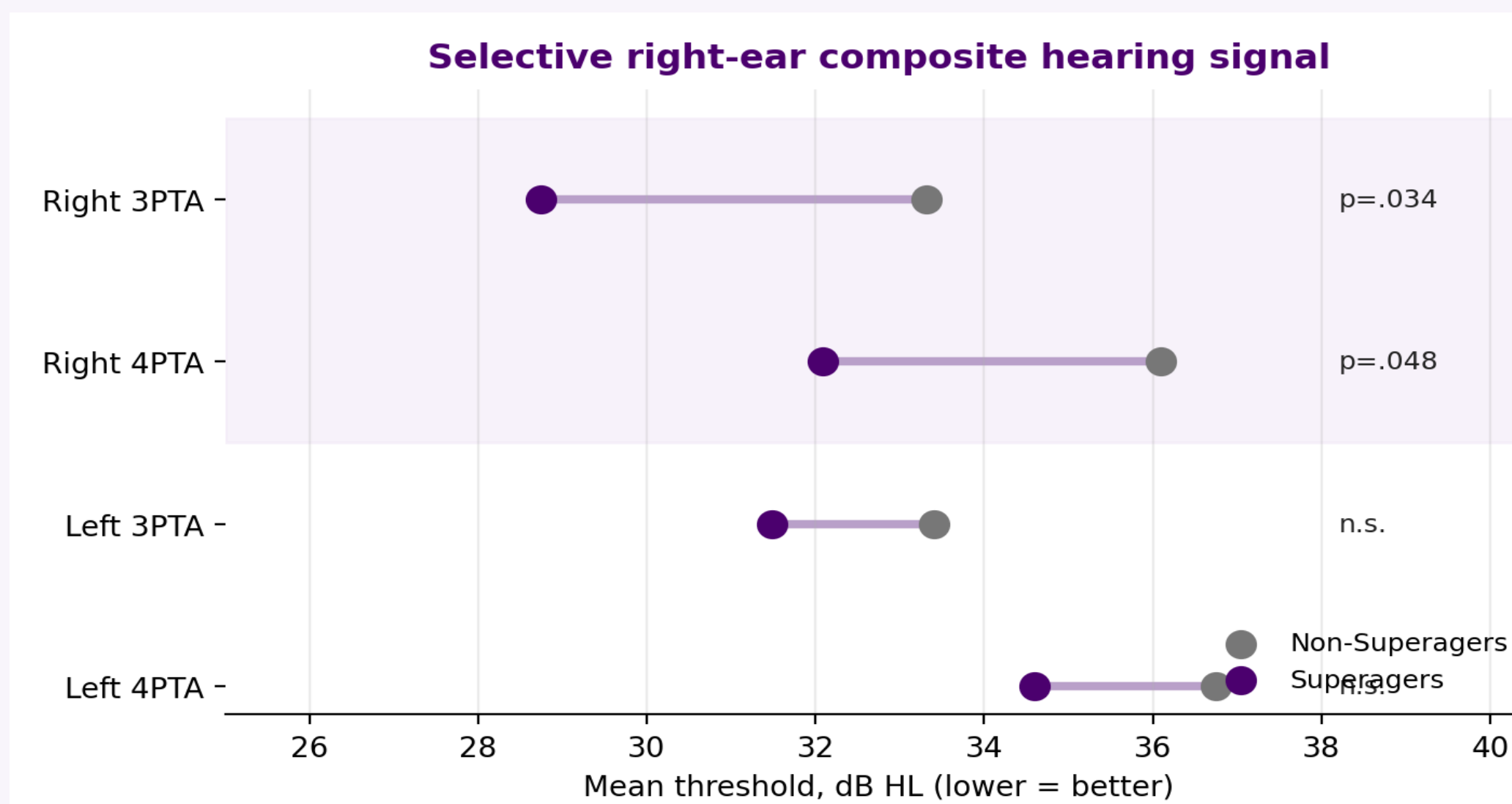
Superagers showed stronger auditory working memory and auditory-verbal recall.



Superagers outperformed comparison participants on digit span and story recall.

RESULT 2: SELECTIVE RIGHT-EAR HEARING

Superagers had lower right-ear composite PTA thresholds. Lower dB HL = better hearing.



Pattern was selective and strongest in right-ear PTA.

WITHIN-SUPERAGER RIGHT-OVER-LEFT

Within Superagers, right-ear sensitivity also exceeded left-ear sensitivity at key measures.

500 Hz
p=.012

3PTA
p=.031

4PTA
p=.024

8 kHz
p≈.050

RESULT 3: HEARING-LANGUAGE LINK

In Superagers, better right-ear composite/high-frequency hearing was associated with better ACE-III language performance.

Right 4PTA

ACE-III Language
ρ=-.221; p=.029

Right 8 kHz

ACE-III Language
ρ=-.235; p=.021

Negative p: higher thresholds = poorer hearing, so better hearing linked to better language.

INTEGRATED INTERPRETATION

Peripheral hearing sensitivity

Auditory-verbal access

Cognitive resilience

- Cognitive superaging as defined by preserved global cognition and intact clinical status reflects meaningful heterogeneity in cognitive aging.
- This heterogeneity may include measurable sensory-auditory features: a right-ear conventional-hearing signal, stronger auditory-verbal cognition, and a language-relevant hearing link.

CONCLUSIONS

- Rather than generalized auditory superiority, these findings highlight ear-specific peripheral auditory characteristics as part of a broader resilience phenotype relevant to Alzheimer's disease research

Sensory preservation may be one visible edge of cognitive resilience.

