

# INPLASY PROTOCOL

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**Conflicts of interest:**  
None declared.

## Effect of hearing aids on cognitive functions in middle aged and older adults with hearing loss: a systematic review and meta-analysis of intervention studies

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**Review question / Objective:** **P:** Middle aged and older adults with hearing loss. **I:** Hearing aids or cochlear implants. **C:** Without the use of hearing aids or cochlear implants. **O:** Cognitive functions.

**Eligibility criteria:** (1) original articles of intervention trials including randomized controlled trials (RCT), non-randomized controlled trials (Non-RCT) and pre-post intervention studies (without control or comparison groups); (2) full-text articles published in English only; (3) subjects aged 45 years or older with hearing impairment (no restriction on types or the onset ages of hearing impairment); (4) no restriction on cognitive impairment or other psychiatric disorder on the subjects; (5) interventions included hearing aids and cochlear implants; and (6) assessment of cognitive function, cognitive impairment as outcome presented as mean standard deviation (SD) or standard error (SE).

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 05 July 2022 and was last updated on 05 July 2022 (registration number INPLASY202270027).

### INTRODUCTION

**Review question / Objective:** **P:** Middle aged and older adults with hearing loss. **I:** Hearing aids or cochlear implants. **C:** Without the use of hearing aids or cochlear implants. **O:** Cognitive functions.

**Condition being studied:** Nowadays, the rate of hearing loss presents an increased trend. For example, in China, the hearing loss prevalence was 50.92%, far greater than 14.3% in the first decade of the 21st century. Hearing loss was previously regarded responsible for contributing to symptoms of dementia and cognitive dysfunction in older adults, and currently it

has been recognized as a risk factor of dementia, meaning that hearing loss adults are at greater risk of dementia in their midlife and later life. As the dementia rate is also increasing among people aged 65 years and older, for instance, in China, the rate was 11.98% in rural areas and 5.19% in urban areas respectively, hearing treatment and cognitive impairment have received much attention, especial in aging society. But, is the risk modifiable and thus making it possible to prevent the onset or delay the progression of cognitive decline with treatment for hearing loss? Nevertheless, the mechanism underlying hearing loss associated cognitive decline is not yet clear. For one thing, indeed, there were studies suggesting improvements on cognition with management of hearing loss, possibly through enhancing communication and improving quality of life, to prevent from isolation and thus decrease the risk of cognitive decline. For another, there is no recommendation based on high-level evidence yet, leaving major disagreement of the effects of hearing treatment on cognition. As a result, we conducted a systematic review and meta-analysis to investigate and quantify the effect of hearing aid, one widely accepted hearing device in hearing loss population, on cognitive functions in middle aged and older adults with hearing loss. And to provide a comprehensive overview to what extent hearing aids can do on cognition under specific circumstances.

## METHODS

**Participant or population:** Subjects aged 45 years or older with hearing impairment.

**Intervention:** Hearing aids or cochlear implants.

**Comparator:** Hearing aids, cochlear implants, blank, and successful aging intervention.

**Study designs to be included:** Randomized controlled trials (RCT), non-randomized controlled trials (Non-RCT) and pre-post intervention studies.

**Eligibility criteria:** (1) original articles of intervention trials including randomized controlled trials (RCT), non-randomized controlled trials (Non-RCT) and pre-post intervention studies (without control or comparison groups); (2) full-text articles published in English only; (3) subjects aged 45 years or older with hearing impairment (no restriction on types or the onset ages of hearing impairment); (4) no restriction on cognitive impairment or other psychiatric disorder on the subjects; (5) interventions included hearing aids and cochlear implants; and (6) assessment of cognitive function, cognitive impairment as outcome presented as mean standard deviation (SD) or standard error (SE).

**Information sources:** PubMed, Cochrane Library, and EMBASE before 30 March 2022.

**Main outcome(s):** Cognitive functions.

**Quality assessment / Risk of bias analysis:** The quality assessment was restricted on RCTs, using the Cochrane protocol for assessing risk of bias (RoB2), consisting of 5 domains: bias arising from the randomization process, bias due to deviations from intended interventions, bias due to missing outcome data, bias in measurement of the outcome, and bias in selection of the reported result.

**Strategy of data synthesis:** Meta-analyses were restricted on RCTs, and the standardized mean difference (SMD) with 95% confidence intervals (CIs) was chosen as the effect size of to estimate intervention effects of hearing aids on cognition in different domains. Our study extracted post-test means and SDs/SEs from the visits of the primary endpoints. Before standardization, mean values were multiplied by -1 from some sets of the studies to ensure all the scales point to the same direction, in which a positive SMD indicated a greater effects of hearing aid use on cognition. Hedge's g values was used to assess clinical significance: 0.2 = small effect size; 0.5 = medium effect size; and 0.8 = large effect size.

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**Subgroup analysis:** Subgroup analyses by baseline global cognition, cognitive domains in population with normal global cognition, and overall risk of bias.

**Sensitivity analysis:** By leave-one-out method.

**Language:** English.

**Country(ies) involved:** China, Dongzhimen Hospital, Beijing University of Chinese Medicine.

**Keywords:** hearing aids, hearing loss, cognitive function, dementia, Alzheimer's disease.

**Contributions of each author:**

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