# INPLASY PROTOCOL

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**Review Stage at time of this submission:** **Piloting of the study selection process.**

**Conflicts of interest:**
**None.**

# WEB- AND APP-BASED TOOLS FOR REMOTE HEARING ASSESSMENT: A SCOPING REVIEW PROTOCOL

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**Review question / Objective:** **The aims of this review are to identify and assess the functionality of remote hearing assessment tools that are available on commercial app stores (e.g. Google Play) and online platforms and to systematically search the literature to determine whether any of the identified tools have been validated in peer-reviewed publications and report on the accuracy and reliability of those tools for which validation data do exist.**
**Condition being studied:** **As technologies advance and the number of active smartphone users increase (reaching about 3.5 billion users worldwide in 2020), remote health services using smartphone applications may improve access to, and uptake of, health care. The use of these applications may also bridge the demand gap in hearing health services and offer an alternative service delivery route for those who are at high risk for coronavirus-related morbidity and mortality. However, it is unknown whether all of these hearing assessment/ screening applications are validated or not.**

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 20 October 2020 and was last updated on 20 October 2020 (registration number INPLASY2020100073).

## INTRODUCTION

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## METHODS

**Search strategy:** The review team has developed the search protocol in consultation with a medical information specialist. The search strategy consists of controlled terms (e.g. Medical Subject Headings) and free text words, where appropriate. An iterative process was conducted to test the proposed strategies.

**Participant or population:** Any tool that is intended to assess or screen hearing ability (measured as pure tone hearing thresholds, ability to understand speech in background noise, or as self-reported hearing disability or handicap) remotely and is available on online platforms or through commercial smartphone application stores.

**Intervention:** The included tools should be self-administered or remotely controlled via a hearing health professional.

**Comparator:** None.

**Study designs to be included:** There will be no restrictions on the types of study design eligible for inclusion in this review.

**Eligibility criteria:** This review will include any tool that is intended to assess or screen hearing ability (measured as pure tone hearing thresholds, ability to understand speech in background noise, or as self-reported hearing disability or handicap) remotely and is available on online platforms or through commercial smartphone application stores. The included tools should be self-administered or remotely controlled via a hearing health professional. English and non-English language tools will also be included when a reliable translation service to English is available. Tools that aim to identify or assess other ear-related disorders (e.g. tinnitus, hyperacusis, auditory processing disorder and balance) will be excluded. Studies performed to validate any remote hearing assessment or screening tool on human participants, irrespective of their age, will be included. The primary outcomes of interest are sensitivity and specificity measures. Other relevant outcomes (e.g., tool performance) will also be included. Randomised and non-randomised controlled peer-reviewed trials will be eligible for inclusion. Theses, conference abstracts, clinical guidelines and book chapters will be excluded.

**Information sources:** Online platforms and application stores will be systematically searched to identify relevant tools. The Google search engine will be used to identify web-based tools. Apple App Store and Google Play will also be searched to identify app-based tools. These platforms were selected because they have the highest share in the global market and are the most commonly searched app stores. As changing the location settings in application stores can potentially omit or reveal certain tools, this review will use the UK as the primary country in all application stores. When necessary, a secondary search will be performed using websites that allow the users to experience the application stores without an official account (e.g., fnd.io website) to verify the search results. Relevant published, concluded but unpublished and ongoing validation studies will be identified through a systematic literature search. The following databases will be searched: EMBASE, EMCare, PubMed, PsycINFO, the Cochrane Library, Global Health and Web of Science. Preprint resources including MedRxiv and PsyArXive will also be searched. The citations of the identified studies will be tracked, and their reference lists will be screened to identify additional

relevant studies. No search restrictions will be imposed in terms of the participant's age, publication date, status or language. The search date for each database and platform will be reported.

**Main outcome(s):** Pure tone hearing thresholds, ability to understand speech in background noise, or as self-reported hearing disability or handicap.

**Additional outcome(s):** None.

**Data management:** Retrieved records from all databases will be exported to reference management software (i.e., EndNote). The same software will be used to automatically remove duplicates. These records will then be exported to a spreadsheet for eligibility screening. Manual deduplication will also be performed to ensure that all records are duplicate-free.

**Quality assessment / Risk of bias analysis:** The quality and functionality of each app will be assessed by two independent authors using the Mobile Application Rating Scale (MARS). The methodological quality of the included studies will be assessed using the revised version of the Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool.

**Strategy of data synthesis:** The data will be narratively synthesised.

**Subgroup analysis:** Not applicable.

**Sensibility analysis:** Not applicable.

**Language:** There will be no language restrictions.

**Country(ies) involved:** United Kingdom, Australia, Cyprus, United States, Saudi Arabia.

**Keywords:** Telemedicine, Smartphone, hearing loss, hearing assessment, hearing screening.

**Dissemination plans:** Review results will be published in a peer-reviewed journal and presented at relevant scientific conferences.

**Contributions of each author:**
Author 1 - Ibrahim Almufarrij - The author developed and prepared the review protocol and will contribute to the selection and data extraction processes, functionality assessment and risk of bias assessment. The author will also prepare the manuscript of this review.
Author 2 - Harvey Dillon - The author contributed to the development of the review protocol and will also critically review the manuscript of this review.
Author 3 - Piers Dawes - The author contributed to the development of the review protocol and will also critically review the manuscript of this review.
Author 4 - Chryssoula Thodi - The author contributed to the development of the review protocol and will also critically review the manuscript of this review.
Author 5 - Michael Stone - The author contributed to the development of the review protocol and will also critically review the manuscript of this review.
Author 6 - Anna-Pavlina Charalambous - The author contributed to the development of the review protocol and will also contribute to the selection and data extraction processes, functionality assessment and risk of bias assessment.
Author 7 - Wai Yenug - The author contributed to the development of the review protocol and will also contribute to the selection and data extraction processes, functionality assessment and risk of bias assessment.
Author 8 - David Moore - The author contributed to the development of the review protocol and will also critically review the manuscript of this review.
Author 9 - Kevin Munro - The author contributed to the development of the review protocol and will also critically review the manuscript of this review.