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Mobile health applications for older people in Asia: protocol for a systematic review of end-user perceptions and recommendations

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ABSTRACT

Introduction Mobile technology has revolutionised the way people interact with others and gain access to healthcare services. Given that cultural background is a strong moderator for technology penetration, this systematic review aims to examine end-user perceptions and design recommendations for mobile health applications among Asian older people.

Methods and analysis Five electronic databases (PubMed, CINAHL, PsycINFO, Medline and Cochrane Central Register of Controlled Trials) will be searched until May 2025. Studies conducted on Asian older people aged 60+ years, with English/Chinese full text available, will be included. Narrative approaches and effect direction plots will be used for data analyses. Risk of bias across studies will be examined using Cochrane Risk of Bias 2 and Risk of Bias in Nonrandomised Studies of Interventions, whereas the quality of evidence will be assessed by Shekelle's classification scheme.

Ethics and dissemination No ethical approval will be required. The findings will be disseminated through peer-reviewed journal articles.

PROSPERO registration number CRD42024562861.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This systematic review will adopt rigorous methodological design, and its findings will be reported in line with the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses.
⇒ Multiple independent reviewers will be involved in conducting all processes, including study screening and selection, data extraction and synthesis, risk of bias assessment and certainty of evidence appraisal, of this systematic review.
⇒ Language bias may exist because only studies published in English and Chinese will be included.
⇒ The inclusion of only journal articles published in English and Chinese may lead to an increased risk of publication bias because negative or null findings will be more likely to be published in local journals in languages other than English or Chinese.
⇒ The quality of evidence of this systematic review may be limited by missing information and the possibility of the high risks of bias of the included studies.

INTRODUCTION

The global population is rapidly ageing on an unprecedented scale and the proportion of people aged 60 years and older is estimated to double from 1 billion in 2019 to 2.1 billion in 2050.[1] Over the past few decades, stakeholders have devoted considerable effort to developing technology to support ageing in place; such technologies include sensor-based technologies for vital sign monitoring, activities of daily living monitoring and fall detection.[2–4] Given that technology acceptance factors consistently evolve over time, further research is required to provide a deep understanding of health-related outcomes, end-user perceptions (eg, barriers and motivators) and persuasive features (eg, medication reminders and messaging channels) to drive the adoption of mobile-based technologies by the elderly.

A systematic review by Peek *et al* provided an overview of technology acceptance factors between preimplementation (initial acceptance) and postimplementation (sustained use) stages with the use of a technology for ageing in place.[5] Perceived need, monetary cost and privacy concerns were the major concerns for initial acceptance at preimplementation. Perceived safety need, false alarms, fears of forgetting or losing technology, user satisfaction, questionable usability and stigmatisation were the major concerns at postimplementation. Liu *et al* further highlighted that an elderly–friendly interface design of mobile health (mHealth)

applications for older people should carefully take into consideration ageing-related functional impairments, such as perceptual (vision) limitations, motor coordination problems and cognitive and memory deterioration.[6] For this reason, recommendations for interface design should include large font size, bold font for key points, high contrast, voice command support and high simplicity and comprehensibility. Meanwhile, persuasive features that provide motivational affordance to sustain older people's use of mHealth applications include reminders (eg, medication reminder), social activity engagement, digital games, personalised settings and health education. Other benefits of mHealth that can surpass the challenges of already existing healthcare services include 24/7 availability, high accessibility, self-management (eg, psychoeducation) and personalisation. However, previous reviews fell short in addressing how cultural background may influence people's behaviours of adopting mobile technologies. The effect of cultural context, especially Asians versus non-Asians, on the uptake of mobile technologies is evidenced by the completely different teleconsultation acceptance rates between Hong Kong and the Netherlands, which are both high-income regions and have similar resources and digital literacy levels.[7]

The objectives of the present systematic review are (1) to examine elderly end-user perceptions (eg, acceptance factors and ageing barriers) among Asian older people, (2) to identify age-appropriate recommendations for mHealth application design (eg, interface and persuasive features) and (3) to examine the health-related effects of mHealth applications among older adults in Asia.

METHODS AND ANALYSIS

Study design

The reporting of the present systematic review protocol is in line with the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocol.[8 9] Given that the meta-analysis of effect estimates will not be possibly conducted due to the heterogeneity of intervention types and outcomes,[6] the reporting of review findings will be in line with the guidelines of Synthesis Without Meta-analysis.[10] The protocol was registered in the PROSPERO registry (CRD42024562861). For ensuring the exhaustive search of relevant literature and a comprehensive study risk of bias (RoB) assessment, amendments to the electronic databases, text word terms used and RoB assessment tools were made in this study protocol.

Eligibility criteria

The Population, Intervention, Comparison, Outcomes, Study Design (PICO-SD) framework will be adopted to guide the inclusion of eligible studies for review. The inclusion and exclusion criteria are shown in table 1. Studies that meet the criteria will be considered eligible.

Information sources

Five electronic databases, namely PubMed, CINAHL, PsycINFO, Medline and Cochrane Central Register of Controlled Trials will be searched from their inceptions though May 2025. The text word terms used in the search will be (older OR senior OR elder* OR aging OR ageing) for older adults, ("mobile health" OR eHealth OR "mobile application*" OR "mobile app*" OR mHealth OR "mobile healthcare" OR smartphone* OR "smart phone*" OR "cell phone*" OR "cellular phone*" OR

Table 1 Eligibility criteria based on the PICO-SD framework

	Inclusion and exclusion criteria
Population	Older adults aged 60+ years in Asia (eg, China, Taiwan, Japan, Korea and India).[a] Studies conducted on Asian immigrants of non-Asian countries will be excluded.
Interventions	Readily available or self-made/customised mobile devices, including smartphones and tablets, with any mHealth applications.
Comparisons	No specific comparator groups will be excluded.
Outcomes	Health-related outcomes, including health behavioural change, health knowledge, physical and cognitive functioning and mental well-being. Usability, acceptability, feasibility, effectiveness, user experience or codesign studies with a focus on end-user perceptions (eg, motivators, barriers and design) conducted on an elderly cohort will be included. However, technical reports or practical guidelines only describing the design and development of mHealth applications without testing the applications in older people will be excluded.
Study designs	Original research journal articles (quantitative, qualitative or mixed methods research) published in English and Chinese with full texts available. Conference abstracts and proceedings, retracted articles, non-human studies or studies other than original research, including grey literature, reviews, meta-analyses, study protocols, editorials and commentaries will be excluded.

*Classification of Asian countries will be according to the country and area codes (M49 standard) used by the United Nations for statistical purposes.[15] Thus, based on the classification system, Russia is not considered as an Asian country in the present study.
mHealth, mobile health; PICO-SD, Population, Intervention, Comparison, Outcomes, Study Design.

tablet* OR "mobile device*" OR iPad OR "digital health") for mHealth apps, and (motivator* OR motivate* OR motivation OR facilitator* OR barrier* OR obstacle* OR accept* OR adopt*) for ageing barriers and motivators. The search strategies for every electronic database are presented in online supplemental information.

Study selection

The searched studies will be screened by using a two-stage approach to first review the titles and abstracts, followed by the full texts. The full-text assessment of the studies that do not provide sufficient information on the basis of the PICO-SD model along with other potentially eligible studies will be conducted. The bibliographies of the included studies will also be screened to avoid missing any potentially eligible studies. The lists of references and of included/excluded studies of three relevant systematic reviews will also be screened to ensure the exhaustive identification of potentially eligible studies.[5 6 11] Librarians will be invited to extract the full-text versions of articles that are not publicly available. The initial screening and full-text assessment will be conducted by at least two independent review authors. Disagreements among the authors will be resolved by discussion.

Data extraction

Key study characteristics, including publication details (authors, publication years, countries and study design), participant characteristics (age, sex, sample size and settings), mHealth application description, health areas, time of follow-up and outcome measures, will be tabulated. Data extraction will be performed by at least two review authors independently, whereas disagreements among the investigators will be resolved by discussion. The data extracted and summarised in the resulting table will also be independently verified by all authors.

Data synthesis

Similar to that done by Liu *et al*,[6] the recommendations for mHealth application design and promotion by older adults and authors of the included studies will be broadly categorised into interface (eg, font and button sizes and voice commands) and persuasive features (eg, serious games and social media) and promotion strategies, and the recommendations will be eventually narratively synthesised. End-user perceptions (facilitators and barriers) will be first clustered into user and product levels, and further grouped into preimplementation (ie, initial acceptance) and postimplementation (sustained adherence) stages for narrative analyses.[5]

If information is missing or unclear, the study authors will be contacted directly via email. Data synthesis will be first conducted by the first author and independently verified by all coauthors. Disagreements among the reviewers will be resolved through discussion.

For health-related outcomes reported in randomised controlled trials (RCTs), effect direction plots will be employed to provide a visual summary of findings from the studies.[12] In short, data extracted from the included RCTs will be first tabulated and the RCTs will be ordered by the date of publication. Health-related outcomes will then be grouped into five broad domains, namely health behavioural change, health knowledge, physical and cognitive functions, mental well-being and others. Different visual representations (arrows) will be used to indicate reported effect directions (improvement ▲, deterioration ▼ and no change/conflicting results ◄►) for each individual outcome. Arrows in different colours (black or grey) will also be used to indicate statistical significance. When effect directions are similar and ≥60% of the reported outcomes are statistically significant, black arrows will be used. On the contrary, when effect directions are similar but <60% of the reported outcomes are statistically significant, grey arrows will be used. Meanwhile, another table containing information, such as mHealth interventions, sample sizes at follow-up and assessment time points, will be prepared to show an overall arrow representation for each outcome domain per study. When more than one outcome per domain exists, an arrow will represent a synthesis of all reported effect directions and statistical significance. Large arrows will indicate large sample sizes. For sample sizes of intervention groups at follow-up, large, medium and small arrows will represent sample sizes of >300, 50–300 and <50, respectively. The two tables will be prepared by the first author and independently checked by another review author.

Rob assessment

The Cochrane Risk of Bias 2 (RoB 2) will be employed to assess the RoB of the included RCTs. This tool is basically structured into five different domains covering all possible biases (ie, randomisation, deviations from intended interventions, missing outcome data, outcome measurement and selective reporting of results) that potentially affect the results of the included trials. An overall RoB judgement for each study (low risk, some concerns and high risk) will be drawn on the basis of the results of each bias domain.

For assessing the RoB of non-randomised trials, the Risk of Bias In Non-randomised Studies—of Interventions (ROBINS-I) containing seven domains of bias will be used.[13] The first two domains are about confounding and participant selection in the study to address issues at preintervention. The third domain is about the classification of the interventions themselves during intervention. The other four domains, covering bias due to deviations from intended interventions, missing data, outcome measurement and selective reporting of results, address issues after the commencement of interventions. An overall RoB judgement for each study (low risk, moderate risk, serious risk, critical risk, no information) will be made on the basis of the judgements made within each domain.

The RoB tools (Cochrane RoB 2 and ROBINS-I) provide signalling questions to guide users to judge RoB

Table 2 Classification scheme for category of evidence and strength of recommendation

Category of evidence	
Ia	Evidence from the meta-analysis of randomised controlled trials
Ib	Evidence from at least one randomised controlled trial
IIa	Evidence from at least one controlled study without randomisation
IIb	Evidence from at least one other type of quasi-experimental study
III	Evidence from non-experimental descriptive studies, such as comparative, correlation and case–control studies
IV	Evidence from expert committee reports, opinions or clinical experience of respected authorities, or both
Strength of recommendation	
A	Directly based on category I evidence
B	Directly based on category II evidence or extrapolated recommendation from category I evidence
C	Directly based on category III evidence or extrapolated recommendation from category I or II evidence
D	Directly based on category IV evidence or extrapolated recommendation from category I, II or III evidence

This classification scheme was adopted from 'Clinical guidelines: Developing guidelines' by Shekelle *et al* (1999).

within each domain. The RoB assessments will be first conducted by the first author and independently verified by another reviewer. Disagreements between the two reviewers will be resolved through discussion or by a third reviewer.

Quality of evidence

The quality of evidence of the included studies will be graded in accordance with the classification scheme developed by Shekelle *et al*.[14] In short, the certainty of evidence will be graded primarily on the basis of study designs, which range from meta-analyses and RCTs to observational studies, case studies or series and expert commentary. The classification scheme regarding the category of evidence and strength of recommendation is shown in table 2.

Patient and public involvement

Patients and/or the public were not involved in this study.

Ethical and dissemination

No formal ethical approval will be sought because this review will only consider published articles, and all data available among included studies should be anonymous without concerns about participant privacy or confidentiality. The findings of this systematic review will be disseminated through peer-reviewed journal articles.

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Contributors WL, SCL, RS, YY, JC, ES, AY, WW, KL, SH and LS conceived and designed the study. This protocol was drafted by WL and then edited by SCL and LS. WL designed the search strategies. WL, CLC, JC and YW will conduct the search, data extraction and risk of bias assessment independently. WL and SCL will analyse and interpret the data. LS will resolve any disagreements during the review. All authors have approved the final version of this study protocol. WL is the guarantor.

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