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Telehealth usability evaluation by healthcare professionals in post-pandemic treatment of non-communicable diseases (hypertension and diabetes): Systematic Review Protocol

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Abstract:

Introduction: *The COVID-19 pandemic prompted policies that limited direct human interactions globally. Due to this, healthcare systems worldwide have witnessed unprecedented challenges in providing adequate and continuous healthcare for patients with Non-Communicable Diseases (NCDs), among them hypertension and diabetes. The pandemic promoted the expansion of telehealth, thanks to its potential to extend services to remote places and capitalize on high expertise made available to patients otherwise kept waiting or unattended. Despite this, few studies have analyzed health professionals' evaluation of telehealth usability for post-pandemic care of patients with NCDs. Objective: To assess healthcare professionals' evaluation of telehealth usability in post-pandemic care of patients with NCDs.*

Methods: *This is a systematic review and narrative analysis. The primary outcome will be usability or "ease of use" in patient care. Secondary outcomes are satisfaction (acceptance), the impression of their patient's satisfaction, and the contexts in which the mobile devices are used. Clinical trials, prospective cohort studies, retrospective observational studies, and studies that used qualitative data collection and analysis methods, published in English, Spanish or Portuguese from March 2020 onwards, on healthcare professionals' evaluation of telehealth in post-pandemic care of patients with hypertension and diabetes will be included. Studies that do not pertain to the research questions, incomplete articles, abstracts, review articles, editorials, books, academic articles, dissertations, theses, and proceedings of scientific events will be excluded. The databases to be queried will be MEDLINE (accessed by PubMed), Embase, BIREME, IEEE Xplore, gray literature, and manual search.*

Keywords: *healthcare professional; telehealth; non-communicable disease; usability COVID-19 Pandemic*

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INTRODUCTION

Rationale

According to the World Health Organization (WHO), at least 71% of global deaths occur from non-communicable diseases (NCDs) (Forouzanfar et al., 2016). This equates to about 15 million people between 30 and 69. Hypertension and diabetes are the two primary diseases responsible for nearly 70% of all deaths (World Health Organization, 2021). Most of

these deaths can be prevented with adequate resources (Forouzanfar et al., 2016). Although deaths occur everywhere since all individuals are vulnerable to NCDs, low- and middle-income countries have higher mortality rates. This is due to, among other things, NCDs being chronic and progressive diseases requiring complex management of the genetic, physiological, environmental, and behavioral factors from which they arise. In this way, the management of NCDs impacts the financial resources of affected individuals and public health, leading to increasing poverty levels, especially in low-income countries (Forouzanfar et al., 2016; Kichloo et al., 2020; World Health Organization, 2019, 2021). The 2019 coronavirus disease (COVID-19) pandemic has worsened this scenario. The COVID-19 pandemic brought a reduction in the follow-up of patients with NCDs due to avoidance (by patients) or interruption (by providers) of regular or emergency clinical meetings due to the increased risk of severe illnesses and death by COVID in people with chronic diseases (Bitar & Alismail, 2021; Kichloo et al., 2020). Innovative and cost-effective solutions that improve the care of NCD patients are urgently needed to solve these problems and reduce the financial burden on healthcare systems worldwide (Elamin et al., 2018). Technology can be that solution (World Health Organization, 2019).

During the pandemic, the use of digital technologies expanded as an indispensable resource to improve the care of isolated patients (Omboni et al., 2020; Smith et al., 2020). They provide convenient access to routine care without the risk of exposure in a crowded hospital or medical practice waiting rooms. They extend access and can make health services more convenient for patients, especially those in rural areas, those with young children, and those with mobility restrictions (Bitar & Alismail, 2021; Kruse et al., 2017; Office of the National Coordinator for Health Information Technology (ONC), 2019). Telehealth can denote remote non-clinical services (such as administrative meetings) and remote clinical services (Bitar & Alismail, 2021). It allows access to health assessment, diagnosis, intervention, consultation, supervision, and information from a distance, generally required to support patients with long-term illnesses (Bitar & Alismail, 2021; Kruse et al., 2017; Office of the National Coordinator for Health Information Technology (ONC), 2019; Smith et al., 2020). It is efficient and cost-effective (Kichloo et al., 2020).

For digital technologies to function as high-quality solutions, they must be acceptable or usable by end-users and have adequate technical support and user training. They should be able to improve self-management skills, communicate, and reduce distance and time spent on tasks. Therefore, they should be simple, culturally specific, and integrated into daily routines. Even the most innovative technologies will not be widely adopted if end-users find them challenging.
The usability of systems is one of the essential quality attributes of any system (Alshamari, 2016). It is considered one of the main topics in Human-Computer Interaction (Alshamari, 2016). It is essential in developing, evaluating, and improving a system and its eventual acceptance by end-users (Hmr et al., 2019; Klaassen et al., 2016; Odendaal et al., 2020; Parmanto et al., 2016). Measuring usability allows for assessing user and provider satisfaction, establishing strengths and weaknesses, and improving the technology and services' effectiveness (Kruse et al., 2017).

In 2019, the WHO created the Guideline of the Recommendations for Digital Interventions for Health System Strengthening (World Health Organization, 2019) with the support of a set of efficacy analyses and two systematic Cochrane reviews. One focused on clients' perceptions and experiences of digital interventions aimed at accessible communication through mobile devices for reproduction, maternal, newborn, child, and adolescent health (Hmr et al., 2019). The other review focused on qualitative research evidence on health professionals' perceptions and experiences using digital tools to provide primary health care services (Odendaal et al., 2020). However, the WHO guideline indicates that digital health has been implemented without examining evidence-based benefits and harms (World Health Organization, 2019).

The Cochrane Database of Systematic Reviews 2020 concluded that more studies are needed to address health professionals' perceptions and experiences using digital tools to deliver primary health services in high-, low- and middle-income countries outside of Africa (Odendaal et al., 2020). Health professionals want reliable, easy-to-use equipment with ongoing technical support; however, they often report usability issues and poor integration with other digital systems (Odendaal et al., 2020). The usability of professionals was reported as "no evidence", "Uncertain effect because of very low evidence", or "Probably makes little or no difference (moderate certainty evidence)" (Odendaal et al., 2020).

Most studies address usability in the construction of the tool or from the patient's point of view. It is equally important to know usability from the point of view of the health professional who uses the tool,

addressing whether it is easy to use, facilitates the work, improves care, improves results, and helps to bring effective health care to distant populations. Based on the above, the main objective of this systematic review will be to synthesize evidence on how health professionals assess the usability of telehealth for the care of patients with NCDs (hypertension and diabetes) in primary care from the COVID-19 pandemic onwards. Based on this, we hypothesize that telehealth usability is positively evaluated by health professionals who provide care for patients with hypertension and diabetes.

Topic of interest Study

The use of digital technologies for health care is defined as "the use of information and communication technologies in support of health and health-related fields" (Office of the National Coordinator for Health Information Technology (ONC), 2019). Digital health has a broad scope, including mHealth, health information technology, wearable devices, telehealth, telemedicine, and personalized medicine (Klaassen et al., 2016) . Although similar, the terms' telehealth' and 'telemedicine' are not synonymous (Office of the National Coordinator for Health Information Technology (ONC), 2019).

Telehealth is a broader term, including telemedicine and various non-medical services, urgency and emergency, dispensing of medication and assisted treatment, telenutrition, telenursing, telepharmacy, teledentistry, teleaudiology, teleneurology, teleneuropsychology, telerehabilitation, teletrauma, telecardiology, tele ECG, telepsychiatry, teleradiology, telepathology, teledermatology, teleophthalmology, telesurgery and even teleabortion in countries where this practice is allowed (Kichloo et al., 2020; Office of the National Coordinator for Health Information Technology (ONC), 2019).

The range of possibilities for carrying out telehealth includes the use of chatbots, video consultations, remotely supervised treatment or training, web-based videoconferencing, and devices such as cell phones, smartphones, personal digital assistants, MP3, app phone plus, medical devices connected to the phone by cable or wireless, E-mail, WhatsApp, educational videos, mobile applications, sensors, websites, a collaboration between health professionals discussing and sharing information of patients through telecommunication channels, data collection and remote monitoring of patient health outcomes through digital, electronic transmission of prescriptions to pharmacists (electronic prescribing), and the diagnosis and treatment of patients through telecommunication technologies (Smith et al., 2020). A primary focus of digital health is to make health care more accessible and personalized (Office of the National Coordinator for Health Information Technology (ONC), 2019).

Usability can be understood as the extent to which specific users can use a product to achieve specified goals with effectiveness (accuracy and completeness), efficiency (resources needed for effectiveness), and satisfaction (comfort and acceptability) in a specific usage context (ISO 9241-11, 1998). Usability is not just a single element or feature; several factors are responsible for a system's overall usability (Alshamari, 2016). The relationship between certain factors makes them essential in specific applications (Alshamari, 2016). Factors such as efficiency, effectiveness, user satisfaction, ease of use, and learning ability will potentially be relevant in this review (Alshamari, 2016). Lack of usability, proper functionality, security, and the ability to resolve and manage different pathologies in real environments have been associated with dissatisfaction and a high dropout rate in telehealth.

Foundations for usability assessments were established in the 1990s by ISO (ETR 095, Human factors; guideline for usability assessments of telecommunications systems and services) and research. Effectiveness and efficiency are part of system performance. Both parameters can be objectively measured by evaluating how users achieve certain goals with the developed product, performing specific tasks. Subjectively captured in attitude measures, satisfaction comprises what the user thinks of the system and its components. Performance and attitude measures do not have to be related (ISO 9241-11, 1998).

For this review, we will consider primary health care services as the first point of contact for health care, any rehabilitation, therapeutic, preventive, and supportive health care being delivered at an individual or community level, or both, or bringing health services where people work and live, which mainly applies to low-income people. Primary health care is considered the foundation of the health system and the principal vehicle for achieving good health and well-being for all people.

The primary care professionals who provide care to patients with hypertension and diabetes are physicians, nurses, physiotherapists, pharmacists, occupational therapists, social workers, biomedical, nutritionists, speech therapists, dentists, psychologists, and physical education professionals.

Strategy for preparing the research

Phases of this review:
0. Identification of the need for a review
1. Preparation of a proposal for a review
2. Development of a review protocol
3. Protocol registration in PROSPERO
4. Identification of research
5. Selection of studies
6. Study quality assessment
7. Data extraction
8. Data synthesis
9. Report and recommendations

Ethical considerations

There is no conflict of interest in this study conduction. Systematic reviews do not require the approval of a research ethics committee.

Financing source

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Report

The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines will be used in this systematic review (Liberati et al., 2009) if clinical trials are included or MOOSE Guidelines for Meta-Analyses and Systematic Reviews of Observational Studies (Stroup et al., 2008) if observational studies are included. The review will follow Cochrane's recommendations (Higgins et al., 2022).

The research project was registered in the International Prospective Registry of Systematic Reviews (PROSPERO) (CRD42021296887) and published in a scientific journal.

MATERIALS AND METHODS

Study Design

This is a systematic review protocol.

Research Question

The acronym PIOT/PEOT (population, intervention/exposure, outcome, time) (Brasil. Ministério da Saúde., 2014) was used to describe all components related to the identified problem and to structure the research question: How do healthcare professionals rate telehealth usability in the care of patients with non-communicable diseases (hypertension and diabetes) from COVID-19 pandemic onwards?

Table 1 presents the description of the components of the PIOT/PEOT framework used as the basis for the research question for the literature search. For the research question, a comparator is not needed.

Population	Healthcare professional
Intervention or Exposure	Telehealth in non-communicable diseases (hypertension and diabetes) from COVID-19 pandemic onwards
Outcome	**Primary:** Usability or ease of use on patient care **Secondary:** - Satisfaction (acceptance) - Impression of their patient's satisfaction - Contexts in which the mobile devices are used
Time	From March 2020

Table 1. PIOT/PEOT framework

Outcome definition

Primary Outcomes

- Usability or "ease of use" on patient care. In the usability evaluation, the primary outcome was defined as the extent to which specific users can use a product to achieve specific goals with effectiveness, efficiency, and satisfaction in a specified context of use (ISO 9241-11, 1998).

Secondary Outcomes

- Satisfaction (acceptance).
- Impression of their patient's satisfaction.
- Contexts in which mobile devices are used.

Variables analyzed

Independent variable (predictor)

- Telehealth

Dependent variable (outcome)

- Usability

Usability can be evaluated in several ways. The main ones are through questionnaires and specific scales. Suppose some studies use scales to assess the usability of telehealth. These will be considered ordinal qualitative variables and presented in tables with numbers and frequency. The main characteristics of interest will be extracted and analyzed for studies that use questionnaires. Suppose it is possible to compare the usability of any specific system that used the same scale (at least three studies). In that case, data will be extracted, and a meta-analysis of these results will be performed.

Study Population

For this systematic review, we will include all categories of health professionals caring for patients with hypertension and diabetes who have used telehealth during the COVID-19 pandemic.

Eligibility criteria for considering studies for this review

Eligibility criteria will be based on the Patient/Population-Exposure-Outcome-Time (PEOT) structure.

Inclusion criteria

Clinical trials, prospective cohort studies, and observational studies that used quantitative or qualitative methods, such as questionnaires, surveys, or interviews, to assess the usability of telehealth from the perspective of the health professional in the care of patients with hypertension and diabetes from the pandemic of COVID-19, published in English, Spanish or Portuguese, as of March 2020.

We will endeavor to include all studies that meet the inclusion and exclusion criteria, including contacting authors for unavailable studies.

Exclusion Criteria

Studies that do not refer to research questions. Studies that do not report health professionals' usability with telehealth. Incomplete articles, abstracts, review articles, editorials, books, scholar papers, dissertations, theses, and scientific event proceedings.

Table 2 describes the PEOT/PIOT framework components used to build the research question based on MeSH/Entree terms for the literature search.

Term		OR	AND
Population	Healthcare professional		
Intervention or exposure	Telehealth	Digital health = Telemedicine Health mobile Healthcare = Telecare Telehealth = telemedicine e-Health = telemedicine Mobile health/mHealth Telehealthcare Telerehabilitation Teleconsultation Telemanagement Remote physiological Telenurse Telehealth Telemonitoring (DeCs) e-Health	Chronic disease illness Non-communicable disease Long-term disease Cardiovascular disease Diabetes Hypertension COVID-19 Pandemic. Usability **<u>Outcome:</u>** Usability Evaluation Teletreatment “Ease-of-use” Monitoring Remote User experience
Time	from March 2020		

Table 2. MeSH/Entree terms for the literature search

SEARCH STRATEGY

Qualifications of researchers

Researchers from various areas of health and linguistics will be included.

Search strategy

The search will occur within a month of registering with the International Prospective Register of Systematic Reviews (PROSPERO). We re-ran the search strategies in October 2020.

Literature search, databases, and registries searched

The literature search will be conducted by three independent reviewers using the following databases: MEDLINE (via PubMed) and then adapted for use in the following databases: Embase, BIREME, IEEE Xplore, BVS,
manual search on academic google, and gray literature. Whenever possible, the following filters will be used: the Publication date 2020, 2021, or 1 year; language: English, Portuguese, and Spanish; type of studies: only in humans. Details on the search strategy are provided in Appendix A.1.

Detailed search data for the identified studies and the demonstration of information for each phase will be presented in a flowchart according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method (Page et al., 2021).

Selection of studies

The search and selection of studies will be carried out blindly and independently by three evaluators, two from health and one from letters (linguistics), and segmented into phases: identification, screening, and inclusion.

Titles and abstracts of identified studies will be independently screened for eligibility. Full-text versions of papers not excluded at this stage will be obtained for detailed review. Then, potentially relevant studies will be independently assessed to determine if they met the inclusion criteria. Differences of opinion will be discussed until a consensus is reached.

In the identification phase, the search will be carried out in the databases using descriptors and filters. After identifying the number of studies, duplicates will be removed. In the screening phase, studies will be selected based on the inclusion/exclusion criteria after reading the titles, abstracts, and texts. The included studies will be selected for qualitative and quantitative analysis in the inclusion phase. Excluded articles will be presented together with the reasons for exclusion.

Risk of bias and methodological quality analysis

The risk of bias and the methodological quality of the included studies will be independently analyzed by two reviewers, one from the health area and one from the linguistics area. The decision will be made by consensus. If necessary, a third reviewer will be convened. The data for the critical quality analysis will be consolidated in a specific form for evaluation.

For the risk of bias in randomized trials, the revised RoB 2.0 tool will be used (JOANNA BRIGGS INSTITUTE, 2014). The domains included in the RoB2 tool cover the types of bias that affect the results of randomized trials, which are: risk of bias due to the randomization process, risk of bias due to deviations from intended interventions, risk of bias due to lack of data from the result, risk of bias in the measurement of the result and risk of bias in the selection of the reported result.

To analyze the methodological quality of observational studies, the Joanna Briggs Institute (JBI) for observational studies will be used (JOANNA BRIGGS INSTITUTE, 2014). This tool aims to assess the methodological quality of studies and determine the extent of possibilities for bias, conduct, and analysis. The JBI tool presents eight questions which are:

1. Were the criteria for inclusion in the sample clearly defined?
2. Were the study subjects and the setting described in detail?
3. Was the exposure measured in a valid and reliable way?
4. Were objective, standard criteria used for the measurement of the condition?
5. Were the confounding factors identified?
6. Were strategies to deal with confounding factors stated?
7. Were the outcomes measured in a valid and reliable way?
8. Was appropriate statistical analysis used?

The studies will be categorized according to the percentage of positive responses to the questions in the assessment instrument. The risk of bias will be considered high when the study obtains below 49% of responses classified as "yes"; moderate when the study obtains 50% to 69%, and low when the study reaches

more than 70% of a "yes" score (JOANNA BRIGGS INSTITUTE, 2014).

Assessment of heterogeneity

To test heterogeneity, the I^2 test of Higgins and Thompson will be used. Higgins et al. suggest a scale in which an I2 value close to 0% indicates non-heterogeneity between studies, close to 25% indicates low heterogeneity, close to 50% indicates moderate heterogeneity, and close to 75% indicates high heterogeneity between studies (Deeks, J., & Higgins, J.P.T., 2020; Higgins, J.P.T., Thompson, S.G., Deeks, J., 2003).

Data extraction and data synthesis

Rayyan Software from Qatar Computing the Research Institute (QCRI) will be used for data management and to remove duplicates during data analysis (Ouzzani et al., 2016). In addition, the Mendeley Desktop software, version 1.19.8 (Glyph, 2020), will be used to manage bibliographic references.

After the final selection, data will be extracted and the characteristics of the included studies will be broken down into a pre-defined model, including title, scientific journal, year of publication, type of study, the population of interest, country, and outcomes, and more findings of interest for the review as the type of connection used, equipment for the digital tool, the level of satisfaction in using the tool and time it takes the user to finish a task. A summary of qualitative findings (SoQF) table of the review will be displayed for an Evidence Profile.

Epidemiological characteristics such as study country, sex, age of health professionals, professional category, and level of health care used will be identified and described for studies included in this systematic review. A qualitative analysis of the usability results will be performed for the review.

Description of statistical methods and software used

After selecting the studies and identifying the outcome variables, a software review Manager (RevMan) (Deeks, J., & Higgins, J.P.T., 2020), version 5.4.1, will be used for statistical analysis, with a 95% confidence interval, heterogeneity (Cochran's Q test, Higgins and Thompson's I^2) and total effect size (Z), with a significant p-value <0.05.

If it is possible to perform the meta-analysis, use the score values of the scale to assess usability, will be used for measures of central tendency, mean and standard deviation of the mean will be used. To analyze the variance between studies, the Tau-square will be used and subsequently used to conduct the analysis of random effects. In the presence of heterogeneity, alternative analyzes, such as subgroup meta-analysis, will be considered to explain the variability between groups. Random effect models can be used depending on the number of studies selected. If the number of studies is too small, impacting the accuracy of the estimate of variation between studies, data will be reported separately and not as a summary measure. A funnel chart will be established. Hypothesis tests can also be performed. In the case of normal distribution, Egger's test can be used depending on the number of studies included. If the distribution is skewed, the Begg test can be used. The visual evaluation of the funnel chart and statistical hypothesis tests can be used if a significant number of studies are included in the meta-analysis. If possible, the meta-analysis's data will be synthesized through a forest graph using the Software Review Manager (RevMan 5.4) (Deeks, J., & Higgins, J.P.T., 2020).

Report and recommendations

The Qualitative Research Checklist of the Critical Appraisal Skills Program (CASP), which is part of the Oxford Center for Triple Value Healthcare Ltd, will be used to evaluate the studies qualitatively and systematically. This will be done by two reviewers independently, one from the health area and one from the literature area, and will be presented in a supplement. This tool analyzes whether the review results are valid, what the results are, and if the results will help locally.

The CASP tool presents ten questions which are:

1. Was there a clear statement of the aims of the research?
2. Is a qualitative methodology appropriate?
3. Was the research design appropriate to address the aims of the research?
4. Was the recruitment strategy appropriate to the aims of the research?
5. Was the data collected in a way that addressed the research issue?
6. Has the relationship between researcher and participants been adequately considered?
7. Have ethical issues been taken into consideration?
8. Was the data analysis sufficiently rigorous?
9. Is there a clear statement of findings?
10. How valuable is the research?

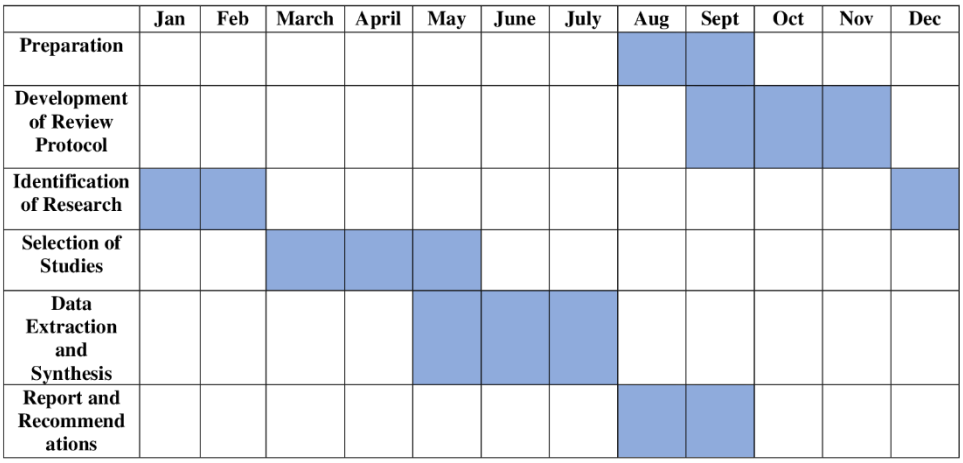

Figure 1. Gantt Chart Template for Project Timetable

The answers are "Yes", "Can't tell" or "No". After this, two reviewers (one from the health area and one from the literature area) independently analyzed the quality of evidence and strength of recommendation by the GRADE-CERQual approach (Lewin et al. 2018). This tool is based on a systematic system and transparent framework to assess confidence in individual review results based on consideration of four components:
(1) methodological limitations,
(2) coherence,
(3) adequacy of data, and
(4) relevance.
The methodological analysis of the included studies will be carried out in steps (Munthe-Kaas et al. 2018). Step 1 was to collect and consider the information necessary to report methodological limitations. Step 2 will assess the body of data that contributed to each review finding and decide whether there was a consensus on methodological limitations. In step 3, a judgment will be made on the seriousness of the concerns, and the judgment was justified.
The result of the recommendation will be considered:

- High confidence: if it is highly likely that the outcome of the review is a reasonable representation of the phenomenon of interest. No or very minor concerns regarding methodological limitations/coherence/adequacy/relevance that are unlikely to reduce confidence in the review finding.
- Moderate confidence: if it is likely that the review finding is a reasonable representation of the phenomenon of interest. Minor concerns regarding methodological limitations/coherence/adequacy/relevance that may reduce confidence in the review finding.
- Low confidence: if it is possible that the review finding is a reasonable representation of the phenomenon of interest. Moderate concerns regarding methodological limitations/ coherence/adequacy/relevance that will probably reduce confidence in the review finding.
- Very low confidence: if it is not clear whether the review finding is a reasonable representation of the phenomenon of interest. Serious concerns regarding methodological limitations/ coherence/adequacy/relevance that are very likely to reduce confidence in the review finding.

Project timetable

The review timeline is shown in **Figure 1**.

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Conflict of Interest

The authors have no personal or financial conflicts of interest related to this study protocol.

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