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Study Protocol

Validity and Reliability of Mobile Applications in Physical Therapy: Protocol for a Systematic Review

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Abstract

Background: Due to technological advancements, mobile applications have aided in the enhancement of assessment, treatment, and exercise programs for the major stakeholders in healthcare. However, there is a lack of preponderance of the evidence of reliability and validity of these mobile applications among traditional tools/methods used in rehabilitation. Thus, this systematic review aims to identify and synthesize existing studies on evidence of the validity and reliability of mobile applications used in physical therapy. **Methods:** Included in this systematic review are studies written in English that tested the PT mobile application in healthy individuals, compared it with gold standard equipment, and tested the app's validity and/or reliability. A literature search will be conducted on nine databases, and two electronic software will be used - (1) Mendeley and (2) Rayyan. The Brink and Louw (2012) Critical Appraisal Tool will be used to assess the validity and reliability of the eligible articles. A qualitative review and meta-analyses will be conducted for data synthesis. **Expected Results:** This study will contribute to current knowledge and healthcare practices by providing information on valid and reliable PT applications, synthesizing evidence on mobile applications that will improve PT assessments and interventions, and which applications can be further studied and developed. Overall, the results of this study will give information on how PT mobile applications can complement standard test measures or procedures in physical therapy such as assessments, interventions, and home exercise programs.

Key Words*: mHealth applications, psychometric properties, rehabilitation, technology*

INTRODUCTION

Mobile health (mHealth), wireless devices for health services and public health, have become a valuable resource for healthcare professionals, patients, and clients.[1] mHealth uses applications (apps) on mobile or tablet devices that provide healthcare services, such as telehealth computer-based systems. These apps are programs based on mobile devices that perform specific healthcare functions.[2] There has been an increase in the number of mHealth apps available for iOS and Android. Due to the wide use of mobile devices, mobile health apps are used frequently in clinical settings because of their greater accessibility, portability, agility, and ease of use.[3]

Mobile apps can significantly improve clinical outcomes in physical therapy in terms of efficiency and effectiveness[2,4] as PT services and information become more available via mobile devices. Mobile connectivity is gradually becoming an essential platform. In addition, the COVID-19 pandemic has significantly influenced the development and use of mobile applications in health and rehabilitation.[5]

For instance, a mobile app is available for ACL patients/clients who require physical therapy

services to receive a rehabilitative program even without seeing a therapist in person. Furthermore, the app can track the process of pre-and post-operative periods, which is extremely important for a successful functional recovery.[6] Existing mobile PT applications can help assess and examine conditions and evaluate test outcomes such as mobility,[7] joint range of motion,[8] gait,[9] and balance.[10]

Although several mobile apps are available in PT, their accuracy and effectiveness in rehabilitation assessment and treatment remain uncertain. It is essential to determine whether these apps are valid and reliable. Mobile apps must be supported by evidence of reliability (i.e., consistency in measures) and validity (i.e., reflect the intended measures) before being used in clinical practice.[10] The empirical evidence on the use of mobile PT applications has been studied through systematic reviews[11,12] that include detailed analyses of typology, individual psychometric results, and effectiveness results.

However, to the authors' knowledge, no systematic review of the existing literature examines the combined evidence of the validity and reliability of the available PT mobile applications. These measures are critical for evaluating the quality of a tool and vital indicators of its effectiveness.[10,13] A review about establishing the psychometric properties essential in PT will help show how existing mobile apps can supplement the integrity and quality of standard test measures, assisting with the standardization, basis for planning rehabilitation, and objectification of the test outcomes.

Furthermore, the findings will help researchers develop and evaluate PT mobile apps in a standardized manner. Improving clinical management and data quality can be achieved by considering the validity and reliability of the existing PT mobile apps.

Objectives. This systematic review aims to identify and synthesize studies on evidence of the validity and reliability of mobile applications in physical therapy. This systematic review will address the question: "What is the existing evidence of the validity and reliability of mobile applications in physical therapy?"

METHODS

The systematic review will adhere to the structure and reporting guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA 2020).[14] The systematic review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on December 9, 2021, and was last updated on February 2, 2022 (registration number CRD42021281151).

Eligibility Criteria. Studies that will be included in this systematic review will be selected according to the criteria below.

Population. Studies that conducted tests in healthy individuals (e.g., healthy athletes or recreationally healthy active adults) will be included. Otherwise, studies that conducted tests in individuals with musculoskeletal or neurologic impairment and/or presence of injury and disease will be excluded.

Intervention. Studies that tested mobile applications in physical therapy (for assessment, health information/patient education/PT exercises; intervention/treatment; specific PT-related apps; monitoring strategies) will be included. Otherwise, instruments other than mobile applications (e.g., computer software, wearable devices such as sensors or electrodes) will not be included in the study.

Comparator. The mobile application should be compared with the gold standard or scientific or laboratory-based equipment.

Outcome. This systematic review will only include studies for validity and/or reliability/measure of agreement of mobile applications in PT.

Validity and Reliability Measures. Measures consist of of typical error, mean absolute error, Bland and Altman's limits of agreement, correlation coefficient, standard error of estimate for validity.For relative reliability, studies which measured intraclass correlation (ICC) are eligible for the review. For absolute reliability, studies, which measured standard error of measurement (SEM), the coefficient of variation (CV), or Bland and Altman's limits of agreement, will be included.

Language. Only full-text studies written in English will be included. Editorials, commentaries, discussion papers, conference abstracts, reviews, and book chapters will be excluded.

Device. Studies that tested applications that are available in either Android or IOS devices will be included.

Timing. This review will include articles that have been published from inception to present

Information Sources. The search will employ using the nine electronic databases: Cochrane Library, Web of Science®, PubMed®, Science Direct, Scopus®, Proquest, MEDLINE®, SPORTDiscus, and CINAHL complete from inception to November 19, 2021. All reference lists of included studies will be reviewed to identify any relevant studies that might have been missed during the database search.

Search Strategy. From November 17, 2021, to November 19, 2021, two authors conducted a preliminary scoping search. The keyword combination that will be used in the study includes ("validity" OR "accuracy" OR "Agreement"), ("reliability" OR "consistency" OR "precision"), ("mobile app" OR "mhealth"), and ("physical therapy" OR "physiotherapy" OR "rehabilitation"). An outline of the search strategy that will be applied to each database is shown in Table 1.

Study Records

Data Management. The guide questions are open-ended Records will be stored and organized using Endnote X9.3.3 (Clarivate Analytics, Philadelphia, PA, USA). This software will help organize and manage references and format citations.

Table 1. Search Strategy

Database searched	Search Terms	Number of Article Hits
CINAHL	("Validity" OR "Accuracy" OR "Agreement") AND ("reliability" OR "consistency" OR "precision") AND ("mobile application*" OR "mobile app*" OR "mhealth") AND ("physical therapy" OR "physiotherapy" OR "rehabilitation")	
COCHRANE	("Validity" OR "Accuracy" OR "Agreement") AND ("reliability" OR "consistency" OR "precision") AND ("mobile application*" OR "mobile app*" OR "mhealth") AND ("physical therapy" OR "physiotherapy" OR "rehabilitation")	
MEDLINE	("Validity" OR "Accuracy" OR "Agreement") AND ("reliability" OR "consistency" OR "precision") AND ("mobile application*" OR "mobile app*" OR "mhealth") AND ("physical therapy" OR "physiotherapy" OR "rehabilitation")	
PROQUEST	("Validity" OR "Accuracy" OR "Agreement") AND ("reliability" OR "consistency" OR "precision") AND ("mobile application*" OR "mobile app*" OR "mhealth") AND ("physical therapy" OR "physiotherapy" OR "rehabilitation")	
PUBMED	("Validity" OR "Accuracy" OR "Agreement") AND ("reliability" OR "consistency" OR "precision") AND ("mobile application*" OR "mobile app*" OR "mhealth") AND ("physical therapy" OR "physiotherapy" OR "rehabilitation")	
SCIENCE DIRECT	("Validity" OR "Accuracy") AND ("reliability" OR "consistency") AND ("mobile application" OR "mobile app") AND ("physical therapy" OR "physiotherapy")	
SCOPUS	"Validity" OR "Accuracy" OR "Agreement" AND "reliability" OR "consistency" OR "precision" AND "mobile application*" OR "mobile app*" OR "mhealth" AND "physical therapy" OR "physiotherapy" OR "rehabilitation"	
SPORTDISCUS	("Validity" OR "Accuracy" OR "Agreement") AND ("reliability" OR "consistency" OR "precision") AND ("mobile application*" OR "mobile app*" OR "mhealth") AND ("physical therapy" OR "physiotherapy" OR "rehabilitation")	
WEB OF SCIENCES	("Validity" OR "Accuracy" OR "Agreement") AND ("reliability" OR "consistency" OR "precision") AND ("mobile application*" OR "mobile app*" OR "mhealth") AND ("physical therapy" OR "physiotherapy" OR "rehabilitation")	

Selection Process. Following the PRISMA guidelines, as shown in Supplement A, two primary reviewers will remove duplicates using Mendeley and screen articles by title and abstract using Rayyan. This software uses semi-automation to speed up the initial screening process. A step-by-step screening process is then performed on relevant full-text and selected studies. Two primary reviewers will separately evaluate the potential full-text articles to determine their eligibility based on the criteria. A third reviewer will be assigned to resolve discrepancies in the selected papers to achieve a consensus.

This will be followed by a manual search for data extraction and methodological assessment.

Data Collection Process. All relevant details on the review will be extracted in MS Excel, and the data collected will support the narrative synthesis of desired outcomes and potential meta-analysis requirements. If the published study data is ambiguous or missing, the authors will contact the corresponding authors for clarification. Using an adopted standardized form from a previous study[15] with similar aims, two reviewers will extract the data independently. In addition, a third reviewer will verify the consistency of the data.

Data Items. The following information will be extracted from each included study. It will be encoded in MS Excel: characteristics of individual studies (e.g., author and year of publication), sample size (n), demographic characteristics of the participants (e.g., age, height, weight, and BMI), mobile applications (e.g., name and characteristics), outcomes (validity and reliability), outcome measure, experimental protocol, and findings.

Outcomes and Prioritization. In this review, the primary outcomes are the existing evidence on the findings of the validity and reliability of mobile applications in physical therapy. These include applications based on the use and function such as assessments, outcome measures, screening, interventions, and clinical management in all populations and conditions.

Concurrent validity using standard error of measurement (SEM), coefficient of variation (CV), and Bland–Altman bias, and intra-rater test-retest reliability using SEM, CV, intraclass correlation (ICC), minimum detectable change (MDC), inter-rater reliability, and other parameters of validity and reliability are considered indicators for the primary outcomes.

Moreover, different outcomes that may emerge from the review include applications with/without standard protocols and procedures that could form a basis for potential future studies.

Risk of Bias in Individual Studies. The methodological quality of the eligible studies will be assessed using the Brink and Louw Critical Appraisal Tool.[16] The tool was designed for use in systematic reviews investigating the validity and reliability of assessment tools. The test consists of thirteen items; five items are related to both validity and reliability studies, four items to validity studies only, and four items to reliability studies.

Items one, two, ten, twelve, and thirteen evaluate both the validity and reliability by assessing if human subjects are used, clarification of the qualification or competence of the raters, execution of the test, withdrawals from the study, and appropriate statistical methods respectively. Items three, seven, nine, and eleven are for validity studies only. These criteria are assessed by evaluating the following: if the reference standard was explained, if the period between the reference standard and the index test was short enough to reasonably ensure that the target condition did not change between the two tests, if the reference standard was independent of the index test, and if the execution of the reference standard was described in sufficient detail, respectively.

Furthermore, all remaining items are for reliability studies as they assess if interrater and intra-rater reliability was tested if the order of examination was varied and if the stability of the measured variable is taken into account when determining the suitability of the time interval between repeated measures. The questions will be scored as 'yes,' 'no,' or 'not applicable. This will be done independently by two reviewers. In case of any disagreement, a third reviewer will be assigned to resolve it.

A study was considered high quality if it scored at least 60%, as done in previous research with similar aims.

Data Synthesis. Considering the possible heterogeneity in the design, objectives, methods, and synthesis of the studies, the researchers plan to conduct a qualitative review and a meta-analysis to synthesize the data. The researchers will describe and analyze qualitative content using a narrative review to determine the outcome and applicability of the findings. The reviewed articles will be integrated and synthesized using qualitative analysis. The extracted data will be categorized according to the area used in PT.[12]

In addition, if the data collected will be appropriate for quantitative analysis, the researchers will present the quantitative data using a forest plot in the meta-analysis. A meta-analysis, if possible, will be performed to determine the statistical significance of outcomes, effects, and application of findings gathered from the included studies. The authors will use mean differences assuming that all data in the included studies are continuous.

Further, the aggregated intervention effect estimates are calculated as a weighted average of the effect estimates in each study. The synthesized results will be visualized using a forest plot to display effect/point estimates (e.g., mean) and confidence intervals (e.g., 95%).[17] The researchers will only be able to discern if a meta-analysis will ensue once they have viewed the data derived for the study.

Confidence in Cumulative Evidence. GRADE (Grading of Recommendations, Assessment, Development, and Evaluation) will be used to evaluate the strength of the overall body of evidence.

EXPECTED RESULTS

In line with the study's objective, the systematic review will develop a synthesized outline of the information regarding the existing evidence on the validity and reliability of mobile applications within the scope of physical therapy. The aforementioned applications are not limited to goniometric, strength, and outcome measurement tools. The study will provide information that may be important to (1) developing valid and reliable assessments and interventions, (2) identifying which mobile applications are suitable for clinical use by physical therapists, and (3) determining which mobile applications can be further researched and developed.

The study will provide a summary and may serve as a basis for setting guidelines regarding valid and reliable mobile applications that can be used in physical therapy. Additionally, it will enable standardization and objectification of outcomes by giving information on how existing mobile applications can complement standard test measures and procedures in the field of PT.

Individual Author's Contributions

The study review conceptualization was the collective effort of all authors. In addition, all authors contributed to the initial search and writing of the protocol.

Disclosure Statement

No sources of support or funding were provided for this review.

Conflicts of interest

There are no conflicts of interest declared by the authors of this study.

Amendments

Important protocol amendments post-registration will be recorded and reported in the publication.

Supplementary Materials

Supplementary Material A. PRISMA 2020 Flow Diagram

Supplementary Material B. PRISMA-P 2015 Checklist

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