Literature Review

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A SCOPING REVIEW OF MHEALTH TECHNOLOGIES FOR PATIENTS UNDERGOING HAEMODIALYSIS

Teknologi Mobile Health untuk Pasien yang Menjalani Hemodialisis: Scoping Review

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Abstract

Background: The prevalence of patients requiring haemodialysis increases annually, highlighting the need for improved quality of care. Haemodialysis care involves several key aspects, including monitoring, education, and patient connectivity. The availability of mobile health (mHealth) technology enhances the effectiveness and efficiency of patient monitoring compared to conventional methods, ultimately improving patients' quality of life.
Aims: To map the development, types, and impact of mHealth technologies on patients undergoing haemodialysis.
Methods: We conducted a scoping review following the Arksey and O'Malley methodological framework. We searched PubMed, Scopus, ScienceDirect, Google Scholar, CINAHL, and Sage Journals to identify relevant studies describing integrated mobile health applications for monitoring patients with Chronic kidney disease (CKD) undergoing haemodialysis. Two independent reviewers screened and categorised findings based on predefined synthesis questions. Eleven studies representing various mHealth technologies were included. The PRISMA-ScR guidelines for scoping reviews were followed to ensure comprehensive reporting of results.
Results: Out of 1,200 papers, 11 studies representing mHealth technologies were included. Most respondents were patients, though several articles also involved healthcare providers. We map our findings into three themes: the functionality of the applications, the types and features of mHealth technologies, and their impact.
Conclusion: mHealth can be implemented as web-based or application-based platforms, offering innovative solutions for monitoring, education, and enhanced connectivity between patients and healthcare providers.

Keywords: mHealth, haemodialysis, quality of life, monitoring, CKD

Abstrak

Latar Belakang: *Prevalensi pasien yang memerlukan hemodialisis meningkat setiap tahun, sehingga diperlukan pelayanan yang berkualitas. Pelayanan hemodialisis membutuhkan beberapa aspek pendukung, seperti pemantauan, edukasi, dan koneksi. Ketersediaan teknologi mobile health (mHealth) membuat pemantauan pasien menjadi lebih efektif dan efisien dibandingkan cara konvensional, sehingga dapat meningkatkan kualitas hidup pasien.*
Tujuan: *Studi ini bertujuan untuk memetakan perkembangan, jenis, dan dampak aplikasi mHealth pada pasien yang menjalani hemodialisis.*
Metode: *Tinjauan cakupan ini dilakukan berdasarkan metodologi dari Arksey dan O'Malley. Database PubMed, Scopus, ScienceDirect, Google Scholar, CINAHL, dan Sage jurnal digunakan untuk mengidentifikasi penelitian relevan terkait integrasi aplikasi kesehatan seluler untuk memantau pasien dengan Penyakit ginjal kronis (PGK) yang menjalani hemodialysis. Proses penyaringan dilakukan oleh dua penulis secara independent dan untuk mensintesis hasil menggunakan pengkategorian. Sebanyak 11 penelitian yang mewakili teknologi mHealth. Pelaporan hasil penelitian menggunakan PRISMA-ScR.*
Hasil: *Sebanyak 11 dari 1200 artikel teridentifikasi sebagai artikel yang relevan. Sebagian besar responden yang terlibat adalah pasien, namun beberapa artikel juga melibatkan penyedia layanan kesehatan. Kami memetakan temuan kami ke dalam tiga tema, yaitu: cara kerja aplikasi, jenis dan fitur, serta dampak teknologi aplikasi.*
Kesimpulan: *Aplikasi mHealth dapat diterapkan sebagai platform berbasis web atau aplikasi, yang dapat menjadi pilihan teknologi inovatif untuk pemantauan, edukasi, dan meningkatkan hubungan antara pasien dan penyedia layanan kesehatan.*

Kata kunci*: Aplikasi, hemodialisis, kualitas hidup, pemantauan, PGK*

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Introduction

Chronic kidney disease (CKD) is a significant challenge for the health sector, affecting millions of people worldwide. The global prevalence of CKD from stages 1 to 5 reaches approximately 843.6 million people, meaning that 1 in 10 individuals is affected by this condition (Lancet, 2020). CKD can lead to a reduced quality of life and various complications. Previous research indicates that the quality of life in CKD patients progressively and significantly declines across all stages (Kefale *et al*., 2019). Haemodialysis is one of the most common therapies administered to patients with CKD (Murdeshwar, 2024).

Patients undergoing haemodialysis require consistent monitoring, education, and reminders about their treatment (Tsai *et al*., 2021). Traditionally, these needs have been managed through conventional, paper-based methods (Torabikhah *et al*., 2023). However, using paper records often results in the loss of critical clinical data. Mobile health (mHealth) technologies are needed to address this issue to enhance medical compliance. mHealth offers a promising solution to the challenges of chronic care by utilising mobile technologies to improve chronic disease management (Patel and Shortliffe, 2023).

mHealth is a form of e-health defined as healthcare services and health-related information provided and accessed using the internet, mobile devices, computers, and information technology (da Fonseca *et al*., 2021). Web and mobile applications are key components of mHealth technologies. As an emerging strategy, mHealth has the potential to become a trusted source of relevant treatment information, significantly improving patients' quality of life and health outcomes while reducing the social, economic, and healthcare burdens associated with chronic diseases (Rowland *et al*., 2020). In the context of CKD management, mHealth can facilitate patient education, support behaviour engagement (such as medication adherence and dietary modifications), and enhance patient-provider communication (Schrauben *et al*., 2021). Previous studies, such as Ørsted Schultz *et al*. (2022), have demonstrated that mHealth technology is feasible, well-accepted, and increases patients' ability to adhere to their desired therapy modality. Similarly, Nurati *et al*. (2024) found that digital health technology is more effective in improving patient knowledge, confidence, and compliance with medical recommendations.

According to Schmidt (2021), haemodialysis patients are prepared to use cell phones to assist with their everyday medical needs. Patients with kidney disease are eager to incorporate mHealth into their healthcare regimen and possess the necessary skills, interest, and capability to do so. mHealth plays a crucial role in supporting patients' successful self-management of their treatment. Therefore, developing an effective monitoring system is essential for the design of mobile dialysis devices.

Research articles specifically addressing mHealth technology in the context of haemodialysis is limited. Therefore, an analysis is required to map and synthesise the available evidence on mobile applications as interventions for patients with CKD undergoing haemodialysis.

Method

This research uses the scoping review method due to the heterogeneity of the existing literature. According to Peters *et al*. (2015), scoping reviews are particularly useful when the literature is still emerging and complex, making it unsuitable for a systematic review.

This research adopts a scoping review method, integrating articles, explanations, and interpretations from available quantitative and qualitative studies to answer the review questions. Unlike a systematic review, this approach requires identifying all relevant literature across various research designs. Scoping reviews enable researchers to interpret search terms and conduct literature analysis in greater detail as knowledge evolves. No fixed limitations were set for search terms or the selection of relevant studies or studies in advance for this

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purpose. The article selection process is iterative, requiring researcher involvement at each stage and allowing flexibility to revisit steps as needed to ensure a comprehensive discussion of the literature (Arksey and O'Malley, 2005).

We conducted this scoping review following Arksey and O'Malley's methodological framework, which involves five steps: 1) identifying the research questions, 2) identifying relevant studies, 3) selecting studies, 4) charting the data, and 5) collecting, summarising, and reporting the results.

Identifying the research questions

Formulating research questions is important for initiating any research, as it helps explore the problem and guides a thorough investigation (Ratan *et al*., 2018). This review uses the PCC (Population, Concept, Context) framework developed by the Joanna Briggs Institute (McArthur *et al*., 2023). For this study, the PCC framework consists of 1) Population: patients with CKD undergoing haemodialysis, 2) Concept: studies discussing the integration of mobile health (mHealth) for monitoring systems, and 3) Context: haemodialysis settings.

In this study, the research questions are as follows: 1) How do patients and healthcare practitioners' access mHealth technology to manage CKD symptoms? 2) What are the development processes and content features of mHealth technology for managing patients with CKD? 3) What are the impacts of mHealth technology on consistent interventions in the management of patients with CKD?

Identifying relevant studies

To identify relevant studies, we used several keywords based on the research questions. The research keywords, derived from MeSH (medical subject headings) terms, were combined as follows: ((m-health OR mobile-health) AND (dialysis OR haemodialysis) AND (quality of life)). Electronic databases, including PubMed, Science Direct, Google Scholar, Scopus, CINAHL, and Sage Journals, were searched to find journal articles that met the inclusion criteria. Additionally, a hand search was conducted to identify relevant articles cited in studies included in the database searches.

Selection of studies

For the article selection process, we applied the following inclusion criteria: 1) articles published in English, 2) studies involving the use of e-Health, including web-based or mobile applications, 3) empirical research using qualitative or quantitative methods, 4) a focus on patients with CKD undergoing haemodialysis, and 5) published within the past 10 years. Exclusion criteria were: 1) non-English language articles, 2) review articles, and 3) articles where the full text was unavailable.

The database search found 1200 articles for consideration. After removing duplicates, 1122 articles remained for the title and abstract screening. EndNote 20 was used as the reference manager. Independent screening was conducted by S.A. and E.R., who assessed the articles based on the inclusion criteria and categorised them into the following groups: 1) Irrelevant topics, 2) Irrelevant design, 3) Irrelevant population, 4) Non-English, and 5) Articles requiring full-text review. Of the 26 articles screened by abstract, 17 were deemed eligible for full-text review. An independent full-text review by S.A. and E.R., based on the inclusion criteria, resulted in 11 articles being included in the final analysis. According to Arksey and O'Malley (2005), selecting relevant articles should be guided by the research questions rather than the author's critical judgment. The entire selection process is illustrated in Figure 1.

Charting the data

The next stage in composing the article involved creating a chart of the key information obtained from the reviewed articles. In systematic reviews, this process is referred to as data extraction. The information presented includes both general research details and specific data relevant to the study (Arksey and O'Malley, 2005). In this study, 11 articles were selected for extraction. The data chart was managed using Microsoft Excel and included the following information: author, year, country, design, sample size, name

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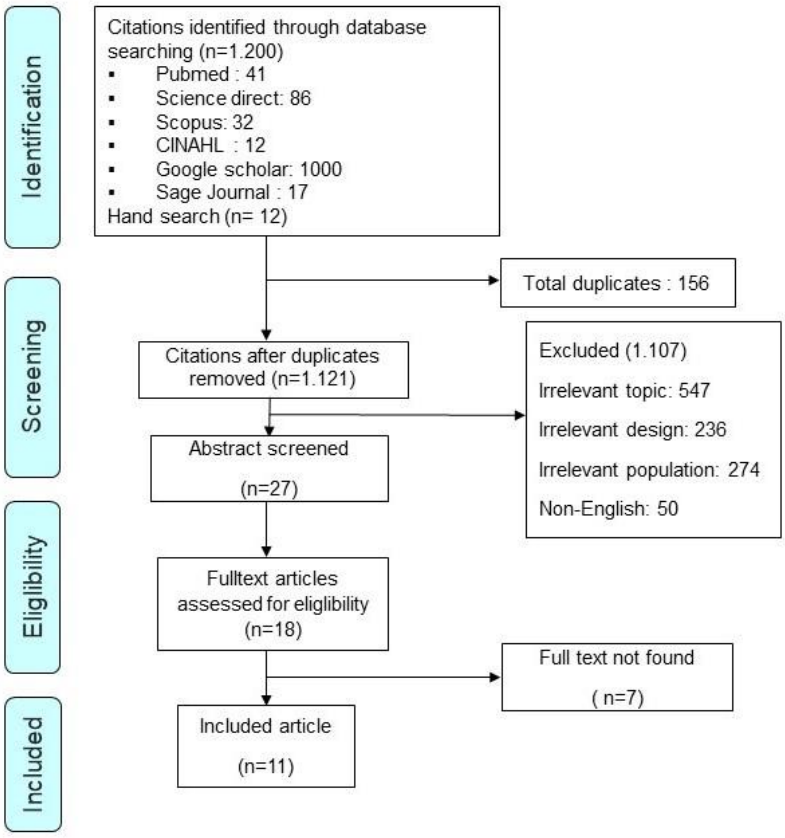

Figure 1 PRISMA Flowchart of the study

and type of mHealth intervention, features, outcomes, and results. The scope of the information presented was determined by an agreement between the two authors.

Compiling, summarising, and reporting the results

In a scoping review, there is no formal 'synthesis' of evidence to present the results. However, the data can be presented in various ways, including identifying related themes within the reviewed articles. These themes are adapted to the main concepts that recur throughout the articles and are aligned with the research questions (Arksey and O'Malley, 2005).

Result and Discussion

Articles were selected from various databases and checked for duplicates, resulting in a total of 156 unique articles. After screening the abstracts, 18 articles were identified as potentially relevant. Following a full-text review, 11 articles were deemed eligible and included in the final analysis. The contents of each article are summarised in Table 1.

Based on Table 1, the majority of studies were conducted in the United States (n=3), followed by the United Kingdom (n=1), Bangladesh (n=1), Spain (n=1), the Netherlands (n=1), Brazil (n=1), Japan (n=1), Australia (n=1), and Taiwan (n=1). Most of the articles involved research that developed and tested applications and web-based studies (non-experimental=1, experimental=3), followed by randomised controlled trials (RCTs) (n=3), a case study (n=1), mixed-method studies (n=2), and a prospective cohort study (n=1). While the participants in all the studies were primarily patients, two studies (n=2) included both patients and healthcare providers.

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Table 1 Extraction data of study characteristics

No	Author (year); Country	Study Design	Sample Size	Result
1.	Aiyegbusi *et al*. (Aiyegbusi *et al*., 2018); United Kingdom	This article uses a mixed-methods approach	This article involves 8 patients	The study reports that using the app to report symptoms remotely is acceptable, effective, and efficient. Healthcare workers also find the app helpful for monitoring symptoms of deterioration in CKD patients, thereby potentially improving the patient's quality of life.
2.	Kiberd *et al*. (Kiberd *et al*., 2018); Canada	single-arm pilot trial	27 patients joined the online portal	Patients used the eHealth portal as intended, utilising online messages for non-emergent health-related concerns. They found the portal easy to use and expressed satisfaction with it.
3.	Sarker *et al*. (Sarker *et al*., 2022); Bangladesh	Randomised control trial	126 participants have been involved in this research: 63 in the treatment group and 63 in the control group.	On average, the quality of life (QOL) improved more in the intervention group than in the control group.
4.	Calvillo-Arbizu *et al*. (Calvillo-Arbizu *et al*., 2019); Spain	Case study	This article involved four patients and several clinicians.	Discussion and user involvement are essential to ensure that the technology adapts to their needs, thereby increasing the level of user acceptance.
5.	Cardol *et al*. (Cardol *et al*., 2023); the Netherlands	Randomised control trial	120 patients with chronic kidney disease	Self-management and psychological aspects have been shown to improve with personalised analysis.
6.	Hernandez *et al*. (Hernandez *et al*., 2018); United States	Pre-post pilot trial	11 patients	Internet-based psychological interventions have been shown to be effective in reducing depressive symptoms in patients undergoing haemodialysis (HD) who experience depression.
7.	Sobrinho *et al*. (Sobrinho *et al*., 2018); Brazil	Pre-post pilot test	8 patients and 3 nephrologists have participated in this research	The use of the app is effective for early referral of patients to nephrologists and provides greater certainty in the diagnosis of CKD.

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No	Author (year); Country	Study Design	Sample Size	Result
8.	Hayashi *et al*. (Hayashi *et al*., 2017); Japan	Pilot test	9 patients with CKD	Mobile applications can enhance the self-management of patients with CKD.
9.	Hand *et al*. (Hand *et al*., 2014); United States	Randomised control trial	39 patients involved	The article showed that using an online algorithm to guide nutritional care on a mobile tablet may be a feasible approach to improving the nutritional status of patients.
10.	Liu *et al*. (Liu *et al*., 2017); Australia	Mixed Method	A field trial involving 3 nurses and 74 patients	This study shows that applications can increase the sense of communication between doctors and patients over the long term. This improvement also leads to increased compliance with treatment and dialysis schedules, as well as improved emotional well-being of patients.
11.	Tsai *et al*. (Tsai *et al*., 2021); Taiwan	A prospective cohort study	The total sample size is 214 patients with CKD (107 in the intervention group and 107 in the control group).	mHealth can improve patients' knowledge of their disease, but it does not necessarily improve self-care behaviour.

Table 2 Extraction of mHealth technologies

No	Type of mHealth	Author (Year); Country	Features of mHealth	Outcome
1.	Mobile Application	Aiyegbusi (2018). United Kingdom	Self-report their symptom, complement clinical parameters, and contain information on the management of patients with advanced CKD.	Self-monitoring, information on the management of disease, and feasibility
2.	Mobile Application	Sarker *et al*. (2022); Bangladesh	Contains health education about fundamental kidney disease, risk factors, and CKD prevention methods using mobile phones.	Quality of life

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No	Type of mHealth	Author (Year); Country	Features of mHealth	Outcome
3.	Mobile Application	Hayashi *et al*. (2017); Japan	Monitoring body weight records, serum potassium, and phosphorus concentrations before dialysis which refer to reference values displayed via graphs.	Clinicals outcomes such as diet and lifestyle and quality of life.
4.	Mobile Application	Liu *et al*. (2017); Australia	The app contains: - Health info - History - Self-alarm - Notification - Emotional info - Feedback from clinicians	Self-monitoring and social well-being in patients undergoing home haemodialysis.
5.	Mobile Application	Tsai *et al*. (2021); Taiwan	Features consist of alert tracking, treatment notification, management of disease, health education videos, interpreting examination results, and feedback features from healthcare providers.	Disease knowledge and self-care behaviour.
6.	Web Based	Kiberd *et al*. (2018). Canada	A medium for communication between patients and healthcare providers regarding treatment, advice, appointment times, and support assessments, integrated with the hospital's information system.	Quality of life, acceptability, and quality of care.
7.	Web Based	Cardol *et al*. (2023); the Netherlands	An electronic module containing psychoeducational information and training related to cognitive behaviour.	Psychosocial functioning and self-management.
8.	Web Based	Hernandez *et al*. (2018). United States	The apps construct psychological aspects such as noticing daily positive events, practicing meditation and mindfulness, and positively reframing stressful events.	Depressive symptoms, quality of life, and dietary adherence.
9.	Web Based	Sobrinho *et al*. (2018); Brazil	This app provides access control, management of medications, allergies, and examinations; monitoring of risk factors for CKD; a history for CKD risk analysis; and CKD risk evaluation.	Assist the CKD early diagnosis and self-monitoring.

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No	Type of mHealth	Author (Year); Country	Features of mHealth	Outcome
10.	Web Based	Hand *et al*. (2014); United States	Guide for nutritional assessment and intervention.	Clinical guidance through screening, assessment, and identification of nutritional diagnosis, etiology, and intervention.
11.	Mobile and web-based Applications	Calvillo-Arbizu *et al*. (2019); Spain	Patient's account: Allows for monitoring and tracking of patient's activities, including a medication checklist, vital signs, and appointments. Doctor's account: The display is similar to the patient's account but with additional functions. Doctors can modify the patient's treatment plan, monitor the patient's condition, and contact the patient. Doctors also have access to all of the patient's medical information.	Adapting to the needs and monitoring of each user based on their technological proficiency and specific requirements, as these can vary.

How the application works

The development of mHealth over time involves several key components, including patients, caregivers, healthcare workers, and programmers. This application was developed to enhance patient compliance with treatment, support self-management through monitoring and diagnostic activities, and improve understanding of health or illness by providing medical and health-related information (both general and personalised) and education (Aiyegbusi *et al*., 2018; Hernandez *et al*., 2018; Sobrinho *et al*., 2018).

Healthcare providers design the content of these applications with specific requirements in mind, such as including health-related information, potential symptoms, and educational content. Once the application is designed for patients, nurses are tasked with monitoring the symptoms reported by the patients or their families and then reporting these findings to the doctor. The doctor can then take an anamnesis and manage the symptoms accordingly (Liu *et al*., 2017; Sobrinho *et al*., 2018; Calvillo-Arbizu *et al*., 2019).

mHealth was developed to facilitate symptom monitoring for patients regardless of their location. Studies have shown that mHealth can be effectively utilised in various settings, such as hospitals, homes, and communities, allowing doctors to provide feedback from anywhere using mHealth technology as the medium (Hand, Leon and Steiber, 2014; Hayashi *et al*., 2017; Liu *et al*., 2017; Aiyegbusi *et al*., 2018; Hernandez *et al*., 2018; Sobrinho *et al*., 2018; Calvillo-Arbizu *et al*., 2019; Sarker *et al*., 2022; Cardol *et al*., 2023). Patients perceive the development of mHealth technology as having a positive impact on their care, particularly in areas of dialysis, such as reducing stress, improving understanding of medications, increasing personal independence, and providing connected access to nephrologists (Kiberd *et al*., 2018).

Types and features of mobile health intervention

Based on the included articles, mHealth applications are divided into two types: mobile applications (Hayashi *et al*., 2017; Liu *et al*., 2017; Tsai *et al*., 2021;

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Sarker *et al*., 2022; Cardol *et al*., 2023) and web-based applications (Hand, Leon and Steiber, 2014; Aiyegbusi *et al*., 2018; Hernandez *et al*., 2018; Kiberd *et al*., 2018; Sobrinho *et al*., 2018; Cardol *et al*., 2023). Some applications are available in both versions (Calvillo-Arbizu *et al*., 2019). In general, both types serve the same function and purpose. They are designed to facilitate user access to the application, aiming to be simple and user-friendly to reduce patient burden (Aiyegbusi *et al*., 2018; Kiberd *et al*., 2018; Sarker *et al*., 2022).

The applications provide several features, including education and information about disease management (Aiyegbusi *et al*., 2018; Tsai *et al*., 2021; Sarker *et al*., 2022). They enable interaction between healthcare practitioners and patients through messaging related to patient care at any time (Kiberd *et al*., 2018; Calvillo-Arbizu *et al*., 2019; Tsai *et al*., 2021). Self-monitoring features allow patients to track symptoms, laboratory results, nutritional status, and required activities (Hayashi *et al*., 2017; Liu *et al*., 2017; Aiyegbusi *et al*., 2018; Sobrinho *et al*., 2018; Calvillo-Arbizu *et al*., 2019; Tsai *et al*., 2021). Two articles reported warning features if medication was not taken or data was not entered (Liu *et al*., 2017; Tsai *et al*., 2021). Additionally, some applications include displays specifically for doctors to monitor patient's conditions (Hand, Leon, and Steiber, 2014; Calvillo-Arbizu *et al*., 2019).

Impact of mobile health intervention

More than half of the publications reported that mHealth positively impacts disease monitoring by making it more organised and effectively managing the development of patients' conditions (Hand, Leon, and Steiber, 2014; Liu *et al*., 2017; Aiyegbusi *et al*., 2018; Sobrinho *et al*., 2018; Calvillo-Arbizu *et al*., 2019; Cardol *et al*., 2023). The interaction between healthcare practitioners and patients is enhanced through real-time messaging related to patient care (Kiberd *et al*., 2018; Calvillo-Arbizu *et al*., 2019). mHealth also supports self-monitoring of symptoms, laboratory results, and required patient activities (Hayashi *et al*., 2017; Liu *et al*., 2017; Aiyegbusi *et al*., 2018; Calvillo-Arbizu *et al*., 2019; Tsai *et al*., 2021). Additionally, certain applications provide specific interfaces for doctors to monitor patient's conditions (Calvillo-Arbizu *et al*., 2019; Tsai *et al*., 2021).

mHealth is designed to address not only the physical condition but also the psychological well-being of patients with CKD. For example, one application uses "emoticons" as markers of the patient's current feelings, serving as a reference for nurses to assess the patient's psychological state (Hernandez *et al*., 2018; Cardol *et al*., 2023).

Several studies have indicated that the quality of life in patients with kidney disease is generally low, but mHealth can improve the quality of life for those undergoing haemodialysis. This improvement is particularly evident in domains such as emotional well-being, kidney disease burden, social interactions, and physical health (Hayashi *et al*., 2017; Hernandez *et al*., 2018; Kiberd *et al*., 2018; Sarker *et al*., 2022). The level of acceptance and satisfaction with mHealth was also measured in some of the included articles, demonstrating overall convenience. This includes ease of patient monitoring, simplicity of mHealth use, and improved access to communication with healthcare workers. Patients reported that mobile health could reduce the distance and time needed to reach healthcare providers (Färber *et al*., 2024).

Findings

This is the first scoping review to map studies of mHealth interventions for patients undergoing haemodialysis. We describe the development and implementation of mHealth interventions targeting patients, families, and healthcare providers. These interventions aim to develop digital-based innovations to improve and facilitate self-management and enhance the quality of life for patients undergoing haemodialysis. Most of these mHealth programs were developed to provide digital information and education and to facilitate closer communication with health professionals. Generally, the

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interventions last for 3-4 weeks.

A unique finding in this review is that mHealth serves not only as a means of information and education but also as an early diagnostic and detection tool, reminding patients to engage in self-management. If the patient fails to follow the suggested self-management, the application is equipped with an “alarm” feature. Overall, patients and healthcare providers expressed satisfaction with the accessibility of mHealth, whether as a mobile application or a web-based platform and felt that online features could offer competitive and enhanced support.

Our review focused on the impact of mHealth on comprehensive clinical outcomes, improved communication between patients and healthcare providers, and patient perspectives on the acceptability of mobile health interventions (Hand, Leon and Steiber, 2014; Liu *et al.*, 2017; Aiyegbusi *et al.*, 2018; Kiberd *et al.*, 2018; Sobrinho *et al.*, 2018; Calvillo-Arbizu *et al.*, 2019; Tsai *et al.*, 2021; Cardol *et al.*, 2023). Most patients typically encounter their nephrologist only monthly, which is often insufficient for effective kidney health management. mHealth technology has the potential to bridge this gap by assisting with patient monitoring through various forms of mHealth support (Schmidt, 2021).

Currently, the traditional approach has been replaced by a patient-centred framework, resulting in a rise in patient engagement in the decision-making process and the development of technologies that facilitate the self-management of CKD. Research has also highlighted electronic personal health records (ePHR) as a promising tool with the potential to support chronic patients through education, counselling, and self-management. The development of mHealth technology is driven by the needs of CKD patients, including the need for access to the latest information, improved communication between patients and healthcare providers, and heightened awareness of individual patient conditions. This mHealth technology integrates various components, such as medical records, diagnostic and therapeutic procedures, customised educational content, and scheduled care reminders (Hayashi *et al*., 2017; Liu *et al*., 2017; Sobrinho *et al*., 2018; Tsai *et al*., 2021; Cardol *et al*., 2023).

The implementation of mHealth technology in the future could have a significant impact on many sectors. Its effective symptom-monitoring capabilities, demonstrated by real-time updates, lead to prompt and efficient discussions, resulting in active engagement between patients and healthcare providers. Nurses also report satisfaction with the remote monitoring system for patients undergoing haemodialysis at home, describing it as a "time-saving tool," which indicates that mHealth technology is well-received by various groups and is ready to be integrated as an innovative solution. Empowering patient self-management, enhancing efficiency, improving access to care, increasing the quality of care, boosting patient satisfaction, and improving the usability of the Internet and mobile software are the primary objectives of healthcare providers who utilise mHealth (Gu *et al*., 2023).

This aligns with the research by Kelly *et al*. (2023), which showed that mHealth technology can facilitate long-term behaviour change, proactively address nutritional issues, reduce travel burdens, and more easily reach individuals without access to healthcare. Several articles indicate a high level of acceptance and satisfaction with mHealth based on patient opinions. Easily access and user-friendly displays are key factors in mobile health acceptance. It has been revealed that many patients with CKD use the internet and smartphones daily, making them more inclined to adopt mHealth technology in the future. This can lead to increased patient compliance in undergoing treatment (Saadatifar *et al*., 2022).

Some studies suggest that one of the factors that can improve compliance with the management of the disease is social support, including family support (Hayashi *et al*., 2017; Hernandez *et al*., 2018; Kiberd *et al*., 2018; Sarker *et al*., 2022). At the same time, families provide a greater contribution every day than others, including health professionals. Families provide support in goal setting, planning,

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implementation, self-monitoring, and evaluation of their performance (Maneesri *et al*., 2022).

This study has potential limitations. The limitations include the restriction to articles published in English, excluding those in other languages, and the focus on articles from the last five years. Additionally, most of the articles were conducted in developed countries.

Conclusion

Several studies indicate that using mHealth for disease management in patients undergoing haemodialysis can improve self-care competence. Consequently, patients' quality of life is also improved. The findings from this review will guide the development of mHealth technology as a tool for home monitoring and self-management in patients on haemodialysis.

Abbreviations

MHealth: Mobile Health; CKD: Chronic Kidney Disease

Declarations

Ethics Approval and Consent Participant
Not applicable

Conflict of Interest
The authors declare that there is no conflict of interest concerning the authorship and publication of this article.

Availability of Data and Materials
Not applicable

Authors' Contribution
SA and ER conceptualized the research; SA and ER conducted a scoping review, arranged the methodologies, screened the manuscripts from various databases, wrote the results, and submitted the manuscript. All content written by SA and ER is original.

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