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Use Of Mobile Applications in Medication Adherence and Patient Education: A Review

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Abstract

Medication non-adherence remains one of the major barriers to achieving optimal therapeutic outcomes in patients with chronic diseases. According to the World Health Organization, nearly 50% of patients in developed countries and up to 75% in developing countries fail to adhere to prescribed medication regimens, leading to poor disease control, increased hospitalization, and higher healthcare costs. In the last decade, mobile health (mHealth) applications have emerged as a promising strategy to improve medication adherence and patient education. These tools utilize smartphones and digital connectivity to provide reminders, educational content, gamification, and communication between patients and healthcare professionals.

This systematic review evaluates the role of mobile applications in promoting medication adherence, with particular emphasis on their use in chronic kidney disease (CKD) management. Seven key CKD-related apps Transplant Hero, Perx, SMASK, Adhere4U, My Dialysis, Kidney Love, and iCKD and several general adherence apps were analysed in terms of their features, usability, and impact on adherence behaviour. Findings suggest that apps integrating reminders, feedback systems, educational modules, and healthcare provider connectivity significantly improve adherence rates and patient engagement. Further research and standardization are, however, essential to ensure long-term effectiveness and integration into clinical practice.

Keywords:

Medication adherence, mHealth, chronic kidney disease, patient education, mobile applications, self-management.

1. Introduction

Medication adherence, defined as the extent to which a patient's behaviour corresponds with prescribed medication schedules, is a crucial determinant of therapeutic success. Despite medical advances, poor adherence continues to undermine health outcomes across chronic disease populations. The World Health Organization (WHO) estimates that non-adherence contributes to 125,000 preventable deaths and approximately 10% of hospital admissions annually [1].

Chronic diseases such as hypertension, diabetes mellitus, and chronic kidney disease (CKD) demand long-term therapy and behavioural adaptation. Patients with CKD face additional challenges, including complex regimens, frequent laboratory monitoring, and dietary restrictions [2]. Consequently, non-adherence in CKD can accelerate disease progression and compromise transplant survival.

In recent years, mobile health (mHealth) technologies have gained attention as scalable, cost-effective tools to address adherence gaps. mHealth applications can deliver medication reminders, provide educational content, and facilitate interaction between patients and clinicians [3]. With the increasing availability of smartphones and internet connectivity, mHealth interventions have become an integral component of digital health transformation worldwide.

2. Objectives

1. The primary objectives of this review are:

2. To assess the effectiveness of mobile health applications in improving medication adherence and patient education.

3. To identify key design features and functional characteristics that enhance adherence behaviour.

4. To evaluate the role of mHealth apps specifically in chronic kidney disease (CKD) management.

5. To summarize available evidence and propose recommendations for future mHealth integration in patient care.

3. Methodology

A structured literature review was conducted to identify studies and reports on mobile applications related to medication adherence and patient education. Major databases, including PubMed, Scopus, and Google Scholar, were searched for studies published between 2015 and 2025. Keywords included "medication adherence," "mHealth," "mobile applications," "chronic disease," and "CKD."

Inclusion criteria involved studies that:

- Focused on mobile applications developed for medication adherence and/or patient education.
- Evaluated apps with at least one adherence-related feature (e.g., reminders, feedback, gamification).
- Included chronic disease or CKD patient populations.

A total of 18 relevant studies and application reports were selected for qualitative synthesis. Apps were evaluated based on usability, functionality, engagement, and adherence outcomes.

4. mHealth Interventions and Their Role in Medication Adherence

mHealth refers to the use of mobile devices such as smartphones, tablets, and wearable technology to deliver healthcare services and information [4]. The rise of mHealth has transformed patient engagement by making health management more personalized, accessible, and continuous.

Medication adherence applications commonly include features such as:

- Automated medication reminders.
- Dose tracking and refill alerts.
- Educational resources and symptom diaries.
- Gamification and reward systems to increase motivation.
- Direct communication links with healthcare providers.

Evidence suggests that these digital interventions can improve self-efficacy, enhance health literacy, and reduce missed doses [5]. In CKD, where medication regimens are often complex and lifelong, mobile applications can serve as valuable adjuncts for sustained adherence.

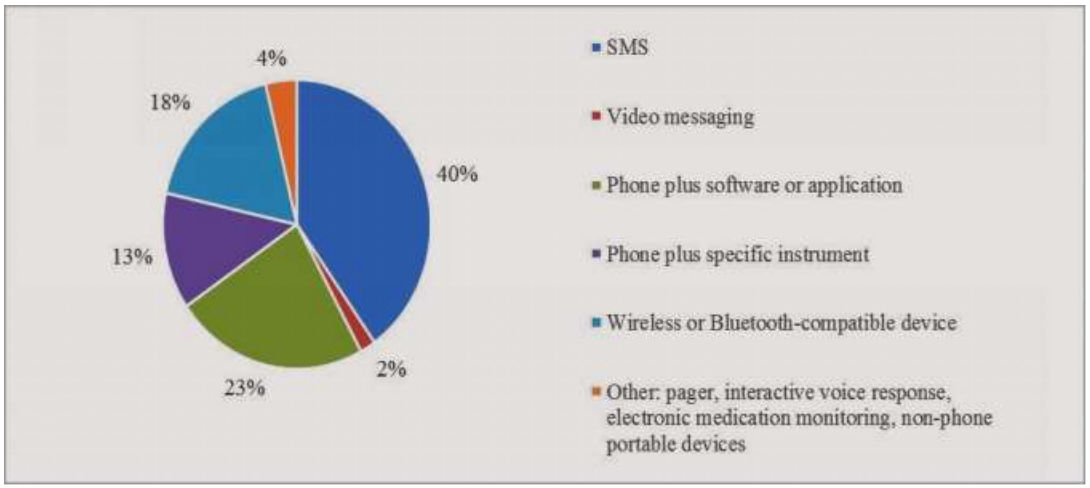

fig 1: mHealth interventions

5. General Aspects and Causes of Non-Adherence

Non-adherence is a multifactorial issue influenced by behavioural, socioeconomic, and system-level factors. WHO categorizes determinants of non-adherence into five dimensions: patient-related, therapy-related, condition-related, healthcare system-related, and socioeconomic [6].

Common causes include:

- Forgetfulness or misunderstanding of instructions.
- Complex medication schedules.
- Lack of perceived benefit or side effects.
- Psychological factors such as depression or denial.
- Inadequate communication between patients and providers.

These barriers underline the need for individualized and technology-assisted interventions that support patient engagement and accountability [7].

6. Medication Adherence Applications Features and Evaluation

Numerous mHealth applications have been developed to enhance medication adherence. This section focuses on seven key apps designed specifically for CKD management and several general-purpose adherence tools.

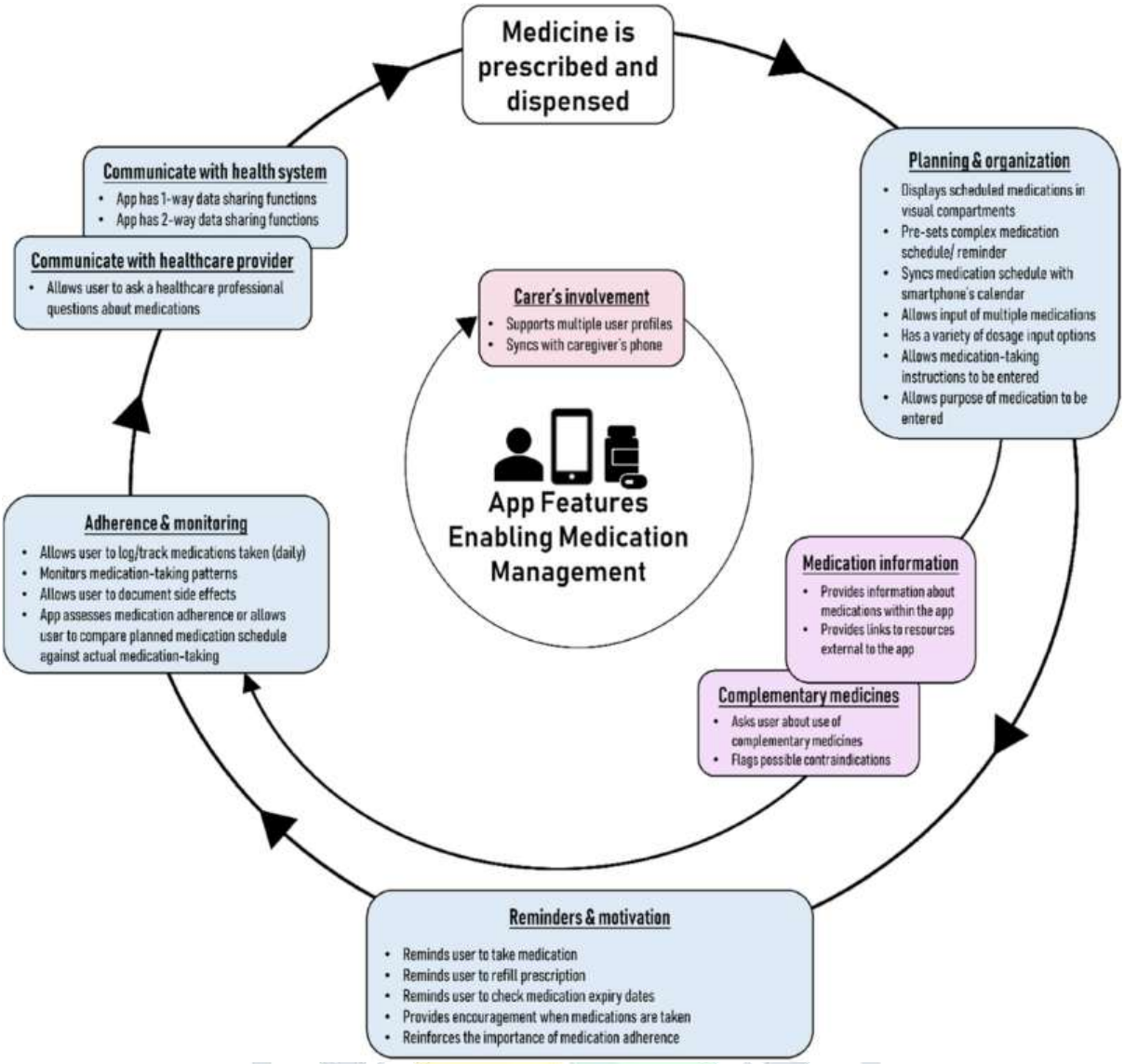

fig 2: app features enabling medication management

Table 1. Summary of CKD Related Mobile Applications

App Name	Target Population	Key Features	Unique Functions
Transplant Hero	Organ transplant recipients	Reminders, rewards, tracking	Motivational graphics and caregiver sharing
prex	Chronic disease patients	Gamification, education, rewards	Points and prizes for adherence
SMASK	Kidney transplant patients	BP monitoring, reminders, motivational messaging	Integrated with smart medication tray
Adhere4U	CKD patients	Offline reminders, health record storage	Works without internet access
My Dialysis	Haemodialysis patients	Educational videos, progress charts	Lifestyle management modules
Kidney Love	CKD patients	SMS reminders, counselling	Community support network
ICKD	CKD patients	Real-time data sharing with clinicians	Personalized education and lab result tracking

6.1. Transplant Hero

Fig 3: transplant hero

Developed for organ transplant recipients, Transplant Hero uses reminder notifications, visual cues, and reward-based motivation to encourage medication adherence [8]. The app enables users to share adherence data with caregivers and healthcare teams, fostering accountability.

6.2. Prex

Prex integrates gamification and behavioural economics to improve adherence. Users earn points and rewards for consistent medication intake, completing tasks, and educational quizzes [9]. It also includes progress tracking and social engagement features.

6.3. SMASK

The Self-Management and Adherence Smart Kit (SMASK) app provides adherence reminders linked to blood pressure and symptom tracking. Its integration with an electronic medication tray enhances real-time adherence monitoring [10].

6.4. Adhere4U

Designed for resource-limited settings, Adhere4U offers offline functionality and supports medication reminders even without internet connectivity. It includes sections for storing medical records and laboratory data [11].

6.5. My Dialysis

My Dialysis focuses on patient education, self-monitoring, and communication with clinicians. It provides videos, activity trackers, and personalized guidance for haemodialysis patients [12].

6.6. Kidney Love

This app promotes medication adherence and lifestyle modification through SMS-based reminders and tele-counselling features. It is particularly useful for CKD patients in rural regions [13].

6.7. ICKD

Fig 4: Indian chronic kidney disease

ICKD integrates personalized education modules, laboratory data, and real-time communication with healthcare providers. It supports continuous monitoring and early intervention for adherence lapses [14].

7. Discussion

The reviewed mHealth applications demonstrate that digital interventions can substantially enhance medication adherence through behaviour modification, education, and continuous engagement. Among CKD specific apps, ICKD and SMASK showed the most comprehensive integration of adherence monitoring and clinician feedback.

Gamification elements, as seen in Prex and Transplant Hero, effectively promote motivation and consistency. Meanwhile, apps like Adhere4U demonstrate the potential for scalability in regions with limited internet access.

However, despite these advancements, several limitations persist. Most studies rely on short-term follow-ups, self-reported data, and small sample sizes. There is also variability in regulatory oversight, data privacy measures, and clinical validation [15][16]. Standardized frameworks for evaluating mHealth app quality and efficacy remain necessary to guide both clinicians and patients in selecting reliable tools.

8. Conclusion

Mobile health applications represent a transformative approach to improving medication adherence and patient education. By combining technological innovation with behavioural science, these tools empower patients to take an active role in disease management. Evidence from CKD and other chronic conditions supports their potential to enhance adherence, communication, and long-term health outcomes.

Future research should focus on large-scale clinical trials, interoperability with electronic health records, and sustainable models for long-term engagement. With continued refinement, mHealth applications can become essential components of personalized and preventive healthcare.

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