



Digital Patient Monitoring as a New Frontier in Chronic Kidney Disease Care

Victoria S*, Miller N, Regina J and Hoffman C

Department of Medicine, Professor, Johns Hopkins University, USA

***Corresponding author:** Shirley Victoria, Department of Medicine, Professor, Johns Hopkins University, USA

Mini Review

Volume 10 Issue 1

Received Date: February 15, 2025

Published Date: March 10, 2025

Abstract

Chronic kidney disease (CKD) requires continuous monitoring because disease progression, blood pressure fluctuations, medication-related problems, and symptom changes may occur between routine clinical visits. Digital patient monitoring is emerging as a useful approach to extend CKD care beyond the hospital or clinic. Mobile health applications, connected blood pressure monitors, wearable devices, digital weighing scales, remote laboratory reporting, and telemedicine platforms can provide healthcare professionals with longitudinal information about a patient's health status. These technologies may support earlier recognition of clinical deterioration, improve treatment adherence, encourage patient participation, and reduce unnecessary hospital visits. Digital monitoring may be particularly valuable for patients with advanced CKD and those receiving home-based dialysis. However, challenges involving data accuracy, privacy, cybersecurity, interoperability, digital literacy, healthcare professional workload, and unequal access to technology must be addressed. Digital monitoring should therefore complement rather than replace conventional clinical assessment. The integration of reliable digital tools with personalized clinical decision-making may represent an important step toward more proactive and patient-centered CKD care.

Keywords: Chronic Kidney Disease; Digital Health; Remote Monitoring; Telemedicine; Wearable Devices; Mobile Health; Nephrology; Patient-Centered Care

Introduction

Chronic kidney disease is a major global health problem associated with cardiovascular complications, hospitalization, reduced quality of life, and progression to kidney failure. Conventional CKD management depends on periodic laboratory investigations, blood pressure measurements, clinical consultations, medication review, and assessment of symptoms. Although these approaches remain essential, they provide only intermittent information about a condition that can change continuously [1].

Digital patient monitoring offers an opportunity to extend CKD management into the patient's home and everyday

environment. Remote monitoring technologies can collect information such as blood pressure, body weight, physical activity, symptoms, medication adherence, and selected physiological parameters. When integrated with electronic health records and clinical workflows, these data may help healthcare professionals identify important changes earlier and provide more individualized care [2].

The growing availability of smartphones, wearable devices, connected medical equipment, and telemedicine services has accelerated interest in this approach. However, digital monitoring should be implemented based on clinical usefulness rather than technology alone [3].

Digital Technologies in CKD Monitoring

Several digital technologies can contribute to CKD monitoring. Connected blood pressure monitors allow patients to record measurements at home and transmit them to healthcare teams. Repeated measurements can provide a better understanding of blood pressure patterns than occasional clinic readings.

Digital weighing scales can assist in monitoring changes in body weight, particularly among patients with advanced CKD, heart failure, or dialysis dependence. Changes in weight, when interpreted together with symptoms and other clinical information, may provide useful indications of changing fluid status.

Wearable devices can collect information related to physical activity, heart rate, sleep, mobility, and other physiological characteristics. Mobile health applications can additionally support medication reminders, symptom reporting, dietary tracking, education, and communication with healthcare professionals [4].

Remote monitoring may also be particularly relevant to home dialysis. Digital systems can facilitate communication between patients and dialysis teams, support treatment monitoring, and allow problems to be identified without requiring every issue to result in an in-person visit.

Potential Clinical Benefits

Digital monitoring has the potential to transform CKD care from an episodic model into a more continuous system. Regular home measurements may allow clinicians to identify concerning trends between scheduled appointments. For example, persistent increases in blood pressure or body weight may prompt earlier clinical assessment.

Digital tools may also improve patient engagement. When patients can view their own measurements and trends, they may better understand their condition and participate more actively in treatment decisions. Medication reminders and educational resources can further support self-management [5-8].

Remote monitoring may reduce travel requirements and improve access to specialist services, particularly for individuals living in rural or underserved areas. It may also improve communication between patients and multidisciplinary healthcare teams.

Challenges and Limitations

Despite its potential, digital patient monitoring presents several challenges. Not all consumer devices provide

measurements that are sufficiently accurate for clinical decision-making. Device validation and appropriate patient education are therefore important.

The large volume of data generated by digital platforms can also create additional workload for healthcare professionals. Automated alerts may produce false-positive signals and contribute to alert fatigue. Monitoring systems should therefore prioritize clinically meaningful trends rather than simply transmitting every available measurement.

Privacy and cybersecurity are additional concerns because digital monitoring involves the collection and transmission of sensitive health information. Interoperability between digital platforms and electronic health records is also necessary for efficient clinical use.

Digital inequality represents another important concern. Older adults, low-income populations, and individuals with limited digital literacy or poor internet access may have difficulty using advanced monitoring systems. Digital CKD care should therefore include technical support and alternative pathways for patients who cannot use digital technologies.

Role of Artificial Intelligence

Artificial intelligence (AI) may further expand the potential of digital CKD monitoring. AI systems can analyze large quantities of longitudinal data and potentially identify patterns associated with clinical deterioration.

For example, an algorithm could combine blood pressure trends, weight changes, symptoms, laboratory results, and medication information to identify patients who may require closer evaluation. Such systems could help clinicians prioritize patients rather than manually reviewing every incoming measurement.

However, AI-generated predictions require careful clinical validation. Algorithms may perform differently across populations and can produce false-positive or false-negative results. AI should therefore support, rather than replace, professional clinical judgment.

Discussion

The major value of digital patient monitoring in CKD may be its ability to provide continuous information rather than isolated measurements. CKD management involves multiple interacting factors, and longitudinal information may help clinicians recognize changes that would otherwise remain unnoticed until the next scheduled appointment.

However, digital monitoring should not be considered a replacement for traditional nephrology care. Laboratory testing, physical examination, clinical history, and professional judgment remain essential. The most effective model is likely to combine conventional care with selected digital monitoring technologies.

Importantly, collecting data alone does not improve outcomes. Digital systems must be connected to clear clinical pathways. When an abnormal trend is identified, there should be a defined process for reviewing the information, contacting the patient, performing additional investigations, or modifying treatment when appropriate.

Future studies should determine which digital measurements provide the greatest clinical value and whether remote monitoring can reduce hospitalization, slow CKD progression, improve quality of life, and increase treatment adherence. Cost-effectiveness and health-equity outcomes should also be evaluated.

Conclusion

Digital patient monitoring represents a promising new direction in chronic kidney disease care. Connected devices, mobile applications, wearable technologies, and remote monitoring platforms can extend CKD management beyond traditional clinical settings and potentially facilitate earlier recognition of health changes.

The future of digital nephrology should focus on clinically meaningful data, patient-centered design, secure information systems, and timely clinical responses. Technology should complement rather than replace the relationship between patients and healthcare professionals. With appropriate validation and implementation, digital monitoring could support a more proactive, personalized, and continuous approach to CKD management.

References

1. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group (2024) KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. *Kidney Int* 105(4S): S117–S314.
2. Bui KL, Purtell L, Hyun A, Bonner A (2025) eHealth Solutions for Symptom Assessment and Monitoring in Adults With Chronic Kidney Disease: A Systematic Review. *J Clin Nurs* 34(9): 3560-3591.
3. Josemans SH, Lindeboom L, Gerritsen KGF, Wieringa FP, Kooman JP, et al. (2024) Home monitoring of patients with chronic kidney disease. *Nat Rev Nephrol* 20(8): 491-492.
4. Lew SQ, Ronco C (2024) Use of eHealth and remote patient monitoring: a tool to support home dialysis patients, with an emphasis on peritoneal dialysis. *Clin Kidney J* 17(Suppl 1): i53-i61.
5. Fudim M, Feldman DI, Sayed A (2025) Digital Health: From Remote Monitoring to Remote Care. *J Card Fail* 31(2): 489-491.
6. Kooman JP, Han M, Josemans S, Rotmans JI, Usvyat L, et al. (2026) Smartwatches in the digital health ecosystem for health monitoring in patients with chronic kidney disease and kidney failure: opportunities and challenges. *Am J Physiol Renal Physiol* 331(3): F345-F357.
7. Lodewyk K, Wiebe M, Dennett L, Larsson J, Greenshaw A, et al. (2025) Wearables research for continuous monitoring of patient outcomes: A scoping review. *PLOS Digit Health* 4(5): e0000860.
8. Mata-Lima A, Paquete AR, Serrano-Olmedo JJ (2024) Remote patient monitoring and management in nephrology: A systematic review. *Nefrologia* 44(5): 639-667.